Frameworks and market specifics related to renewable energy sources utilization in specific CEE countries (Bulgaria, Czech Republic, Romania and Slovakia)

A Master Thesis submitted for the degree of
"Master of Science"

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Affidavit

I **Ľudovít Sluka**, hereby declare

1. that I am the sole author of the present Master Thesis, “Frameworks and market specifics related to renewable energy sources utilization in specific CEE countries (Bulgaria, Czech Republic, Romania and Slovakia", 140 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted this Master Thesis as an examination paper in any form in Austria or abroad.

Banská Bystrica, 15 January 2008

Ľudovít Sluka

Table of Content

List of tables

List of figures

Acronyms

ANRE	Romanian Energy Regulatory Authority
BACI	Before/After and Control/Impact
BEERECL	Bulgarian Energy Efficiency and Renewable Energy Credit Line
BgEEF	Bulgarian Energy Efficiency Fund
BIDSF	Bohunice International Decommissioning Support Fund
CCGT	Combined Cycle Gas Turbine
ČEA	Czech Energy Agency
CEE	Central and East Europe
CF	Cohesion Fund
CFC	Chlorofluorocarbons
CHP	Combined Heat and Power
CR	Czech Republic
CZK	Czech crown (national currency)
CZ REA	Czech Renewable Energy Agency
ČNB	National Bank of the Czech Republic
DAM	Day Ahead Market
DC	Direct Current
DHW	Domestic Hot Water
EBO	Jaslovské Bohunice Nuclear Power Plant
EBRD	European Bank for Reconstruction and Development
ECB	Energy Centre Bratislava
EDF	Electricitè de France
EE	Energy Efficiency
EEA	European Economic Area
EFEKT	State program on support of energy savings and renewable energy sources use in the Czech Republic
EFTA	European Free Trade Association
EIA	Environmental Impact Assessment
EMEPA	Enterprise for Management of Environmental Protection Activities
EPBT	Energy Pay Back Time

ERDF	European Regional Development Fund
ERF	Energy Return Factor
ERÚ	Energetický Regulační úřad
ESCO	Energy Service Company
ETBE	Ethyl tert-butyl ether
	Energy Regulatory Office (of the Czech Republic)
EU	European Union
EUR	Common currency of European Union
EWEA	European Wind Energy Association
FDI	Foreign Direct Investment
FREE	Romanian Energy Efficiency Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GER	Germany
GHG	Greenhouse Gas
HDR	Hot Dry Rock
HPP	Hydro Power Plant
IBRD	International Bank for Reconstruction and Development
ICEMENERG	Energy Research and Modernizing Institute
JAVYS	Jadrová a vyraďovacia spoločnosť a.s. (Nuclear Decommissioning Company, PLC)
JEMO	Mochovce Nuclear Power Plant
JI	Joint Implementation
KIDSF	Kozloduy International Decommissioning Support Fund
MERO	Methylester of Rapeseed
NEK EAD	Natsionalna Elektricheska Kompania EAD (National Electricity Company)
NGO	Non-governmental organization
NO_x	Nitrous Oxides
NPP	Nuclear Power Plant
NPPRES	National Project/Programme on Renewable Energy Sources (in Bulgaria)

OECD	Organization for Economic Co-operation and Development
OP	Operational Program
OPCOM	Romanian Power Market Operator
PB	Participating Bank
PP	Power plant
PPC	Combined Cycle Power Plant
PPDS	Rules for the Operation of Distribution System (in the Czech Republic)
PPS	Purchasing Power Standards
PV	Photovoltaics
REE	Raiffeisen Energy & Environment GmbH
REECL	Residential Energy Efficiency Credit Line
RES	Renewable Energy Sources
RES-E	Renewable Energy Sources – Electricity
SAŽP	Slovenská agentúra životného prostredia (Slovak Environmental Agency)
SEFF	Sustainable Energy Finance Facility
SEPS	Slovenská elektrizačná a prenosová sústava, a.s. (Slovak Electricity Transmission System, PLC)
SEWRC	State Energy and Water Regulatory Commission (in Bulgaria)
SF	Structural (European) Funds
SKK	Slovak crown (national currency)
SME	Small and medium enterprise
SO_2	Sulfur Dioxide
SPP	Slovenský Plynárenský Priemysel, a.s. (Slovak Gas Industry, PLC)
SSE	Stredoslovenská Energetika, PLC
TPP	Thermal Power Plant
UCTE	Union for the Co-ordination of Transmission of Electricity
UNDP	United Nations Development Programme
UNOPS	United Nations Office of Project Service

ÚSES	Territorial System of Ecological Stability
VEG	Vodná Elektráreň Gabčíkovo
	(Gabčíkovo Hydro Power Plant)
VSE	Stredoslovenská Energetika, PLC
VVER	Vodo-Vodyanoi Energetichesky Reactor
	(Russian type pressurized water reactor)
VVN	High Voltage product
WB	World Bank
ZSE	Západoslovenská Energetika, PLC
ZVES	Association for Wind Energy in Slovakia

Used common energy units and Conversion factors

List of used energy units

GJ	Giga Joule
GW	Giga Watt
GWh	Gigawatt-hour
GW_p	Giga Watt (installed electric output) / PV
koe	k of crude-oil equivalent
kW	Kilo Watt
kWh	Kilowatt-hour
kW_p	Kilo Watt (installed electric output) / PV
kW_{th}	Kilo Watt (installed thermal output)
Mcal	Mega Calorie
MJ	Mega Joule
MW	Mega Watt
MWh	Megawatt-hour
MW_e	Mega Watt (installed electric output)
MW_p	Mega Watt (installed electric output) / PV
MW_{th}	Mega Watt (installed thermal output)
Mtoe	Million tons of crude-oil equivalent
PJ	Peta Joule
TJ	Tera Joule
toe	Tons crude-oil equivalent
TW	Tera Watt
TWh	Terawatt-hour
W_p	Watt (installed electric output) / PV

Conversion factors

	MJ	kWh	koe	Mcal
1 Mega Joule (MJ)		0,278	0,034	0,239
1 Kilowatt-hour	3,6		0,123	0,86
1 k of crude-oil equivalent	41,91	11,63		10,01
1 Mega Calorie	4,187	1,163	0,1	

da	Deca	10^1	**G**	Giga	10^9
h	Hecto	10^2	**T**	Tera	10^{12}
k	Kilo	10^3	**P**	Peta	10^{15}
M	Mega	10^6	**E**	Exa	10^{18}

Introduction

The Central and East European countries (CEEC) have many common features. All of them were strongly influenced by centrally managed economic system in socialism period (1947-1989). Characteristic for this period was utilization of cheap energy sources imported almost exclusively from the former Soviet Union, extremely high industrial energy intensity, low level of energy efficiency, over-consumption of natural resources as well as high stage of environmental pollution.
The following period (since 1990) has been characteristic of a difficult process of transition from a central planned system to a market economy, accompanied by a process of de-monopolization and privatization, liberalization of trade and capital flows, development of financial markets and process of decentralisation of public administration. Coessential were also crucial reforms in health-care system, judiciary, school and pension systems and tax reforms. Despite a traumatism of the overall process, the outcomes have been very positive - such as liberalisation of the economy, attraction of foreign direct investments and increasing the quality of life. In this period, even the very first ideas related to energy savings, energy efficiency and RES utilization have been taken into accounts and consequently presented to the leading decision makers at the national level. However, there had not been sufficient incentives to accept and further develop these ideas to concrete activities till 2000. The bigger progress has been evident since the beginning of 21st century, and especially, after the accession of some of the CEE countries to the European Union (the Czech Republic and Slovakia acceded on 1st May 2004 and Bulgaria and Romania on 1st January 2007).

The specific goal of this Master Thesis is to describe and compare the situation in two groups of CEE countries: Czech Republic / Slovakia and Bulgaria / Romania in relation to utilization of renewable energy sources (RES). The pivotal topic of this Master Thesis was chosen after receiving an approval from the Supervisor Mr. Roman Doubrava, director of the Energy Centre Bratislava (ECB), as well as experts from the Raiffeisen Bank, Raiffeisen – Leasing GmbH and Raiffeisen Energy & Environment GmbH / REE.

1. Basic geographical, social and economical characteristics

1.1. Bulgaria

Area: 110,993.60 km^2

Population: 7,970,000 inhabitants (the end of 2007)

Density: 72 / km^2

GDP (current prices, in millions of euro / seasonally adjusted):

GDP (percentage change): 6.1% (the end of 2006)

Inflation rate: 6.5% (the end of 2006 / annual)

Unemployment rate: 9.61% (the end of 2006)

Foreign Direct Investment (in millions of USD): 5,172 (December 31, 2006) *[110]*

1.2. The Czech Republic

Area: 78,866 km^2

Population: 10,325,941 inhabitants (2007)

Density: 131 / km^2

GDP (current prices, in millions of euro / seasonally adjusted): 30,954.2 (2nd quarter of 2007)

GDP (constant prices / percentage change - NSA): 6.0% (2nd quarter of 2007)

Inflation rate: 2.5% (the end of 2006 / annual)

Unemployment rate: 5.2% (3rd quarter of 2007)

Foreign Direct Investment (in millions of USD): 5,957 (December 31, 2006) *[110]*

1.3. Romania

Area: 237,500 km^2

Population: 22,276,056 inhabitants (July 2007, estimation)

Density: 94 / km^2

GDP (current prices, in millions of euro / seasonally adjusted):

GDP (percentage change): 7.7% (the end of 2006)

Inflation rate: 6.6% (the end of 2006 / annual)

Unemployment rate: 6.1% (the end of 2006)

Foreign Direct Investment (in millions of USD): 11,394 (December 31, 2006) *[110]*

1.4. Slovakia

Area: 49,035 km^2

Population: 5,396,168 inhabitants (June 30, 2007)

Density: 110 / km^2

GDP (current prices, in millions of euro / seasonally adjusted): 13,272.1 (2nd quarter of 2007)

GDP (constant prices / percentage change - NSA): 9.4% (2nd quarter of 2007)

Inflation rate: 4.3% (December 31, 2006 / annual) and 2.1% (as of October 2007 / annual)

Unemployment rate: 8.3% (September 2007)

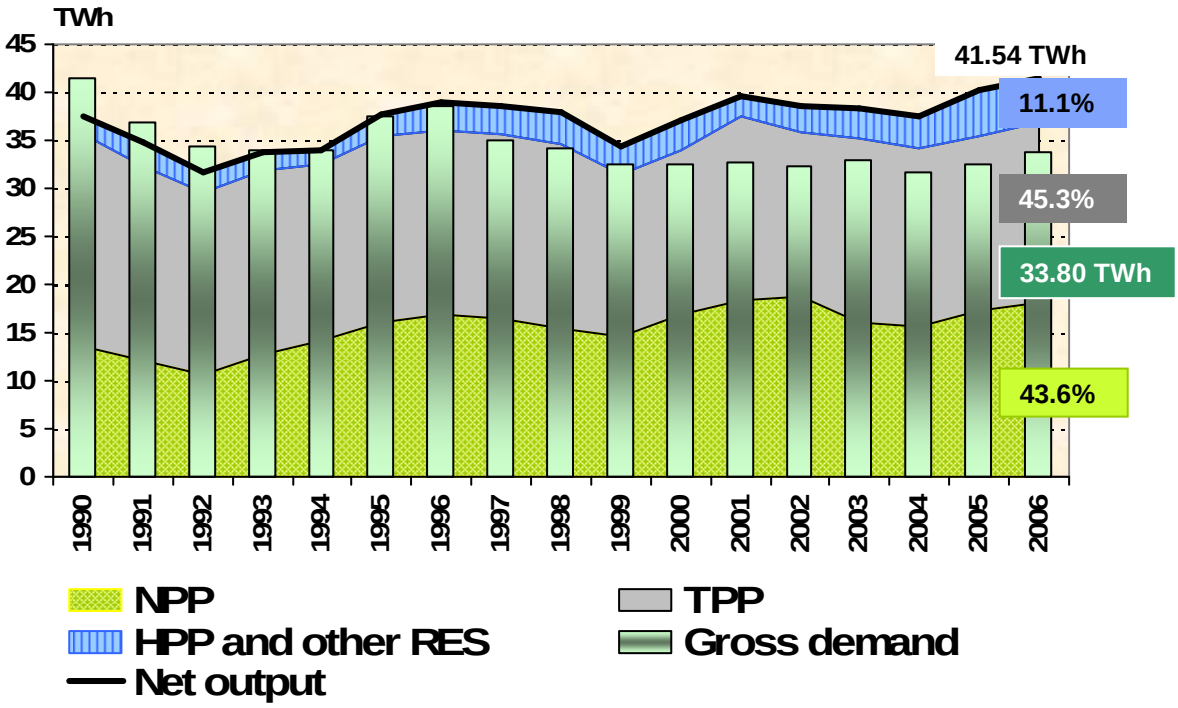
Foreign Direct Investment (in millions of USD): 4,165 (December 31, 2006) *[110]*

2. Energy structure of the respective countries

2.1. Bulgaria

The energy mix of Bulgaria is fairly diversified. The economy depends on the import of energy carriers, mainly due to the deficiency of local energy sources. Slightly less than a half of the primary energy needs of the country are covered by imported energy sources – mainly crude oil and natural gas from Russia as well as hard coal (47.1% share of net energy imports on gross energy consumption in 2005) *[31]*. Petroleum products and electricity are the main export commodities within the energy sector of Bulgaria. Solid fuels (mainly hard coal, lignite and peat) and nuclear energy play the most important role in generation of electricity and together have approximately 86 % share on domestic electricity generation (thermal power plants – 45.3 % and nuclear power plants – 43.6 % in 2006). Hydro power plants had 11 % share on electricity generation in 2006 but the share of other RES was almost negligible (0.1%).

Figure 5: Development of net power generation in Bulgaria (1990-2006)



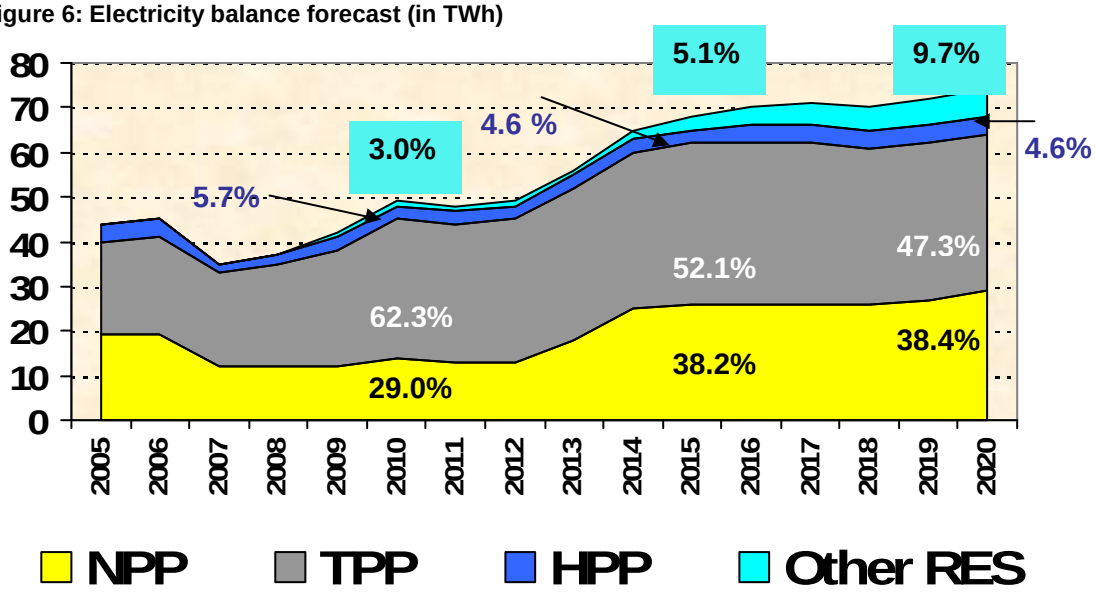
Source: Papazyan, M.: Electric Power Infrastructure in Bulgaria and Prospects for its Development

As it can be seen in the chart above, after 1996 the situation in the energy sector changed due to drop of electricity demand inside the country and therefore the Bulgaria have become exporter of power, especially to the other Balkan Region countries.

Approximately 14 to 17 % of the annual electricity output of Bulgaria was exported during the past years and therefore Bulgaria has been able to cover up to 50-60 % of the regional electricity deficit (but only 20-25 % of the regional deficit in the first half of 2007 year). The main power importers from Bulgaria has been Romania (20-30 %) and Bosnia/Hercegovina (10-15 %) *[65]*.

The nuclear power plants electricity generation dropped in 2002 due to the decommissioning of the units 1 and 2 in the nuclear power plant Kozloduy (2 x 440 MW). The original total installed capacity of six units of the Kozloduy NPP was 3,760 MW. Units 3 and 4 were decommissioned by the end of 2006, immediately prior to the accession of the country to the European Union. According to the official documents of the Ministry of Economy and Energy Bulgaria, due to the decommissioning of four units of NPP Kozloduy, will loose power generation capacity of approx. 6 TWh/year. The subsequent power shortage in the Balkan region in the following years was estimated to be about 15-20 TWh (approx. 5-8 % of the overall electricity demand). Even forecasts for next years (based on the evaluation of weather conditions during the first 10 months of 2007) regarding the hydro power indicate lower level of electricity generation. In parallel with this, there was 2.5% power growth demand assumed in the entire Balkan region in 2007, which would require about 5 TWh higher output compared to the previous year.

Figure 6: Electricity balance forecast (in TWh)



Source: Papazyan, M.: Electric Power Infrastructure in Bulgaria and Prospects for its Development

The Bulgarian government therefore expects the completion of the second NPP near the Belene at the Danube River, as this project was nominated by the government as a "project of national importance". The contract related to the construction of the NPP was signed with NEK EAD and Atomstroyexport JSC (Russian Federation) on 29 November 2006. Also the procedure for Invitation of Expressions of Interest for External Investor for the Belene is in progress. Five large European energy companies – ČEZ (CZ), Electrabel (BEL), ENEL (ITA), E.ON (GER) and RWE (GER) have already presented their bids. The government expected to make conclusion regarding a contract for the Belene NPP till the end 2007. The commissioning of the first unit of NPP is expected in 2013 and the second in 2014.

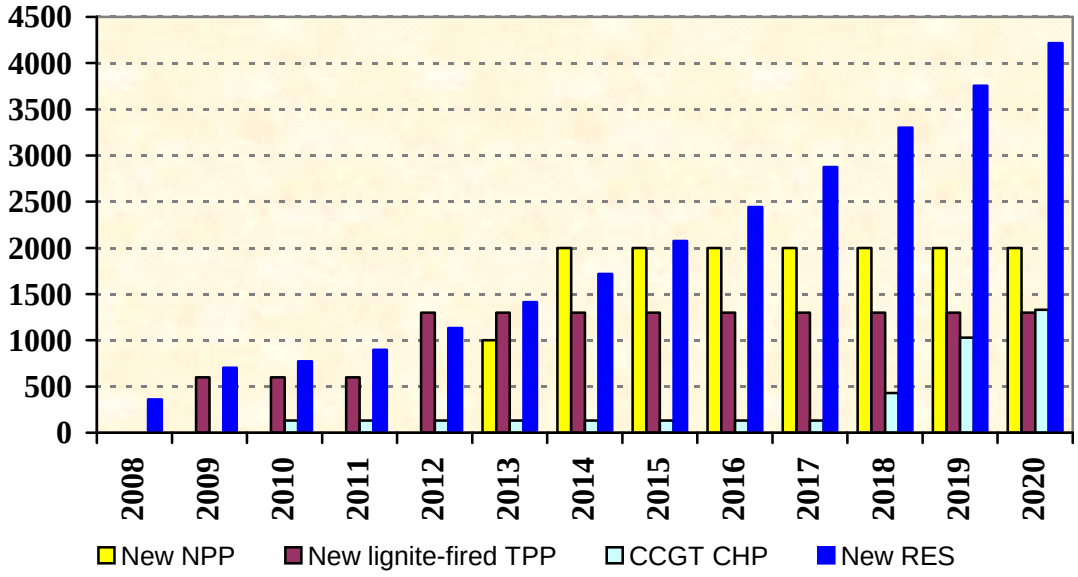
The Bulgarian government in order to secure the smooth supply of energy and to avoid complications in the energy sector envisages a lot of investments in power generation sector that would include:

- renewal of the following large condense-type power plants: TPP Maritsa East 2 (units 150 MW in the period 2005-2008; units 210 MW in the period 2008-2009), TPP Maritsa East 3 (2004-2008), TPP Varna (2009-2014) and TPP Russe (units 3 and 4 in 2009). The renewal of all facilities must comply with the Directive

2001/80/EC establishing the standards of admissible emissions of SO_2, NO_x and dust from big combustion facilities.

- renewal of hydro power plants (HPP) within the cascades Belmeken-Sestrimo, Vacha and Batak (concluded)
- renewal of HPPs at the Arda cascade (in the process)
- construction of Yadenitsa HPP (planned)
- completion of Tsankov Kamak HPP and Maritsa East 1 TPP
- possible extension of capacity of DHC Sofia (2 x 65 MW)
- possible new NPP after 2012 (1.000 MW), CCGT plants (150 MW and 300 MW), new HPPs at the Gorna Arda cascade
- installations based on RES use

Figure 7: Commissioning of new capacities by stages in the period 2008-2020 (in MW)



Source: Papazyan, M.: Electric Power Infrastructure in Bulgaria and Prospects for its Development

The most important domestic energy company is Natsionalna Elektricheska Kompania EAD (NEK EAD). It is a single-owner joint-stock company, 100% held by the State. The main activities of the company include *[60]*:

- Reliable and secure generation and transmission of power
- Centralized purchase and sale of electrical energy
- Supply of electrical energy to customers connected to the transmission network

- Import, export of electrical energy
- Construction and maintenance of power generation and transmission facilities
- Investment activities
- Introduction and promotion of energy efficiency in the generation and transmission of electrical energy

NEK EAD runs altogether 31 hydro power plants with total installed capacity of 2,563 MW. Out of the largest, 14 operate within four cascades: Belmeken-Sestrimo-Chaira, Batak, Vacha and Arda. Their main functions are generation of electricity, covering of peak loads and regulation of the parameters of the power system. In the aggregate there was 3.544 TWh of power generated by all NEK EAD hydro power plants in 2005 (see the figure No. 8 below).

HPP AND PSHPP GENERATION IN 2005

Cascade/Power Plant	Storage	Effective Capacity, mln. m³	Head m	Capacity MW	Generation/ Consumption, GWh
Cascade Belmeken-Sestrimo-Chaira	**turbines**	**137**		**1 599**	**1 146**
	pumps			**898**	**532**
PSHPP Chaira	turbines		690	864	342
	pumps		701	788	474
PSHPP Belmeken	turbines		730	375	331
	pumps		730	104	58
HPP Sestrimo	turbines		553	240	318
HPP Momina Klissura	turbines		251	120	155
Cascade Vacha	**turbines**	**500**		**380**	**864**
	pumps			**45**	**5**
HPP Teshel	turbines		341	60	189
HPP Devin	turbines		156	80	145
PSHPP Orfeus	turbines		125	160	274
	pumps		125	45	5
HPP Krichim	turbines		172	80	256
Cascade Batak	**turbines**	**361**		**231**	**629**
HPP Batak	turbines		421	40	149
HPP Peshtera	turbines		586	125	333
HPP Aleko	turbines		272	66	147
Cascade Dolna Arda	**turbines**	**812**		**270**	**728**
HPP Kardjali	turbines		93	106	240
HPP Studen Kladenets	turbines		66	60	244
HPP Ivailovgrad	turbines		54	104	244
Other HPPs	**turbines**			**83**	**177**
TOTAL HPP	**turbines**			**2 563**	**3 544**
	pumps			**943**	**537**

Source: http://www.nek.bg/

As it was already stated above, NEK AED has also a very important role in the overall process of the Belene NPP development and construction, which is supposed to be the biggest investment in Bulgaria in the next 15 years. The NEK developed an environmental impact assessment report related to the investment proposal of NPP construction, as well as a feasibility study to substantiate the construction of this NPP analyzing possible reactor technologies and its social and economic effects. The company was also responsible for the selection of a financial consultant and an architect / engineer to perform the activities under the programme of financing and constructing the Belene NPP *[60]*.

The most utilized fuel for heat production in heating plants is natural gas. Among other important sources are coal and liquid fuels. Just a very small amount of heat comes from nuclear power plants [89]. There is one dominant player in the gas sector – Bulgargaz EAD. This vertically integrated company is responsible for supply, storage and transit activities. After the unbundling a new separate enterprise, it has started to deal with transmission. The share of supply of Bulgargaz AD on overall natural gas consumption in the country was 88 % in 2005. The rest is managed by distribution companies (7%) and natural gas traders (5%) *[34]*.

Despite to a great extent decreased energy consumption in recent years, the energy intensity per unit of GDP (or adjusted according to Purchasing Power Standards) still remains one of the highest in the EU-27. The most energy consuming economy sector remains industry.

Main energy statistics (2005):

Gross inland energy consumption (in 1,000 toe): 19,884

Final energy consumption (in 1,000 toe): 9,506

Primary energy production (in 1,000 toe): 10,553

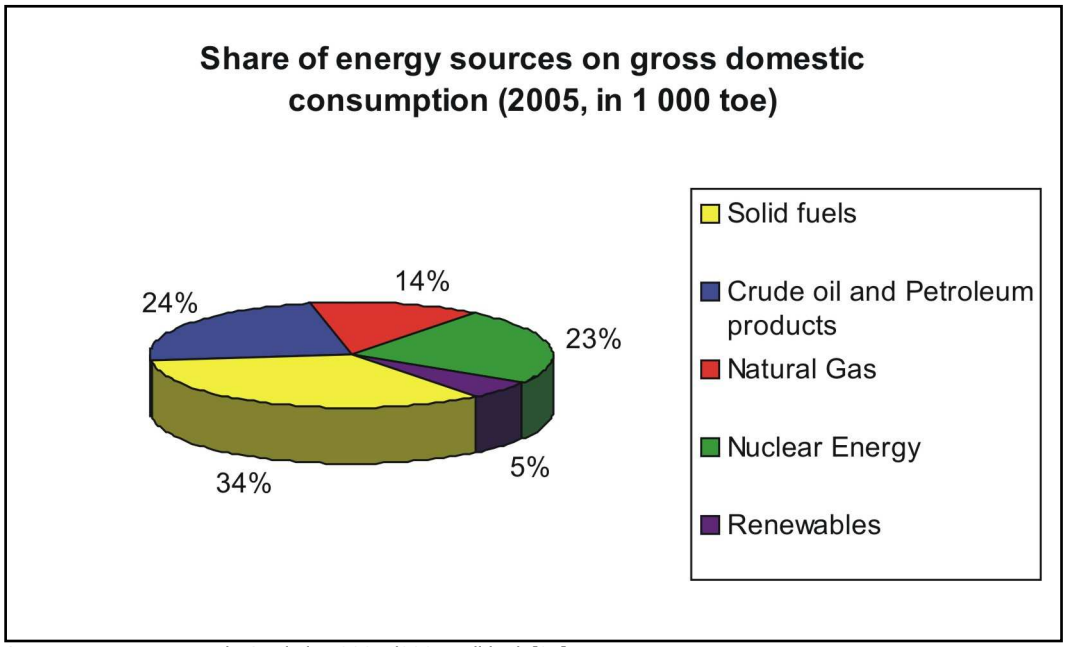
Net energy imports (in 1,000 toe): 9,416

Final electricity consumption (in GWh): 25,678

Gross electricity generation (in GWh): 44,366

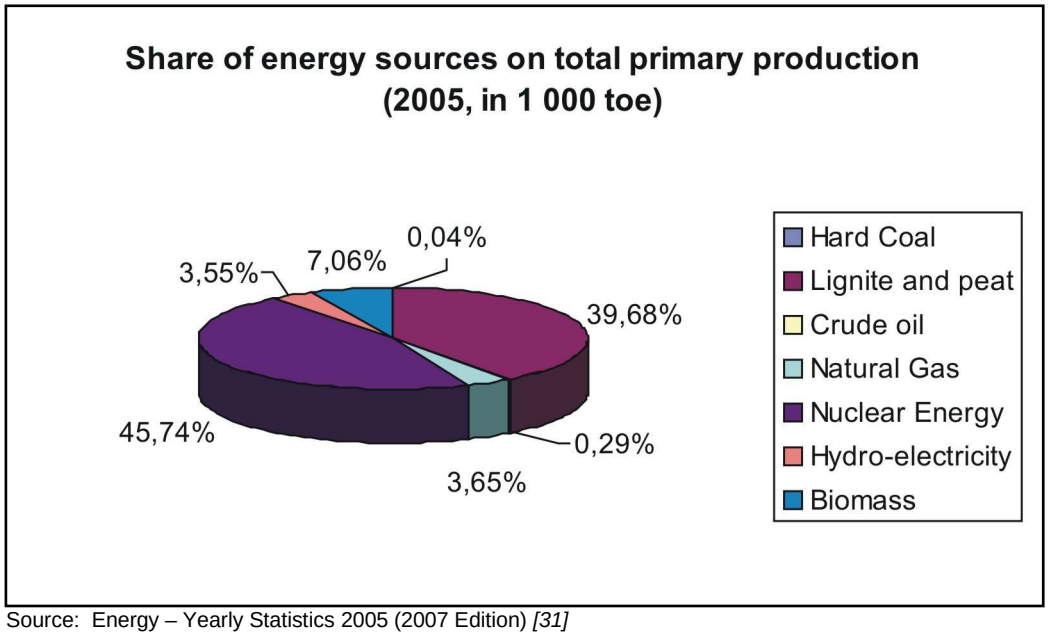
Total heat production (in TJ): 1,277

Figure 9: Share of energy sources on gross domestic consumption in Bulgaria (2005, in 1,000 toe)



Source: Energy – Yearly Statistics 2005 (2007 Edition) *[31]*

Figure 10: Share of energy sources on total primary production in Bulgaria (2005, in 1,000 toe)



Source: Energy – Yearly Statistics 2005 (2007 Edition) *[31]*

2.2. The Czech Republic

Due to a large share of domestic fossil fuels and nuclear energy on country's energy mix, the Czech Republic within the EU-27 belongs among the countries with the lowest dependency on imports of energy sources. The share of net energy imports on gross energy consumption in 2005 was 27.4 % *[31]*. The most imported energy carriers are crude oil and natural gas, mostly from the Russian Federation. Minor amounts of crude oil are imported from Kazakhstan and natural gas from Norway. The major importer and wholesale supplier of gas is RWE Transgas, a.s. (joint-stock company) with a dominant position on the domestic market and 83.86 % share on all gas sales in the Czech Republic. This company is also a major owner of six out of eight large companies dealing with the gas distribution and supply. The liberalization of the Czech gas market continued in 2006 by its second phase of opening. Since January 1, 2006, the „eligible customers“ had been all final natural gas consumers, except the households, which henceforth stayed in the category of protected customers. The market became fully liberalized since January 1, 2007, since when all households can choose their gas supplier.

The RWE Transgas, a.s. was the first company in the gas sector where the unbundling in the form of legal division has been accomplished. As of January 1, 2006, the new business RWE Transgass Net, s.r.o. (Ltd.) – transmission gas system operator – started operation in the Czech market. RWE Transgas, a.s. has got left licensed gas trade and storage. Unbundling of other eight regional distribution companies with more than 90,000 customers was effectuated in the mid of 2007 in line with the relevant energy legislation.

The biggest exportable energy carrier is brown coal, despite the decrease of export in last years. But even in spite of significant decrease (by 35 % over the period 1999-2004) of share of fossil fuels on primary energy supply, the share of fossil fuels is still very high, far above the EU-27 average. Due to the decrease of industrial activity up to 1999 (especially in the period 1997-1999), the final energy consumption in 2004 was 29 % lower compared to 1990. But there has been noticed a slight increase of final energy consumption due to a higher activity of the industrial sector after 2000. Currently, the share of industrial sector on final energy consumption is still far above the EU-27 average.

Regarding the generation of electricity, a strong concentration of facilities is still clearly visible – the state power generator ČEZ has 73 % share on overall national power generation. Also a number of smaller power generators exist in the country, but none of them exceeds a level of 3 % share on total power generation. Distribution and supply of power is dominantly covered by three vertically integrated enterprises (ČEZ, E.ON and PRE) with 95 % share on power supply for final consumers (in case of smaller consumers the share is even bigger – more than 99 %). Besides them another 10 smaller supply companies actively operate in the market.

The electricity market in the Czech Republic has been subsequently opening up since 2002. Market is fully liberalized since January 1st, 2006 (1.5 years ago as it was required by the Directive 2003/54/ES), after the last group of consumers (households) became so called „eligible costumers", i.e. obtained the right to select the power supplier. After full opening of the market, all proceedings where competition is possible – e.g. power generation, import or sale, are not regulated any more. Regulated are only proceedings with monopolistic character – these include electricity transport from generation source to final consumer by medium of transmission and distribution system as well as activities connected with assurance of stability of energy system from technical and business standpoint as well [58]. The main administrative authority liable for regulation in the energy sector, for support of economic competition and utilization of renewable and secondary energy sources, as well as for protection of interests of consumers in the energy sector where competition is not feasible, is the Energy Regulatory Office (ERÚ). The ERÚ was set up on January 1, 2001 under the Act No. 458/2000 on the Conditions for Business and State Administration in the Energy Industries and on Amendments to Certain Laws (hereinafter "the Act") of November 28, 2000 *[29]*.

Important change in the energy sector in 2006 was also so called *unbundling* that has been carried out in line with the Czech Energy Law. According to this Act, the transmission system operators (TSO) or distribution companies with more than 90,000 customers were obliged to detach distributional proceedings from other licensed proceedings. This duty in fact concerned only the three largest energy companies – ČEZ group, E.ON group and RWE.

The gross inland electricity consumption in the Czech Republic in 2006 was roughly 59.4 TWh, out of that 34.6 TWh (58.2 %) related to wholesale customers connected

to High Voltage (HV) and Very High Voltage (VHV), 8 TWh (13.5%) on retail customers connected to Low Voltage (LV) and 15.2 TWh (25.6%) represented households. Remaining 1.6 TWh (2.7 %) related to the energy sector (i.e. other consumption of power plants).

The total installed capacity in the Czech Republic on January 1, 2007, amounted to 17,508 MW. Out of this, 61.1 % (10,691 MW) presented thermal power plants, 21.5 % (3,760 MW) nuclear power plants, 12.4 % (2,175 MW) hydro power plants including pumping plants and small HPP, 4.6% (804 MW) gas and combined gas cycles and 0.4% (78 MW) related to RES (wind power, photovoltaics etc.). The overall inter-annual growth of installed capacities in power system was 96 MW.

58 % of the overall power output is connected directly to the transmission system and remaining 42 % to the distribution system.

The energy intensity per unit of GDP (or adjusted according to Purchasing Power Standards) is one of the highest within EU-27 in the Czech Republic – far above the EU average. As well GHG (especially CO_2) emission intensity per capita is one of the highest among the EU-27 countries *[30]*.

Main Energy statistics (2005):

Gross inland energy consumption (in 1,000 toe): 44,795

Final energy consumption (in 1,000 toe): 25,801

Primary energy production (in 1,000 toe): 32,368

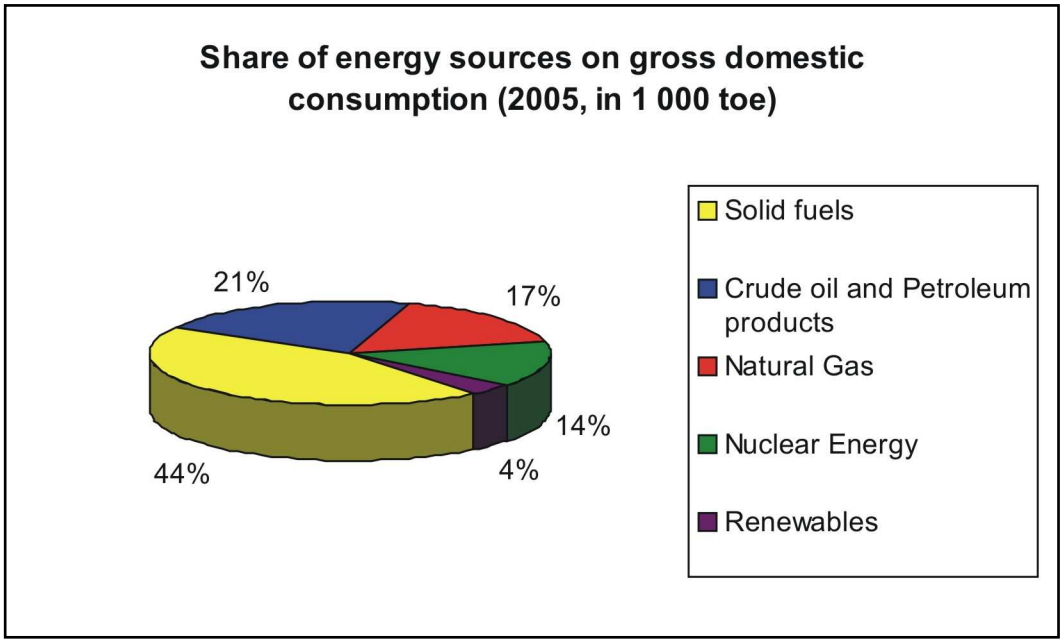
Net energy imports (in 1,000 toe): 12,268

Final electricity consumption (in GWh): 55,246

Gross electricity generation (in GWh): 82,578

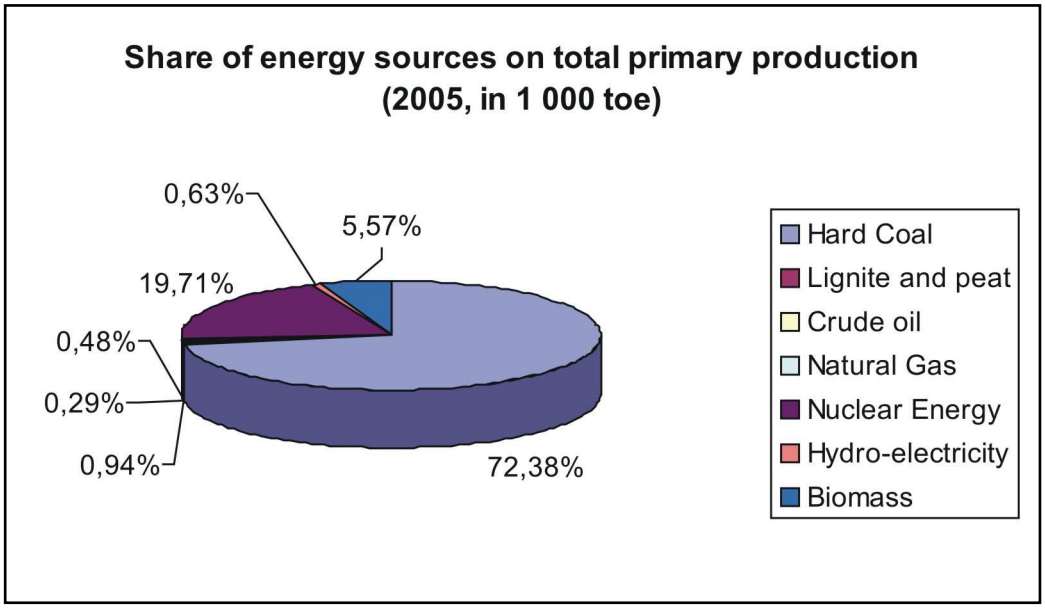
Total heat production (in TJ): 3,326

Figure 11: Share of energy sources on gross domestic consumption in Czech Republic (2005, in 1,000 toe)



Source: Energy – Yearly Statistics 2005 (2007 Edition) *[31]*

Figure 12: Share of energy sources on total primary production in Czech Republic (2005, in 1,000 toe)



Source: Energy – Yearly Statistics 2005 (2007 Edition) *[31]*

2.3. Romania

Total primary energy consumption in Romania had been significantly cut down after 1989, mainly due to changes in the economy sector connected with closing of non-efficient enterprises (3.039 PJ in 1989 and 1.544 PJ in 1999). There has been a slight increase of primary energy consumption in last three years. Industry is the most consuming sector also in Romania, with 40 % share on final energy consumption.

Natural gas, oil and solid fuels have altogether a high share (74 %) on primary energy supply. Majority of them are domestic sources, therefore Romania needs to import just small amounts of gas, oil and hard coal. Therefore, the dependency on imports of energy carriers is under the EU-27 average. The share of net energy imports on gross energy consumption in 2005 was 27.4 %. Romania imports mainly crude oil (40 % of all imported sources) from Russian Federation and Kazakhstan. Other significant imported sources are natural gas and solid fuels. But there is a tendency towards increasing of natural gas import mainly due to a recent increase of gas consumption and successive depletion of domestic natural resources. If the share of imported natural gas on total consumption in period 1990-2002 was 20-25 %, it is forecasted it can grow up to 60-65 % in 2010. The import of natural gas are mostly ensured by WIEE and Wirom Gas companies, which are controlled by the German business Wintershall, a joint venture of BASF and Gazprom. Local gas production is supplied by Petrom and Romgaz enterprises. Natural gas distribution market is dominated by Distrigaz Sud (owned by Gaz de France) that ensures distribution and supply of gas in the southern part of the country and Distrigaz Nord (owned by E.ON-Ruhrgas), which is responsible for gas distribution and supply in the northern part of Romania. These businesses jointly supply 92 % of connected municipalities. There are another 19 smaller distribution companies and roughly 40 licensed suppliers active on the domestic gas market. The process of liberalization of gas market in Romania started in August 2001, but only 10 % was opened for competition. The opening of the market continued in subsequent years, and in July 2006 reached 75 %. The companies in industrial and commercial sectors became the eligible customers in January 2007 and market for households was fully opened in six months (July 2007) *[34]*.

The most important energy source for electricity generation is coal (lignite), but also renewable sources (hydro energy mainly) and natural gas are of great importance. The share of nuclear energy has been increasing since 1996 as well. This share will be definitely increased by 2015 at the latest due to commissioning of other units (3 and 4) in NPP Cernavoda. The feasibility study was finalized on 31 March 2006 and afterwards on the basis of the Government Decision, the Ministry of Industry and Trade and SN Nuclearelectrica SA power utility have started the negotiations with potential investors, financing groups and other participants in securing the financial scheme for to define and implement the commercial/financial framework of the project so to allow the start-up of the works earlier, in the year 2008. The negotiations are currently proceeding with six selected investors: ARCELOR-MITTAL (Romania), ČEZ (Czech Republic), ELECTRABEL (Belgium), ENEL (Italy), IBERDROLA (Spain), and RWE (Germany).

The share of individual power facilities on electricity generation in august 2007 was as follows *[81]*:

- solid fuels 45 %
- hydro 45 %
- gas 16 %
- nuclear 12 %
- liquid 1 %

The Romanian sector of power generation is not concentrated. The largest power generator is Hidroelectrica with roughly 27 % share on total capacity (January - August 2007), followed by another five power generators with roughly 8 to12 % share (each) and two other companies with 4-7 % share (each). The remaining share of 9.4 % relates to 13 small power generating companies. The most notable enterprise in the sector of power distribution and supply is definitely Electrica S.A. - a state-owned company, subordinated to the Ministry of Economy and Commerce *[27]*. The company consists of eight power supply / distribution businesses. The electricity market has been widely opened by July 2005 (83.5 %) and full market liberalization was completed in July 2007 since when all consumers can choose their power supplier.

The public independent body responsible for the creation and implementation of the appropriate regulatory system in order to ensure the proper functioning of the

electricity and heat sector in terms of efficiency, competition, transparency and consumer protection is Romanian Energy Regulatory Authority (ANRE) [85].

The high energy intensity is typical for Romania as well. Another problem that must be promptly solved concerns high emissions of GHG with unequivocal prevalence of CO2 (75 %). The energy sector is the biggest contributor that accounted for 77.4 % of total GHG emissions in 2003.

Main Energy statistics (2005):

Gross inland energy consumption (in 1,000 toe): 39,146

Final energy consumption (in 1,000 toe): 24,502

Primary energy production (in 1,000 toe): 27,451

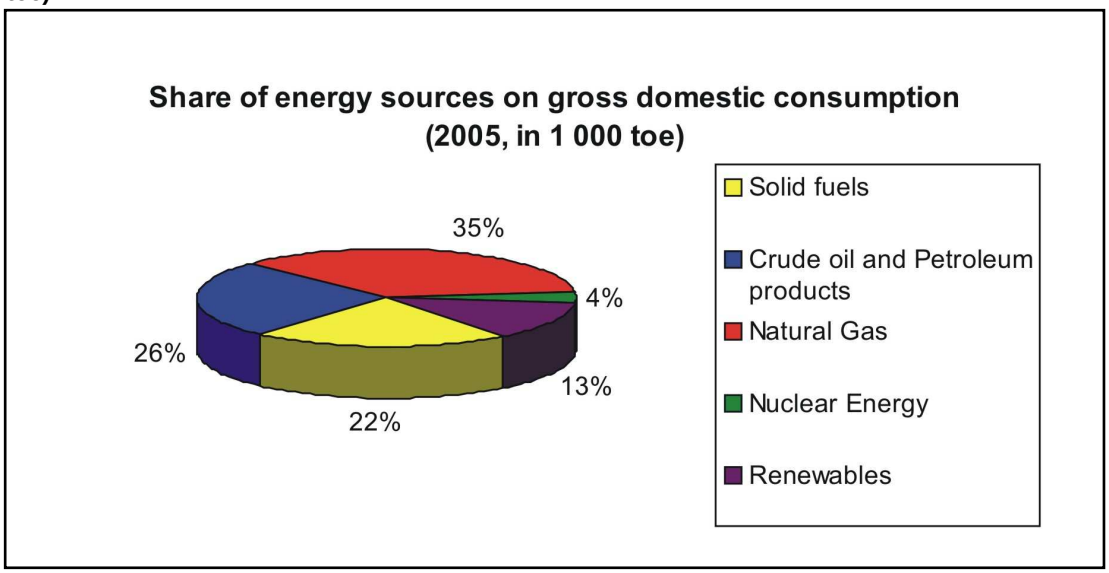
Net energy imports (in 1,000 toe): 10,719

Final electricity consumption (in GWh): 39,046

Gross electricity generation (in GWh): 59,413

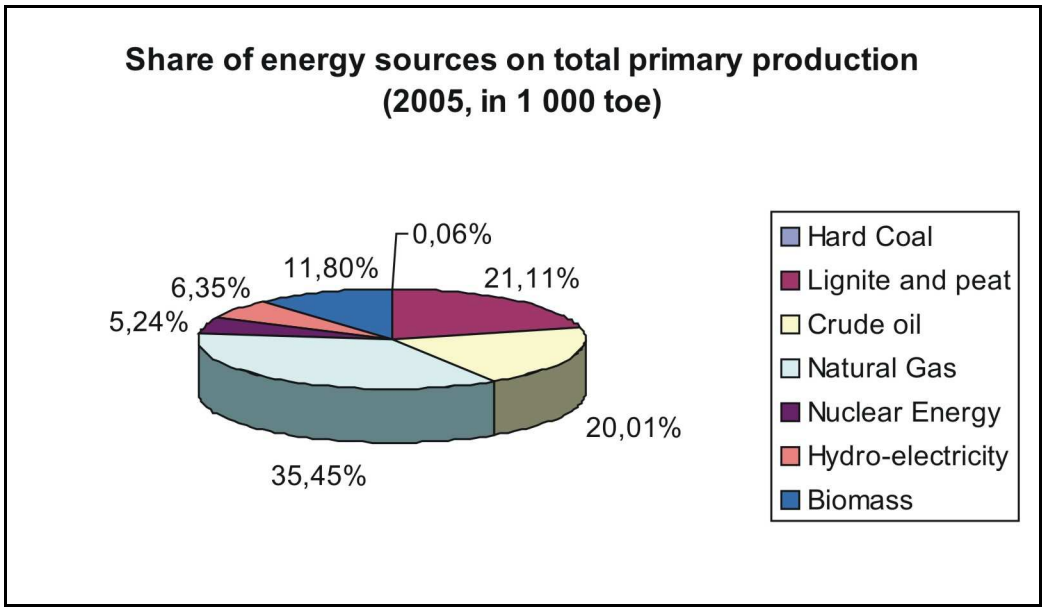
Total heat production (in TJ): 3,049

Figure 13: Share of energy sources on gross domestic consumption in Romania (2005, in 1,000 toe)



Source: Energy – Yearly Statistics 2005 (2007 Edition) *[31]*

Figure 14: Share of energy sources on total primary production in Romania (2005, in 1,000 toe)



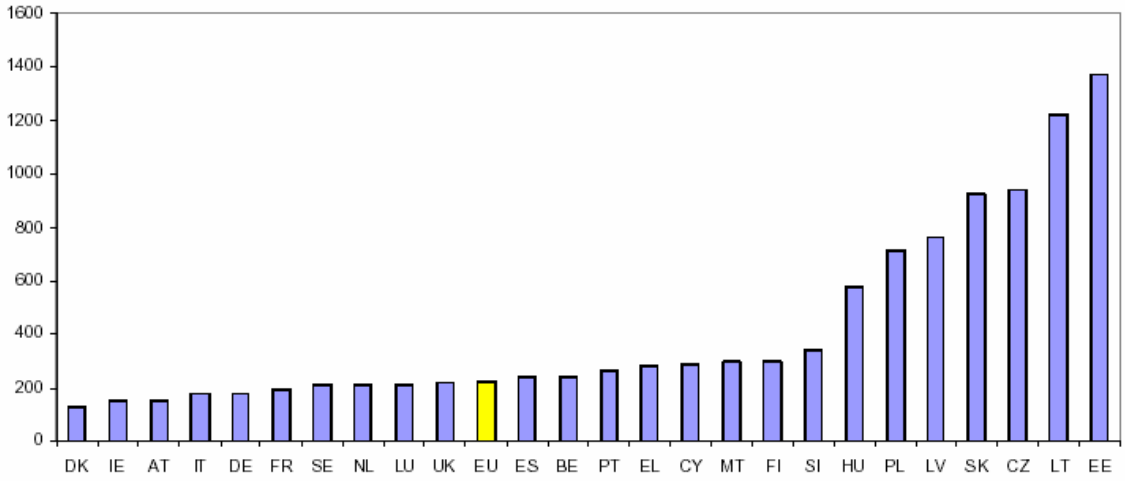
Source: Energy – Yearly Statistics 2005 (2007 Edition) *[31]*

2.4. Slovakia

Slovakia (as a part of Czechoslovakia) as well as other CEE countries has been affected by a massive industrialisation in the post-war communist period. An inadequate structure of the economy was influenced by ideological and geopolitical rather than primarily economical factors and preference of heavy industry has created strong dependency on the raw-materials and energy carriers imported from the former Soviet Union. Characteristic feature for this central planned economy was extremely high energy intensity, energy consumption as well as strong environmental pollution.

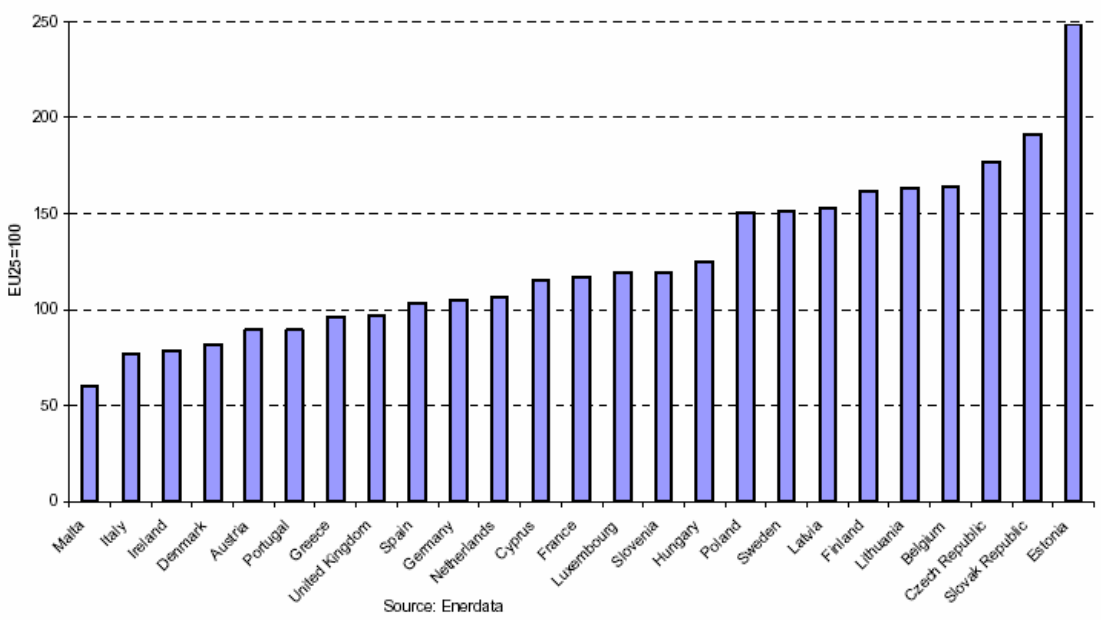
Despite the slight decline of energy intensity in last years, it still remains very high (4.1 times higher compared to EU-27 average; in terms of Power Purchasing Parity it is almost two times higher than the average of OECD countries) and it is henceforth one of the typical features of the Slovak energy sector *[44]*. The most energy consuming sector of economy is industry.

Figure 15: Energy intensity (toe/M€95)-2003



Source: in „Green Paper on energy efficiency – Doing more with less"; European Commission (DG for Energy and Transport), 2005 *[44]*

Figure 16: Primary energy intensity adjusted to Power Purchasing Parity (2002), EU -25=100



Source: in „Green Paper on energy efficiency – Doing more with less"; European Commission (DG for Energy and Transport), 2005 *[44]*

On the other hand, the final energy consumption per capita in the Slovak Republic is still rather low and is below the EU-27 average. Due to the restructuralization of the whole economy the final energy consumption dropped by 30 % in the period 1990-2003. A slight increase of the gross domestic consumption was noticed just in the last three years, concurrently with the growth of GDP and improvements in living standards.

Another typical feature of the energy sector is an extreme dependency on energy import, i.e. over 90 % of primary energy sources are imported. The most imported energy sources are natural gas and crude oil – in 2005 imported from the Russian Federation alone. The third biggest share on energy imports have solid fuels, especially hard coal – imported from the Russian Federation as well. Natural gas is the most used fuel for production of heat in CHP units and boilers in district heating systems in Slovakia (74 %). The share of natural gas on electricity generation is much smaller, approximately 7 % in 2005 (PPC, a.s. Bratislava – the sole gas fired combined cycle plant had 4 % share on total power generation in 2005). The sector is dominated by Slovenský Plynárenský Priemysel, a.s. (SPP joint-stock company) that accounts for supply of all gas in Slovakia [92]. The minority shareholder (49%) is consortium consisted of Gas de France and E.ON-Ruhrgas. Till the middle of 2006, SPP has been also the owner of transmission and distribution networks, but

after legal unbundling on 1 July 2006, two separated companies have begun to act in the market – SPP Transmission, a.s. and SPP Distribution a.s. In relation to natural gas, Slovakia is still an important transit country and has a significant position in the European gas network, mainly due to transport of gas from Russia and former Soviet Republic to Central and Western Europe *[34]*.

The domestic energy production unambiguously depends on nuclear energy, mainly because of the electricity generation (although the fuel for the old style VVER 440/V213 nuclear reactors is imported from Russian Federation only). Other important shares on primary energy production have solid fuels (especially lignite), hydro energy and biomass.

The electricity consumption has been increasing very slowly since 2000 with drop in 2004 and 2005 years and unexpected increase in 2006 (+3.68%). As well the electricity generation has been increasing since 1992, with more abrupt growth in the period 1997 – 2000, and on the contrary, with significant declines in 2003 and 2004.

Slovakia was a net electricity exporter from 2000 to 2006. The overall balance of foreign exchanges of electricity in 2006 was 1,603 GWh in favour of export, which was 1,119 GWh less than in 2005. Export saldo was 5.13 % out of the total electricity production in 2005, compared to 8.7 % share in 2005 *[75]*.

The most important event in the Slovak energy sector in the past years was the privatization of Slovenské Elektrárne a.s. (LPC), a state owned power generator that was founded on January 21, 2002, after the separation of Transmission System Inc. (SEPS, a.s.) and Heating Plant Košice from the former Slovenské Elektrárne a.s. company. 66-percent share was sold to Italian ENEL S.p.A. for € 840 million and deal was officially concluded on April 27th 2006. This was the first privatization of nuclear assets in Europe since the privatization of British Energy plc in 1996. Moreover, the nuclear assets were sold to a foreign company. The owner of the remaining 34 % is the National Property Fund of the Slovak Republic. The main activities of the company include generation, sale, import, export and distribution of power as well as production and sale of heat. Slovenské Elektrárne a.s. are the second largest utility company (right after Hungarian MOL) in the Central and Eastern Europe *[91]*. The company operates two nuclear power plants in Slovakia (two units in NPP Bohunice – EBO with the total installed output of 880 MW_e and two units in NPP Mochovce – JEMO with the same installed output), two thermal

power plants (Nováky – EMO A and B with the total installed capacity of 518 MW_e and Vojany – EVO I. and II. with the total installed capacity of 1,320 MW_e) and 34 hydro power plants with the total installed power of 1,652.70 MW_e. Out of this, 736.6 MW_e is an installed capacity of hydro power plants located at large water reservoirs (e.g. Orava, Liptovská Mara, Nosice, Kráľová) and 916.4 MW_e presents pumped storage hydro-plants (Čierny Váh 734.4 MW_e, Liptovská Mara 98 MW_e, Dobšiná 24 MW_e and Ružín 60 MW_e) that help to satisfy the non-uniform electricity consumption during the day [91]. The overall installed capacity of all power facilities operated by SE was 5,250.70 MW on December 31, 2006. Slovenské Elektrárne a.s. generated 26,482 GWh of power (without JAVYS and VEG companies, which extended Slovenské Elektrárne on April 1st, 2006 or April 28th, 2006 it was just 20,450 GWh) and 3,951,503 GJ of heat in 2006 (without JAVYS and VEG) *[2]*.

Regarding the power distribution and supply, the Slovakia is divided to three zones operated by distribution companies. The western part of country is operated by Západoslovenská energetika (ZSE), a.s., the largest electricity distribution company in Slovakia - 49 % shares are owned by E.ON Energie. In 2003, the ZSE, a.s. supplied an area of 14,928 km^2, with 4,685 wholesale consumers from high voltage level and 980,696 retailers from low voltage level. Company also operated 2,719 km of 110 kV lines and 12,574 km of 22 kV lines in 2003. Central Slovakia is operated by Stredoslovenská energetika (SSE) – 49 % shares are owned by Electricitè de France (EDF). The SSE, a.s. supplied an area of 17,978 km^2, with 5,023 wholesale consumers and 687,332 retailers. Company operated 2,625 km of 110 kV lines and 9,778 km of 22 kV lines (in 2003). Power distribution and supply as well as system and ancillary services in Eastern Slovakia are provided by Východoslovenská energetika (VSE), a.s., with RWE plus as minority shareholder – 49% shares. The VSE, a.s. supplied in 2003 an area of 15,746 km^2 that included 1,925 wholesale consumers and 508,803 retailers as well as 1,255 km of 110 kV lines and 8,000 km of 22 kV lines *[52]*.

The electricity and gas market was opened for all customers except households on 1 January 2005, and fully liberalized on 1 July 2007 since when also households are allowed to choose the energy supplier.

The authority liable for regulation in the energy and water management sectors is the Regulatory Office for Network Industries established on the basis of the Regulatory Act in 2001 [90]. The power transmission system is operated by

Slovenská elektrizačná prenosová sústava, a.s. (SEPS, a.s.) / Slovak Electricity Transmission System PLC. The company ensures dispatching control of the system, its maintenance and development in order to guarantee reliable and quality electricity supply. SEPS is supposed to ensure as well the parallel operation with neighbouring systems in line with UCTE recommendations while respecting non-discriminating and transparent principle approaches to the grids with minimum environmental impacts *[88]*.

The total installed output in Slovakia in 2006 was 8,157 MW with 38 % share of thermal power plants, 32 % share of nuclear facilities and remaining 30 % presented water power plants. The majority of electricity in 2006 was generated by nuclear power plants (58 %), followed by thermal power plants (28 %) and hydro power plants (14 %).

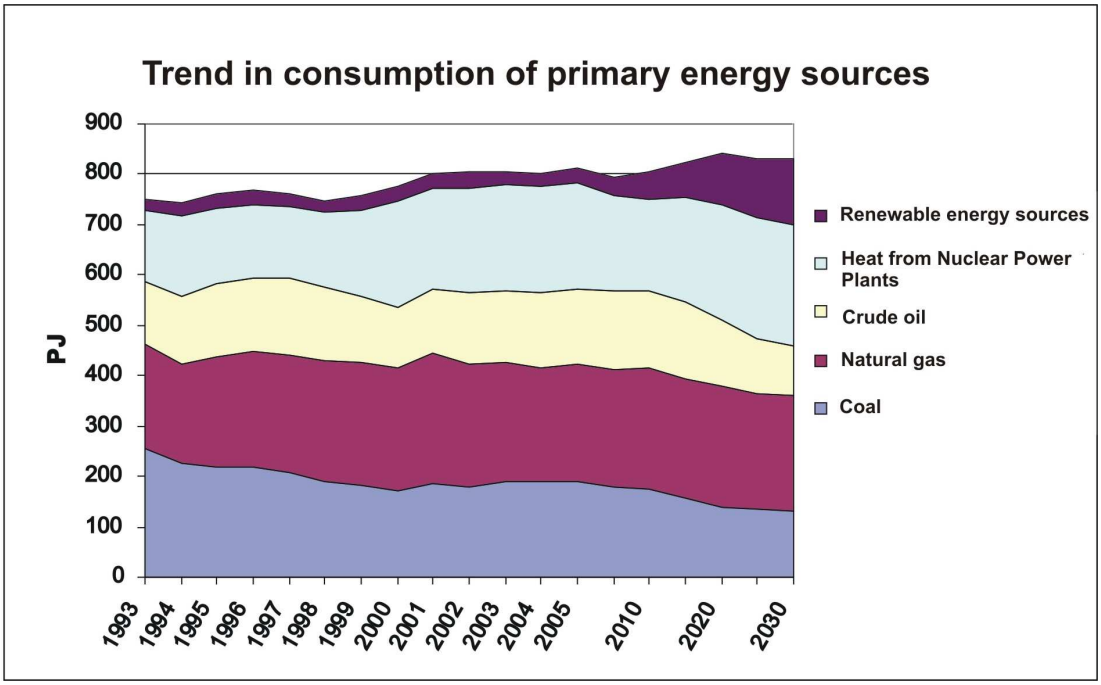
Table 1: Trend of electricity production and consumption in Slovakia (adjusted by Sluka, Ľ.; Center of Energy Alternatives):

Year	Production	Annual Growth / Fall	Installed capacity	Total consumption	Annual Growth/ Fall	Average load	Maximum load	GDP (inter-annual growth in %)[1]
	[GWh]		[MW]	[GWh]		[MW]	[MW]	
2000	30,877		8,313	28,204		3,220	4,275	2.8
2001	32,003	+3.65%	8,363	28,325	+0.43%	3,233	4,393	3.2
2002	32,830	+2.58%	8,306	28,674	+1.23%	3,273	4,421	4.1
2003	31,147	-5.40%	8,297	28,892	+0.76%	3,298	4,338	4.2
2004	30,543	-1,98%	8,267	28,682	-0.73%	3,274	4,349	5.4
2005	31,294	+2.46%		28,572	-0.38%	3,262	4,346	6.1
2006	31,227	-0.21%		29,624	+3.68%	3,382	4,423	8.3
2007[2]	26,176	-19.30%		29,790	+0.56%	3,401	4,450	8.8
2008								6.8
2009								5.8
2010								5.0

Source: Report on outcome of monitoring of energy supply safety, Ministry of Economy of Slovak Republic and Slovak Electricity Transmission System PLC (Slovenská elektrizačná prenosová sústava / SEPS), a.s., July 2005 / 2006 / 2007

[1] Institute of Financial Policy, Ministry of Finance
[2] Forecast for 2007

Figure 17: Trend of primary energy sources consumption in Slovak Republic



Source: Ministry of Economy of Slovak Republic in Proposal on Energy policy of the Slovak Republic (10 January 2006)

On December 31st 2006, the first unit (Soviet type VVER-440/V213 reactor with installed capacity of 440 MW_e) of Nuclear Power Plant Jaslovske Bohunice (EBO V1) was shut-off. The four units in the Thermal Power Plant Vojany (EVO) with total installed capacity of 440 MW_e were decommissioned in 2006 as well.

There are supposed to be decommissioned as well other units with total installed capacity of 490 MW (2nd unit of EBO V1 mainly) till the end of 2010 *[75]*. Altogether, till the end of 2030, there is supposed to be decommissioned facilities with total installed capacity of 3,855 MW. According to the Slovak Electricity Transmission System Joint-stock company, it presents 56 % loss in the electricity production compared to 2006.

Due to the decommissioning of production capacities and expected growth of electricity consumption (see the table below), the Slovak Electricity Transmission System company expects deficit of 29 TWh and therefore necessity to install 6,600 MW of new capacities.

Table 2: Forecast of electricity consumption trend in Slovakia

		2005	2006	2010	2015	2020	2025	2030
Low scenario	GWh	28,572	29,624	30,379	32,008	33,330	34,603	35,987
Reference scenario	GWh	28,572	29,624	31,892	34,713	37,534	40,418	43,112
High scenario	GWh	28,572	29,624	32,815	37,121	41,530	45,990	50,544
Average annual growth	%	3.7						
Low scenario	%	0.8						
Reference scenario	%	1.6						
High scenario	%	2.3						

Source: Slovak Electricity Transmission System Inc. (SEPS a.s.) in Strategy of Energy Security of Slovak Republic up to 2030

According to author of this study, the forecast developed by SEPS a.s. is strongly tendentious, based on abrupt increase of electricity consumption in 2006. It is not clear so far whether it is a beginning of a longer period with higher electricity consumption or it is just an anomaly. Especially in 2004 and 2005 there was a drop in electricity consumption compared to previous years even in spite of a quite strong annual growth of GDP (5.4% or 6.1%). Even the percentage growth of total electricity consumption in 2007 was 0.56% compared to 2006. It might mean that sudden increase of electricity consumption in 2006 (+3.68%) was very likely anomaly.

However, this forecast also does not take into account predicted gradual decline of GDP beginning in 2008 and especially any of the measures focused on lowering of extremely high energy intensity and increase of energy savings / energy efficiency in the economy and energy sectors. Therefore, a growth corresponding with the low scenario among the above stated forecast (i.e. 35,987 GWh in 2030 at most) can be assumed.

Ministry of Economy and SEPS, a.s. recommends the following program of installation of energy facilities up to 2030:

Table 3:

Description	Proposal of installations for balanced production and consumption of electricity	Output (MW)	Phase-in (year)
In the process of construction	Levice PPC	80	2007
	Increasing of output of EBO V2 and EMO 1, 2	164	to 2010
	Completion of EMO 3. unit	471	2012
	4. unit	471	2012
Renewable Energy Sources	Biomass + waste	210	to 2030
	Biogas	270	
	Small hydro power plants	100	
	Large hydro power plants	250	
	Wind power plants	450	
	Geothermal power plants	100	
	Solar power plants	720	
Forced production	Restoration of thermal power plants and cogeneration	362	to 2030
Proposal of new power plants	New or restored decommissioned units of thermal power plants	800	2015-2023
	New PPC	400	2015-2020
	New nuclear power plants	600	2024
		600	2025
	Pumping water power plants Ipeľ	600	around 2020
Total		**6,648**	

Source: Slovak Electricity Transmission System, PLC (SEPS a.s.) in Strategy of Energy Security of Slovak Republic up to 2030

Main Energy statistics (2005):

Gross inland energy consumption (in 1,000 toe): 19,407

Final energy consumption (in 1,000 toe): 10,606

Primary energy production (in 1,000 toe): 6,547

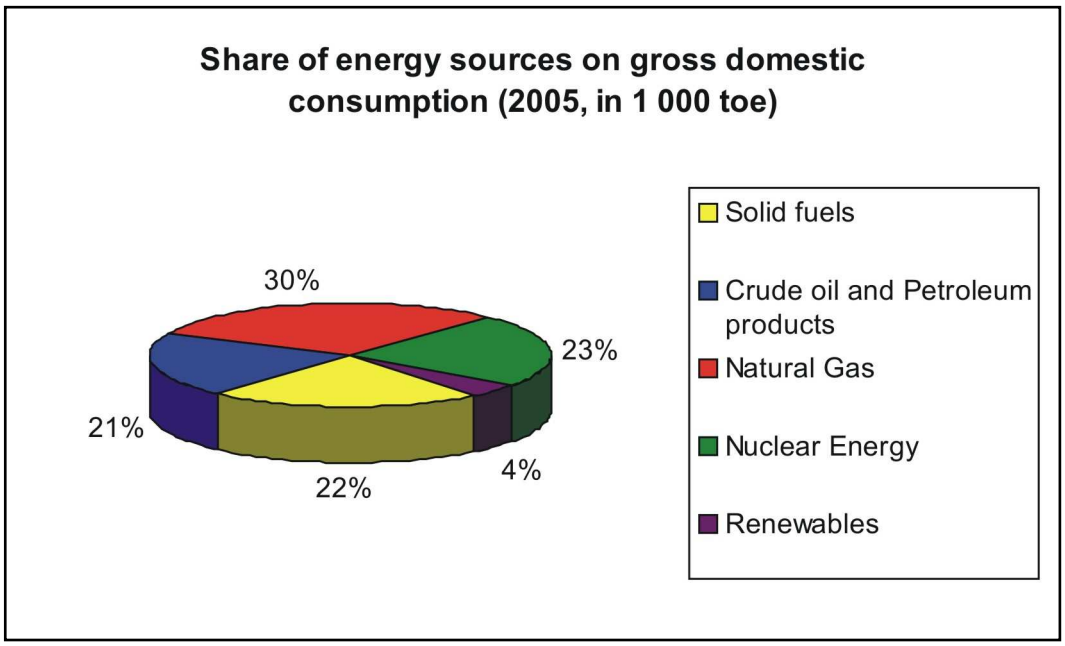
Net energy imports (in 1,000 toe): 10,719

Final electricity consumption (in GWh): 22,850

Gross electricity generation (in GWh): 31,455

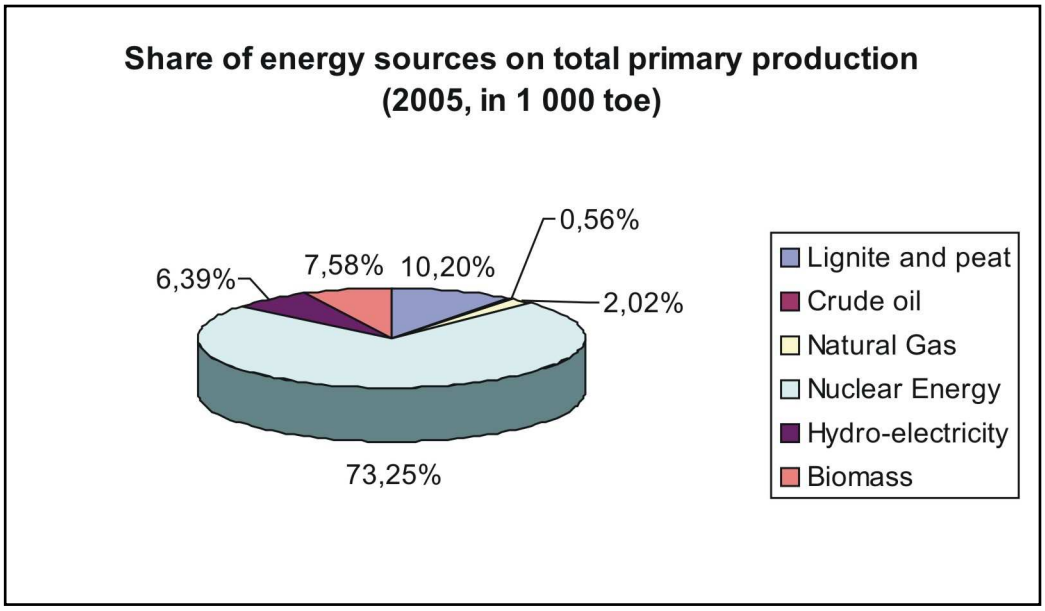
Total heat production (in TJ): 1,255

Figure 18: Share of energy sources on gross domestic consumption in Slovakia (2005, in 1,000 toe)



Source: Energy – Yearly Statistics 2005 (2007 Edition) *[31]*

Figure 19: Share of energy sources on total primary production in Slovakia (2005, in 1,000 toe)



Source: Energy – Yearly Statistics 2005 (2007 Edition) *[31]*

3. Prices of electricity and natural gas in engaged CEE countries

3.1. Electricity prices

The average electricity price for households is in both cases – including taxes or without taxes, definitely the highest in Slovakia. In Bulgaria, Czech Republic and Romania, the price of electricity for households until the 2006 was fairly below the EU average, only in Slovakia it has exceeded this average in 2005 and 2006, but not substantially.

The price of electricity in Slovakia was even the highest among the EU-27 countries, if the Purchasing Power Standards (PPS)[3] is taken into account (0.2448 PPS, as of January 1, 2006). The second highest price among the EU-27 countries was recorded in Romania (0.2150 PPS, as of 1st January 2006). If the PPS is taking into account, the electricity prices are higher also in Bulgaria (0.1669) and Czech Republic (0.1581) in comparison with the other EU member states (for instance the second lowest is in United Kingdom – 0.0905) *[39]*.

The electricity price (without VAT but including other taxes or duties) for industrial facilities is in all four countries below the EU average. The price accounted very similar level in the Czech Republic, Romania and Slovakia in 2006. The price of electricity for industry in Bulgaria was the second lowest among all EU member states in 2006 (the lowest was in Latvia).

Table 4a: Comparison of electricity prices for households (average price of 1 kWh, without taxes in c€)

	2001	2002	2003	2004	2005	2006
EU-25				10.02	10.25	10.78
EU-15	10.27	10.32	10.36	10.27	10.43	10.94
Bulgaria				4.86	5.37	5.52
Czech Republic	5.38	6.42	6.54	6.60	7.29	8.29
Romania					6.55	8.59
Slovakia				10.24	11.23	12.16

Note: Based on the standard consumer Dc (3.500 kWh/year) on the 1st of January of each year (weighted by consumption)
Source: Gas and electricity market statistics; 2006 Edition (Data 1990-2006), Luxembourg 2006 *[39]*

[3] The PPS is an artificial common reference currency unit that eliminates price level differences between countries; one PPS thus buys the same given volume of goods/services in all countries

Table 4b: Comparison of electricity prices for households (average price of 1 kWh, all taxes included in c€)

	2001	2002	2003	2004	2005	2006
EU-25				13.20	13.54	14.16
EU-15	13.17	13.36	13.55	13.58	13.85	14.44
Bulgaria				5.83	6.44	6.60
Czech Republic	6.58	7.83	7.97	8.07	8.68	9.85
Romania					7.79	10.23
Slovakia				12.18	13.38	14.48

Note: Based on the standard consumer Dc (3.500 kWh/year) on the 1st of January of each year (weighted by consumption)
Source: Gas and electricity market statistics; 2006 Edition (Data 1990-2006), Luxembourg 2006 *[39]*

Table 4c: Comparison of electricity prices for industry (average price of 1 kWh, without VAT but including other taxes or duties in c€)

	2001	2002	2003	2004	2005	2006
EU-25				7.04	7.45	8.65
EU-15	6.95	6.76	7.34	7.21	7.60	8.78
Bulgaria				4.09	4.29	4.60
Czech Republic	4.73	5.18	4.99	4.92	6.01	7.31
Romania			4.42	5.10	7.69	7.04
Slovakia				6.83	7.03	7.73

Note: Based on the standard industrial consumer Dc (2.000 MWh/year) on the 1st of January of each calendar year (energy and other taxes are included)
Source: Gas and electricity market statistics; 2006 Edition (Data 1990-2006), Luxembourg 2006 *[39]*

3.2. Prices of natural gas

The average prices of natural gas are in all four countries below the EU-27 average (including the all taxes or without taxes) – in Romania is actually the lowest among all EU countries. But situation is different if the Purchasing Power Standards is considered. In that case the price of natural gas in Bulgaria is the third highest in the EU-27 (19.49 PPS as of 1 January 2006), in Slovakia the fourth (18.40 PPS as of 1 January 2006) and in the Czech Republic the seventh (16.90 PPS as of 1 January 2006). It is much more than in United Kingdom, where the price is the lowest (7.30 PP). The price of natural gas (including VAT) for the sector of industry is in all four countries below the EU average as well. One of the lowest prices of natural gas for industrial purposes was in Bulgaria and Romania (just behind the Baltic States), out of all EU member states in 2006.

Although the electricity and natural gas prices are still mostly below the EU-27 average, there has been more striking increase of prices of both commodities (but especially of natural gas) in the period of 2005-2006 in all four countries, ranging between 2.5 % (annual percentage change of average electricity price for households including all taxes in Bulgaria) and 50.6 % (annual percentage change of average price of natural gas for industry without VAT in Slovakia). Therefore, some substantial steps and measures in order to eliminate those negative factors will have to be carried out in very short term.

4. Potentials and current status of renewable energy sources utilization

4.1. Bulgaria

In spite the fact that Bulgaria has a sizeable potential related to energy production from renewable energy sources, the portion of RES, both of total energy use and of total energy consumption, is currently very small. The data concerning potential of RES in Bulgaria can be found in numerous publications. The general idea for the potential of economical renewable energy sources (based on 1999), equal to 60 % of the reserve potential defined under the most commonly quoted ESD study, is presented in the following table No. 5 *[87]*:

Economical potential of renewable energy sources in Bulgaria (TJ/year)		
Type of Resource	Value (TJ/year)	Share (%)
Biomass and waste	27,134	31.0
Small Hydro Power Plants	1,992	2.3
Wind Energy	14,752	16.8
Solar Energy	34,440	39.3
Geothermal Energy	9,261	10.6
Total RT FEC (final energy consumption) 1999	87,579 384,518	100.0
Potential share RES in %	**22.8%**	

Source: National energy saving study of Bulgaria. SAVE II project. Study on the possibility for an implementation of a widespread energy saving programme in Bulgaria. Vienna: E.V.A. SEEA, E.V.A. and I.C.E. 2001, in Slavov, T.: Incentives and barriers for the development of renewable energy sources, Bulgaria – country analysis

The data pertaining to mid-term economical potential of the country can be found also in the National Programme on RES 2004-2014 that provides an idea of the financial measures needed to achieve the targets as well *[87]***:**

Table 6: RES National Potential in Bulgaria

RES NATIONAL POTENTIAL	Total Value (in million USD)	Total Power Capacity (in MW)	Total Heat Capacity (in MW)
1. Solar hot water systems	81.09		202.72
2. Solar photovoltaic power systems	49.70	12.43	
3. Wind power generators	162.19	62.22	
4. Small and Medium Hydro PPs up to 10 MW	151.77	101.18	
5. Geothermal installations	393.22		786.44
6. Biomass installations	559.07		372.73
7. Biogas and Natural gas installations	251.96	244.26	125.98
RES TOTAL	**1,647.01**	**302.55**	**1,487.87**

Source: "National Project/Programme on Renewable Energy Sources (NPPRES) in Republic of Bulgaria 2004 – 2014", Energy Efficiency Agency, MEER; in Slavov, T.: Incentives and barriers for the development of renewable energy sources, Bulgaria – country analysis

In order to achieve the national RES targets indicated by the State Energy and Water Regulatory Commission (SEWRC), it will be absolutely inevitable to develop a new long-term national program. This program is supposed to provide targeted incentives for the use of RES in a manner which meets the national goals, since the project intentions in the power sector introduced in NPPRES for period 2004-2014 seems to be insufficient to meet those targets.

Bulgaria, as a member of the European Union since 1 January 2007, has also committed to increase the share of RES on electricity generation in the country. On the basis of COUNCIL DIRECTIVE 2006/108/EC of 20 November 2006 that adapted Directives 90/377/EEC and 2001/77/EC in the field of energy, by reason of the accession of Bulgaria and Romania, and even within the EU Accession Treaty for Bulgaria, the country set an indicative target to achieve 11 % share of RES on gross inland electricity production by 2010. Even the long-term goal related to share of RES on total energy consumption by 2010 was set by the Government at the level of 11 %. Fulfilling this target would require an annual installation of 450 MW and 450 million EUR of investments [87]. Bulgaria is approaching the Renewable electricity target in stages – the share of RES on gross domestic electricity consumption increased from 7.2 % (2,795 GWh) in 1997 to 9.28 % (3,296 GWh) in 2004. On the other hand, the technical and economical potential of large-scale hydro power plants that are currently the main source of power generation is already almost fully exploited *[87]*. Therefore it will be unavoidable to support wider utilization of other RES with obvious potential, i.e. biomass and biogas, solar, wind and geothermal

energy sources and increase the share of those sources in the energy mix as it is the goal of the National Programme on Renewable Energy Sources as well.

The share of RES on gross domestic consumption in 2005 was 5.65 % (i.e. 1,123,000 toe / 47,064,930 GJ). The final energy consumption of RES in 2005 (excluding electricity) was 745,000 toe (31,222,950 GJ). The share of RES on Bulgarian total primary energy production in 2005 was roughly 10.89 % (1,149,000 toe). Out of this, 373,000 toe presented hydro energy (excl. pumped storage), 743,000 toe biomass (wood and wood-waste only) and 33,000 toe hit upon geothermal energy. Only two renewable energy sources took a share in the heat production in 2005 – biomass (713,000 toe) and geothermal (33,000 toe).

The power generation from RES in 2005 was as following *[31]*:

- hydro with installed capacity < 1 MW: 3 GWh (equivalent to installed output of 9 MW)
- hydro with installed capacity > 1 & <10 MW: 851 GWh (equivalent to installed output of 63 MW)
- hydro with installed capacity > 10 MW: 3,483 GWh (equivalent to installed output of 1,928 MW)

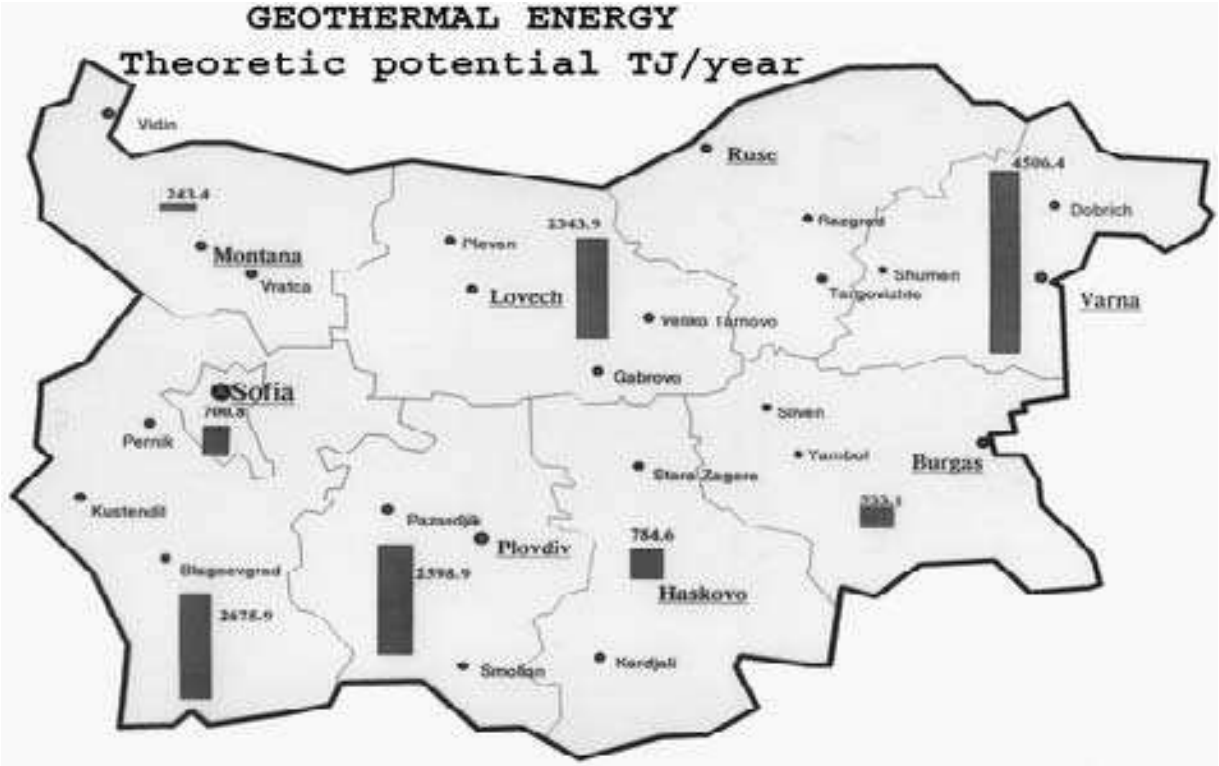
Gross power generation of HPP (including large HPPs) in 2005 has been 4,730 GWh (equivalent to installed capacity of 2,567 MW among which 864 MW presented pumped storages) and wind turbines 2 GWh (equivalent to installed capacity of 1 MW).

As it was stated above the third most utilized source of renewable energy in Bulgaria is ***geothermal energy***. The importance of this source can grow in the close future because of its significant potential, mainly for heat production *[87]*.

There have been registered 136 mineral springs in Bulgaria, of different capacity and temperature. A characteristic feature of those thermal waters is low mineralization, small yield – from 0.5l/sec to 478 l/sec (or in sum total for the country from 3,934.7 l/sec to 4,600 l/sec) and low temperature – from 20 ℃ to 101,4 ℃ with total energy equivalent of 0.3 ktoe. The waters of temperature between 20 – 30 ℃ cover roughly 30 % of the existing potential and those of temperature between 40 – 60 ℃ cover about 43 % share. Low alkaline waters (pH 7.2 – 8.2) make 55 % of the overall capacity [3]. The survey conducted by the Bulgarian Academy of Sciences

localized 216 geothermal sources (springs or geothermal wells) and defined their basic parameters – temperature, yield, chemical components etc.

Figure 20: Map of potential of geothermal energy in Bulgaria



Source: in Georgieva, V.: Energy from the Earth – geothermal energy; Energy Efficiency and Environmental Protection Directorate, Ministry of Economy and Energy of Bulgaria

Table 7: Theoretical potential of geothermal energy by regional centres

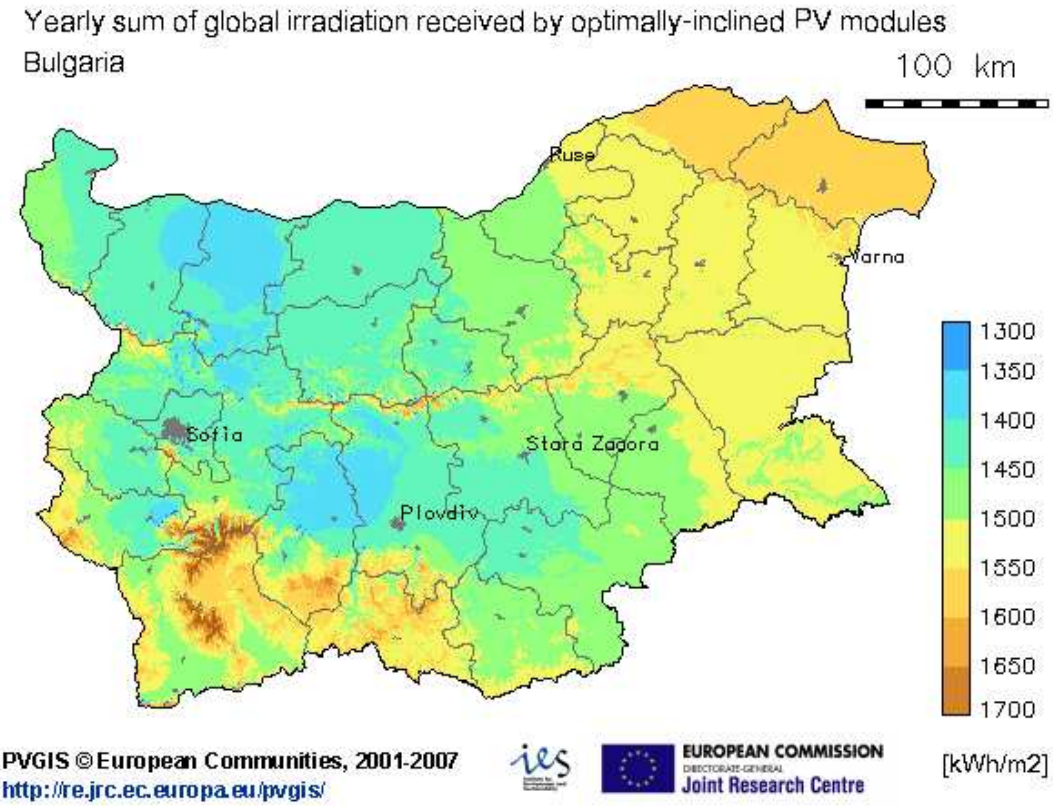
Regional Centre	**RES Type – Geothermal Energy**		
	TJ/year	MWh	toe/year
North-western VIDIN	260	8.3	6,190
North Central ROUSSE	2,213	70.2	52,690
North-eastern VARNA	3,996	126.7	91,142
South-eastern BOURGAS	453	14.4	10,786
South Central PLOVDIV	3,277	103.8	87,119
South-western SOFIA	3,657	115.9	87,072
Total:	**13,856**	**439.3**	**325,903**

Source: PHARE Project Technical and Economic Assessment of the Renewable Energy Resources in Bulgaria – 1997; in *[41]*

Geothermal energy from water resources is nowadays used in Bulgaria mainly in specialized health facilities (for rehabilitation, prophylactics, relaxation etc.), for the preparation and supply of hot water in hospitals, sanatoriums and hotels as well as in the heating systems for schools and municipality and state owned buildings and above mentioned consumers. The application of this energy resource in agriculture sector is not widely distributed but has a measurable energy-saving effect *[41]*.

Potential of ***solar energy*** is the biggest out of all RES in the country, which is related to the favourable geographical and climate conditions. The energy can be mostly used for preparation of domestic hot water (DHW) or heat production but substantiation can also have power generation – either by means of photovoltaic systems or solar thermal power plants.

Figure 21:



As far as the global solar irradiation, Bulgaria can be divided into three zones / regions:

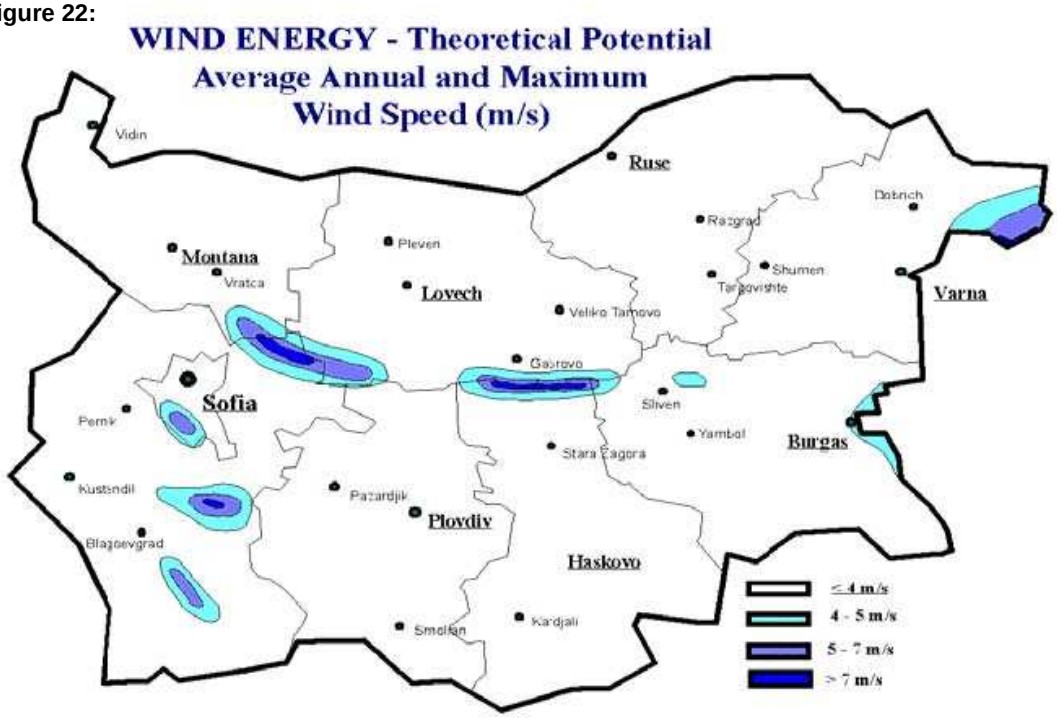
A. **Central-east region:** covers 40 % of the overall territory and includes 30 % of the population in Bulgaria. It covers mostly mountainous regions and is characterized by inconsistence of micro-climatic conditions. The daily global solar irradiation is 4 kWh/m^2 – i. e. annual irradiation is 1,450 kWh/m^2. The average annual sunshine duration from 31 March to 31 October is up to 1,640 hours and from 31 October to 31 March just up to 400 hours.
B. **North-east region:** is the biggest of all – covers 50 % of the territory and includes 60 % of the population. It covers industrial and agricultural regions and a part of the central north riverside strip. The daily global solar irradiation is 4.25 kWh/m^2 – that means annual irradiation of about 1,450 – 1,500 kWh/m^2. The average annual sunshine duration from 31 March to 31 October is up to 1,750 hours and from 31 October to 31 March 400 - 500 hours.
C. **Southeast and South-west region:** covers 10 % of the territory and includes 10 % of the population. This region lies on the south coast of the country. The daily global solar irradiation is 4.25 kWh/m^2 and annual irradiation 1,550 kWh/m^2. The average annual sunshine duration from 31 March to 31 October is over 1,750 hours and from 31 October to 31 March over 500 hours.

Taking into consideration that 77 % of the total territory of Bulgaria is covered by forests, arable land, natural protected areas and reserves, military bases etc., the Ministry of Economy and Energy presupposes that roughly 3 % of the total territory of the country could be used for installations for power production from solar energy. Current utilization of solar energy for power generation is rather omissible. The total installed capacity of all PV installations in the country as of the end of 2006 was 66 kW only. Out of this, 53 kW related to on-grid installation and 13 kW to off-grid installations *[97]*. The first grid-connected demonstration 10 kW PV system (AcadPV) was put into the operation in August 2006 in Sofia *[104]*. The system was supported by the EU project “PV Enlargement”. Within the framework of the same project, the second PV installation was expected to be put into the operation in the Gabrovo University in the first half of 2007.

The feed-in tariffs for PV installations are being set by the Ordinance of State Energy and Water Regulatory Commission.

The surface of the country offers also good opportunities for ***wind power installations***, mainly along the Black Sea coast and at in the mountain regions with altitude above the 1,000 meters. But the areas suitable for wind energy utilization are limited to the certain extent – it was estimated that an area with annual wind velocities more than 6.5 m/s, which is economically viable threshold for wind energy installations, cover roughly 1,400 km^2. The following map of wind potential from 1982 is based on 30-years historical data coming from 119 weather stations that measure wind direction and velocity.

Figure 22:



Source: in Georgieva, V.: Wind energy in Bulgaria; Energy Efficiency and Environmental Protection Directorate, Ministry of Economy and Energy of Bulgaria

On the basis of annual data of measurement of wind velocity and direction at a height of 10 meters above the ground level, suitable localities related to wind energy use can be divided into three zones *[42]*:

1. **Zone A (Region One)**: the average multi-annual wind velocity in this zone does not get over 2 m/s and is the highest in winter (February, March) and the lowest in autumn (September, October) and therefore 60-70 % of the wind potential is available in winter and spring and remaining 30-40 % in summer/autumn months, the duration of period in winter and spring time with

velocity of wind 2+ m/s is roughly 2,000 hours; this region includes the vast flat parts of Bulgaria (Danubian Plain, Thracian Lowlands, Sofia Flat Field, the valleys of Struma and Mesta rivers and the Fore-Balkan area)

2. **Zone B (Region Two**): the average multi-annual wind velocity in this zone ranges from 2 m/s to 4 m/s but in some areas (on capes) exceeds 4 m/s, wind velocity is the highest in winter (February, March – 24-hour peaks occur during daytime) and the lowest at the end of summer and beginning of autumn (August, September) but the maximum wind speeds on the Black Sea coast occur in February and minimums in June or July; 60-65 % of the wind potential is available in winter and spring and remaining 35-40 % in summer/autumn months, the duration of the period in winter and spring with velocity of wind 2+ m/s ranges between 2,300 and 2,400 hours; this region includes the parts of Bulgaria situated east from the line Rousse-Veliko Tarnovo-Elhovo, the Danubian riverside as well as exposed low mountainous parts at altitude approximately 1.000 meters a.s.l.
3. **Zone C (Region Three**): the average multi-annual wind velocity in this zone markedly exceeding 4 m/s and is the highest in winter (February) and the lowest in summer (August) and therefore 65-70 % of the wind potential are available in winter and spring and remaining 30-30 % in summer/autumn, the duration of the period in winter and spring time with velocity of wind 2+ m/s is approximately 4,000 hours; 24-hour night-time peaks and day-time minimums are well traceable during transitional seasons; the region covers exposed and forestless mountainous areas (altitude more than 1,000 meters a.s.l.)

These data in fact can have an approximate value only, as wind direction and velocity as well as wind power density measured at 10 meters height are not sufficient for preparation of any capital investment project. For example, one of the most important parameters influencing the amount of gained energy – air density – is decreasing with altitude (1 % for each 100 meters). The wind potential at 50 meters height above the surface level is twice as high as that at 10 meters. Therefore, for an absolutely accountable development of a project for utilization of wind energy, it is inevitable to position a cup anemometer or any other gauging device on a measurement mast at height of at least 20 meters below the considered location of a nacelle (while optimal would be the same height) *[109]*. It is

recommended to carry out measurements off all necessary “wind” parameters for a period of one year at least as well.

The cumulative installed capacity of wind power reached in Bulgaria 32 MW by the end of 2006, which was 320 % growth in comparison to the end of 2005 (10 MW) *[33]*.

After the accession to the EU, even Bulgaria must comply with the Directive 2003/30/EC of the European Commission, which requires all EU member states to guarantee a minimal share of biofuels in the fuels used in the transport sector. The directive set national indicative targets that are in line with the reference value - 2 % share of biofuels on all fuels used in the sector of transport by 2005 and 5.75 % share by 2010. The first target (2 % in 2005) has not been reached as the share of biofuels achieved 1.4 % only *[40]*. The European Commission therefore developed and presented the EU Strategy for biofuels in February 2006, which defined new priorities. This Strategy was based on the Biomass Action Plan. One of the most used tools in the EU member states concerning the increase of use of biofuels is exemption from excise taxes on the basis of the Directive 2003/96/EC *[15]*, according which the member states can, under certain conditions, introduce fiscal incentives in order to promote the wider use of biofuels.

A superb natural and climate conditions offer a lot of opportunities for biofuels production development in Bulgaria. The share of arable land on all agricultural used land was 59.4 % (3,128,210 hectares) in 2005 (the share in 1998 was even bigger – 60 % and 3,392,000 ha). The great potential for biofuels production offer mainly unused agricultural land (fallow and uncultivated land), which had 19 % share on the total agricultural land in 2005.

Concerning production of **bioethanol**, three main crops should be considered – sugar beet, wheat and maize. Despite of favourable climatic conditions, the domestic production of *sugar beet* in the last years was relatively low – 26,367 t in 2004. According to the data from the Bulgarian Ministry of Agriculture and Forestry, the average harvest of this crop is about 22.55 t/ha, which corresponds to 1.97 t/ha of alcohol. *Wheat*, in terms of volume, has currently a dominant position in domestic plant agricultural sector – the country produced 3,961,000 t in 2004 (in an area of 1,039,678 ha). The average harvest of wheat is about 3.09 t/ha, which corresponds to 0.88 t/ha of alcohol. The best conditions for wheat cultivation can be found in

regions with the largest amount of arable land in the country – Dobroudja region and plain regions of Northern Bulgaria. The average harvest of *maize* is 4.47 t/ha, which corresponds to 0.41 t/ha of alcohol. The maize prefers warm weather and humidity therefore it is cultivated on irrigated lands of North-eastern and North-western regions.

The rapeseed and the sunflower should be taken into account in relation to **biodiesel** production. Suitable climatic and agro-meteorological conditions highly favour *rapeseed* for a wider biodiesel production. However, the amount of harvested rapeseed in 2004 was low – only 22,388 tons. This state was a result of some negative factors – e.g. lack of tradition in production, low winter temperatures and rapid warming in the period of ripening. According to the Bulgarian Ministry of Agriculture and Forestry, the average harvest of rapeseed is about 1.5 t/ha, which corresponds to 0.53 t/ha of oil. The average harvest of *sunflower* is about 1.48 t/ha, which corresponds to 0.59 t/ha of alcohol *[40]*. The sunflower is after the maize the second important agricultural crop in Bulgaria, and is mostly recommended for a future production of biodiesel.

On the basis of the potential for biofuel production, the prospects for development of agriculture and the forecast levels of liquid consumption in Bulgaria, the following indicative targets have been proposed:

Table 8:

YEAR	Indicative target (in %)	Biofuel (in tonnes)[4]	Required area (in hectares)[5]
2008	2	43.241	57,574
2010	5,75	166,787	164,086
2015	10	292,608	438,390

Source: in Georgieva, V.: BIOFUELS – The alternative fuel or fuel of the future in United Europe; Energy Efficiency and Environmental Protection Directorate, Ministry of Economy and Energy, Sofia, Bulgaria

To reach the above defined targets in 2010 and 2015 will require a new incentives in the agricultural sector - especially in relation to cultivation of energy crops, clear improvement of efficiency in the sector of transport, introduction of criteria for the quality of the vehicle pool in the country *[40]*, as well as many other specifically targeted ones.

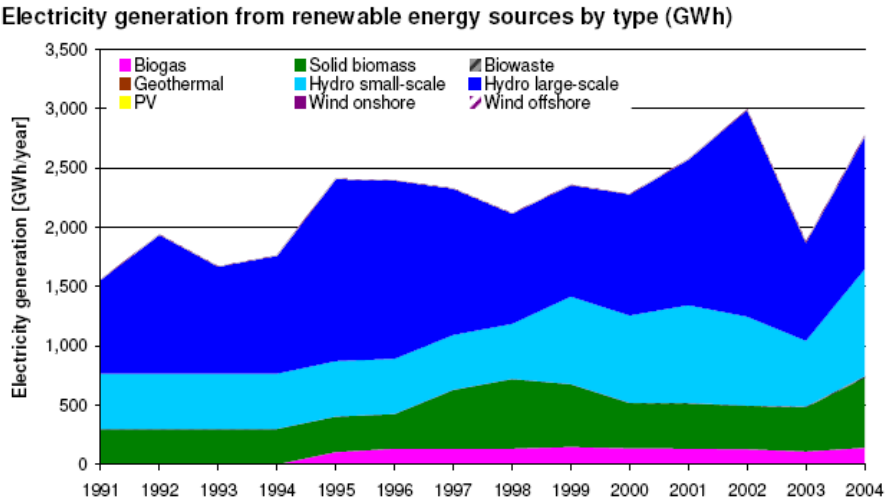
[4] Necessary quantity of biofuel on the domestic market as percentage of total quantity of fuels used in the period
[5] Necessary area with energy crops for the production of quantity of biofuel

4.2. The Czech Republic

The Czech Republic belongs to those EU member states countries lagging behind in the utilization of RES – although the situation is not so critical in comparison with the other member states. On the basis of approaches of member states to compliance with the indicative targets related to the share of electricity from RES (RES-E) in gross electricity consumption (average in EU-25 was set on 21 % in 2010), the Commission presented a special report assessing progress in RES-E in individual member states at the beginning of 2007 *[43]*. The Commission has divided states to five categories (ranked from best to worst): 1. "Perfect: on track for meeting the 2010 target"; 2. "Current developments provide a reasonable chance of reaching the 2010 target"; 3. "Additional effort needed to achieve the 2010 target"; 4. "Stronger additional efforts are needed in order to reach the 2010 target" and 5. "Far from the commitment". The Czech Republic was classified for the category No. 3, „With additional efforts there is a good chance of reaching the 2010 target", with modest progress in RES-E due to uncertainty of financial support. Commission also stated that *in order to reach the 2010 target, the faster growth is needed*. Also the revised support scheme to provide bigger support from 2006 onwards has been expected.

It is necessary to quote as well the fact that the indicative target of the Czech Republic at the level of 8 % is one of the lowest among the EU – 27 member states (only seven EU states set lower targets). The share of RES generation in gross electricity consumption in 1997 was 3.8 %, in 2004 4.1 % and in 2006 4.91 %. The share of RES generation in gross inland electricity production was 4.17 % in 2006.

Figure 23:



Source: European Commission
http://ec.europa.eu/energy/res/legislation/share_res_eu_en.htm

The gross power production from RES in 2006 amounted to 3,518.8 GWh that presented rise of 385.3 GWh compared to 2005 (3,133.5 GWh) and it has been the same annual increment as between 2004 and 2005 *[9]*.

Table 9: Power generation from RES in Czech Republic in 2006

	Gross electricity generation	Supply to the grid / netto generation	Share on green electricity	Share in gross domestic electricity consumption	Share in gross electricity generation
	MWh	**MWh**	**%**	**%**	**%**
Hydro power plants	**2,550,700**	**2,540,100.0**	**72.49%**	**3.56%**	**3.02%**
Small HPP up to 1 MW	333,000	b.d.	9.46%	0.46%	0.39%
Small HPP 1-10 MW	631,400	b.d.	17.94%	0.88%	0.75%
Large HPP > 10 MW	1,586,300	b.d.	45.08%	2.21%	1.88%
Biomass - total	**731,066.4**	**285,746.4**	**20.78%**	**1.02%**	**0.87%**
Wood chips etc.	272,724.5	190,673.1	7.75%	0.38%	0.32%
Cellulose leaches	350,027.7	0.0	9.95%	0.49%	0.41%
Plant substances	84,464.5	76,040.0	2.40%	0.12%	0.10%
Pellets	23,849.7	19,033.3	0.68%	0.03%	0.03%
Biogas - total	**175,837.2**	**99,755.9**	**5.00%**	**0.25%**	**0.21%**
Communal water treatment plants	67,661.6	16,126	1.92%	0.09%	0.08%
Industrial water treatment plants	2,069.6	407.0	0.06%	0.00%	0.00%
Biogas stations	19,210.5	6,953.3	0.55%	0.03%	0.02%
Landfill gas	86,895.5	76,269.6	2.47%	0.12%	0.10%
Solid communal wastes	**11,264.4**	**4,43.,6**	**0.32%**	**0.02%**	**0.01%**
Wind power plants (over 100 kW)	**49,400**	**49,100**	**1.40%**	**0.07%**	**0.06%**
Photovoltaic systems (estimation)	**540.0**	**200.0**	**0.02%**	**0.00%**	**0.00%**
Liquid biofuels	**22.3**	**20.7**	**0.00%**	**0.00%**	**0.00%**
Total	**3,518, 830.3**	**2,979,358.6**	**100.00%**	**4.91%**	**4.17%**

Source: Ministry of Economy, Energy Regulatory Office of Czech Republic (ERU) in *[9]*
Note: at the wind, water and solar power plants the netto generation is quoted according to ERU

The increase of electricity generation compared to the previous years has been achieved mainly due to favourable hydrological conditions and consequential higher production in hydro power plants. But the provisional data for 2007 year show drop of power generation in HPP because of a dry season. Taking into consideration dependence on variable climatic conditions, there is necessity to evaluate all statistical data very precisely and responsibly. Also the power generation from biomass increased well in 2006 and there is a positive fact that the share of plant substances used for power generation (energy crops, pellets) is gradually

increasing. The important factor is the production of heat energy from biomass in households.

Table 10: Heat production from OZE in 2006

	Gross production	Own consumption including losses	Supply	Share on heat production from RES
	GJ	GJ	GJ	%
Biomass - total	**41,759,667.8**	**40,214,646.4**	**1,545,021.4**	**91.19%**
Biomass apart from households	**16,369,797.1**	**14,824,775.7**	**1,545,021.4**	**35.75%**
Fire-wood	556,157.8	555,972.8	185.0	1.21%
Wood chips etc.	7,918,201.5	7,032,247.7	885,953.8	17.29%
Cellulose leaches	7,656,367	7,100,369.7	555,997.3	16.72%
Plant substances	122,521.8	63,946.2	58,575.6	0.27%
Briquettes and pellets	116,549	72,239.3	44,309.7	0.25%
Biomass in household	**25,389,870.7**	**25,389,870.7**	**–**	**55.45%**
Biogas - total	**918,510.6**	**842,624.7**	**75,885.9**	**2.01%**
Communal water treatment plants	709,546.4	709,546.4	0.0	1.55%
Industrial water treatment plants	50,500.9	48,123	2,377.9	0.11%
Biogas stations	80,270	71,330	8,940	0.18%
Landfill gas	78,193.3	13,625.3	64,568	0.17%
Biologically degradable parts of solid communal waste	**1,909,760.7**	**425,778.9**	**1,483,981.8**	**4.17%**
Biologically degradable parts of industrial wastes and alternative fuels	**400,083.2**	**400,083.2**	**–**	**0.87%**
Heat pumps	**676,499.4**	**676,499.4**	**not finding**	**1.48%**
Solar thermal collectors	**127,637.9**	**127,637.9**	**not finding**	**0.28%**
Liquid biofuels	**163.7**	**163.7**	**0.0**	**0.00%**
Total	**45,792,323.3**	**42,687,434.2**	**3,104,889.1**	**100.00%**

Source: Ministry of Economy, Energy Regulatory Office of Czech Republic (ERU) in *[9]*

The solid biomass had the biggest share (91 %) in heat production from RES in 2006. There was 16,370 TJ of heat produced apart from households, which is less than in 2005. The importance of other renewable sources on heat generation has been very low so far (4.17 % share of biologically degradable parts of solid communal waste and 2.01 % share of biogas). The share of heat pumps on heat production is also very low – 1.5% (676.5 TJ in 2006), but a more significant growth in the next years is expected. The importance of solar energy on heat production by

medium of solar thermal collectors is more than negligible nowadays – 0.28 % (127.6 TJ).

The national target pertaining to the share of RES in total primary energy consumption by 2030 has been set at the level of 15-16 %. The share of RES on primary energy sources was 4.31 % in 2006.

Table 11: Total energy from RES in 2006

	Energy in fuel used for heat production (GJ)	Energy in fuel used for electricity generation (GJ)	Primary energy (GJ)	Energy from RES - total (GJ)	Share on PES	Share on energy from RES
Biomass apart from households	19,920,070.93	5,609,825.23	–	25,529,896.16	1.34%	31.16%
Biomass (households)	40,138,138.37	–	–	40,138,138.37	2.11%	48.99%
Hydro PP	–	–	9,182,520	9,182,520.00	0.48%	11.21%
Biologically degradable parts of solid communal waste	2,189,306.18	52,041.73	–	2,241,347.92	0.12%	2.74%
Biologically degradable parts of industrial wastes and alternative fuels	400,083	–	–	400,083.00	0.02%	0.49%
Biogas	1,163,534.28	1,492,037.77	–	2,655,572.05	0.14%	3.24%
Liquid biofuels	192.50	94.50	798,319	798,606.00	0.04%	0.97%
Heat pumps			676,499.36	676,499.36	0.04%	0.83%
Solar thermal collectors	–	–	127,637.91	127,637.91	0.01%	0.16%
Wind power plants	–	–	176,400.00	176,400.00	0.01%	0.22%
Photovoltaic systems	–	–	1,944.00	1,944.00	0.00%	0.00%
Total	**63,811,325.26**	**7,153,999.23**	**10,963,320.27**	**81,928,644.76**	**4.31%**	**100.00%**

Source: Ministry of Economy, Energy Regulatory Office of Czech Republic (ERU) in *[9]*
Note: PES – Primary Energy Sources

Table 12: Potential of renewable energy sources in Czech Republic

Potential of electricity generation from the Sun			
Potential	**Total collector area (m^2)**	**Installed output (MW)**	**Power generation (GWh/year)**
Technical	210,000,000	22,000	23,000
Available	50,200,000	5,300	5,500
Potential of utilization of thermal solar energy			
Potential	**Total collector area (m^2)**		**Production (TJ/year)**
Technical	13,000,000		25,000
Available	9,000,000		17,000
Potential of agricultural cultivated biomass			
Potential	**Production of biomass (thousands of tonnes)**		**Energy (PJ)**
Economical (in 2004)	2,737		41
Available	9,037		136
Usable	13,693		205
Technical	18,348		275
Theoretical	27,385		411
Potential of forest biomass			
Potential			**Energy (PJ)**
Technical			77.6
Available			44.8
Potential of biogas use			
Potential	**Biogas (thousands of m^3)**	**Electricity (GWh)**	**Energy (PJ)**
Technical	1,510,600		33
Available	625,000	1,200	16
Potential of water energy			
Potential	**Annual production (GWh)**	**Installed output (MW)**	**Number of hydro power plants**
Technical	13,100		
Available	2,280	1,134	1,618
out of that small HPP	1,115	398	1,610
Used	1,850	1,004	1,188
out of that small HPP	705	268	1,180
Non-used (SHPP only)	410	130	430
Re-powering (technological modification	40	15	200
Technical potential of power generation from wind energy			

Potential	Wind velocity (m/s)	Installed power (MW)	Expected generation (GWh/year)
	4,1 - 5,0	2,571	2,236
	4,6 - 5,0	2,368	2,053
	5,1 - 6,0	8,208	12,312
	> 6,0	888	1,776
Total technical		11,667	16,324
Total available		3,000	4,000

Technical and available potential of geothermal energy use			
Kind of energy (MW)	**Technical potential (MW)**	**Available potential (MW)**	**Note**
Hydrothermal > 130 °C (power generation)	300	100	one borehole presents an output roughly of 10 MW
Dry heat of rocks (power generation)	35,000	3,400	one locality presents an output roughly of 4 MW (two boreholes are needed)
Hydrothermal < 130 °C (heat production)	200	25	utilization is bounded to chosen localities
Energy of shallow environs of the rocks (heat production)	25,000	4,000	energy usable by heat pumps; available potential would require the power sources with installed capacity of 1 GW

Source: Information about the potential of renewable energy sources in Czech Republic; Association for renewable energy sources utilization, at www.czrea.org

As it is clearly visible from the figures (tables) above, the most important source of all RES in the Czech Republic is ***biomass***, mainly due to its energy utilization for production of heat. Biomass has also the second biggest share out of all RES on the power production, right behind the hydro power plants (especially in relation to those with installed power of more than 10 MW). The following kinds of biomass are utilized in the Czech Republic for energy purposes:

- Wood wastes – wood chips, sawdust, wood shavings, bark, residues from forest harvesting
- Firewood
- Briquettes and pellets
- Charcoal

- Plant substances / non-timber biomass (phytomass) – green biomass, grain and rape straw, “energy plants”
- Industrial and communal wastes of plant origin e.g. cellulose leaches
- Sources of animal origin – manure
- Biologically degradable parts of industrial and solid communal wastes
- Liquid biofuels

There was 16,370 TJ of heat produced from biomass apart of household and small consumers. For this production, 1,839,577.5 tons of fuel was consumed. The most utilized kind of biomass in 2006 was cellulose leaches, closely followed by wood waste (wood chips, sawdust, wood shavings, bark and residues from forest harvesting). The share of plant substances / non-timber biomass still remains very low, despite experts seeing them to be one of the biggest potential within the whole biomass category. The low share of pellets and briquettes and partly also of firewood can be a result of higher prices of these sources, which results in their export abroad.

Approximately 25,390 TJ of heat was produced by households in 2006 and all energy has been consumed on-site as well. The biomass in this sector is often combusted non-efficiently. The sources of biomass are often local forests, municipal greenery or it comes from self-harvesting or local traders of biomass. Pellets, briquettes or wood from energy plants has a marginal share on consumption in this category *[9]*.

The electricity generation from biomass increased by 30.5 % in 2006 compared to 2005 (from 560 GWh to 731 GWh). Out of this amount, 349 GWh has been generated by co-firing with coal and remaining 373 GWh is a result of co-generation in large heating plants. In order to generate the above mentioned amount of power, 512,000 tons of biomass has been used (389,000 in 2005). The biggest share on supplies of biomass had wood waste, wood chips and sawdust (250,000 t), followed by cellulose leaches (about 185,000 t), but the share of briquettes / pellets and plant substances increased in 2006 as well.

Concerning the ***biogas*** in the Czech Republic, there are four main types of biogas retrieval registered *[79]*:

- ⇨ Biogas stations on communal water treatment plants
- ⇨ Biogas stations on industrial water treatment plants

- ⇨ Biogas stations on farms utilizing industrial and communal waste, other co-fermentation
- ⇨ Energy use of landfill gas

The most utilized facilities or sources for biogas production in the past years were communal water treatment plants (using mostly anaerobic fermentation) and dumping sites (landfill gas). Nowadays, the development of biogas stations located at farms is booming (14,694,000 m^3 increase in 2006). There were 14 biogas stations in operation in 2006, but the construction of others was in progress *[9]*.

There was 122,902,000 m^3 of biogas used for energy purposes in 2006 (14 more than the previous year – 107,761,000 m^3) that corresponds to the energy content of 2,655,572 GJ. The installed electricity capacity was 42,838 kW in 165 units and power generation amounted to 175,837 MWh. Out of this, 57 % of power was supplied to the grid. The installed heat capacity was 171,757 kW in 256 units and heat production amounted to 918,510.6 GJ. Only 10 % of the total production was heat supplies – the energy was mostly used for the operation of stations.

There were also 111 biogas cogeneration units in operation with the installed electricity output of 28,539 kW and heat output of 41,417 kW. These units generated 112,749.9 MWh of power and 555,719.2 GJ in 2006.

The Czech Republic, as a member state of the EU, has also to comply with the Directive 2003/30/EC of the European Commission, which requires all EU member states to guarantee a minimal share of ***biofuels*** in the fuels used in the transport sector – 2 % share of biofuels on all fuels used in the sector of transport by 2005 and 5.75 % share by 2010. Besides this Directive, in order to speed up the process of biodiesel production, as well other legislative documents were issued in the Czech Republic in the last years: Ordinances of government No. 125/1996 about the use of ethanol for non-food purposes, No. 420/1998 about the possibilities of bioethanol use at the production of spirituous-gasoline mixtures, No. 833/2003 and No. 825/2004 related to program of bioethanol production. But the current situation in bioethanol production is a blind corner, mainly because of uncertain conditions pertaining construction of large distilleries. More than 10 companies already declared their interest to produce bioethanol, e.g. Synthesia Pardubice, Setuza, „Průmyslový lihovar Přestanov“ - distillery, Trmice at Ústi nad Labem, Sugar factories – a member of TEREOS concern, Distillery Kojetín. As main sources for

bioethanol production in the Czech Republic are considered sugar beet, grain, maize, fruits or potatoes, and in some cases also vegetables and cellulose can be taken into consideration. Altogether 258.1 t of bioethanol was used for direct blending into motor petrol and 1,531.6 t for production of 2,968.2 t of ETBE in 2006. From the both bio-components, 114,411.5 t of motor petrol, including bio-components meeting the ČSN EN 228 standard, was produced. The whole amount was consumed in the Czech Republic.

Biodiesel is generally a mixture of MERO (methylester of rapeseed) and diesel oil, but biodiesel should be correctly MERO only. On the basis of a legislative standard from 1995, it was allowed to accomplish blending of mixtures (petroleum derivates, additive and high quality diesel oil) with MERO in order to have at least 30 % share of MERO in the fuel. The biodiesel is produced by the several companies, e.g. KL-OIL, SWAM CS, ADW Bio, Agricos, Agrochem. MERO was produced by more than 20 companies in 2004: e.g. Setuza, Fabio Produkt, KL-OIL. There was 3,364.3 tons of diesel oil with 5 % share of methylester of fatty acids (FAME) produced in 2006, out of this 2,393.9 t were exported. The amount of produced diesel oil with 31 % share of MERO reached 32,829.1 tons in 2006 with annual export of 8,321.9 t. Since 2007, a regulation on compulsory blending of bio-components in motor fuels is in force.

Water energy has the second biggest share among all RES on primary energy sources in the Czech Republic. It has a dominant position within RES sector on power generation – 72.49 % in 2006. The share in total gross electricity production was 3.02 % and in total gross electricity consumption 3.56 % in 2006.

But there is almost no potential to build large HPP, the favourable conditions for construction of HPP can be found on small rivers only. Those rivers are suitable for construction of small HPP (< 10 MW), which are environmentally more friendly. Besides this, there are also considerations to build pumped-storage hydroelectric plants, but not enough specific so far.

According to expert's estimations, 70 % of overall hydro potential is already utilized. The remaining non-utilized hydro-energy potential can be divided according to percent occurrence of localities on watercourses considering the head gaining to following groups *[79]*:

- Head > 5 m: 10 % occurrence

- Head in the range of 2-5 m: 55 % occurrence
- Head < 2 m: 35 % occurrence (extremely low heads)

Watercourses in the Czech Republic are divided (belong) to five river-basins and are managed by five administrations.

Table 13: Technically usable hydro-energetic potential of watercourses in Czech Republic up to 10 MW, divided according to respective water-basins

River-basin	Installed output (MW)	Power production (GWh/year)
Labe	114	420
Vltava	164	430
Ohře	78	300
Odra	56	100
Morava	100	250
Total	**512**	**1,500**

Source: in „Renewable energy sources and possibilities of their application in Czech Republic"; ČEZ, a.s., Prague, 2007

There are 530 small HPP with the total installed capacity of 110 MW currently in operation in *Labe water-basin*. The average current utilisation of energy potential of overall water-basin is 74 %. The upper reaches of the Labe River is 100 % used, localities in the middle reaches are also occupied, though not all them are being utilized so far (heads at the non-used localities range from 1.2 to 2.5 m). The lower reaches of the river are being considered for construction. The installations on the other rivers in this basin are limited due to the ecological requirements mainly. The current average utilisation of energy potential of the *Vltava water-basin* is about 49 %. There are rivers with 80-100 % utilization of potential, but vice-versa, also watercourses with just a very low utilization – of 15-30 %. The fact is the localities non-utilized so far have worse conditions pertaining energy utilization, mainly due to low heads of 1.2 - 2.5 m. The current average utilisation of energy potential of the *Ohře water-basin* is high – 72 %. Almost all utilizable localities are already exhausted and utilization of the remaining ones is limited by the economical parameters (e.g. pay-back period etc.). The average utilisation of energy potential of *Odra water-basin* is about the lowest of all – roughly 46 %, which is consequence of the negative attitude of the watercourses administration towards construction of small HPP and the instability of watercourses (threat by sudden large flows). The

average utilisation of energy potential of the *Morava water-basin* is 59 %. Free localities for energy use within this basin are situated mostly on the lower reaches of the rivers, but are limited by low or very low heads up to 2 metres and some of them by instability of watercourses as well.

Besides the construction of new small hydro power plants, the restoration or re-powering of currently operated small HPP is considered. The bigger utilization of potential of dam reservoirs, retentive reservoirs and especially fishponds (only 20 % of all ponds is energetically used so far) was being taking into account in recent years as well.

Gross power production in hydro power plants in the Czech Republic in 2006 amounted to 2,550.7 GWh that corresponded to 1,028.5 MW of installed power. It presented 7 % growth compared to the previous years. Out of that, small HPP (up to 10 MW) generated 964.4 GWh of power (installed power of 275.7 MW). Compared to 2005, decreasing of power generation from small HPP has been registered.

Besides that, 706.6 GWh were generated by pumped-storage hydroelectric plants in 2006, which corresponded to 1,146.5 MW of installed power.

The assessments of respective kinds of potential however differ even in expert publications and materials. It concerns the potential of ***wind energy*** as well. The assessment of realization wind energy potential (considering installation of wind turbines with installed output of 1.75 MW) *[79]* is based on the following materials:

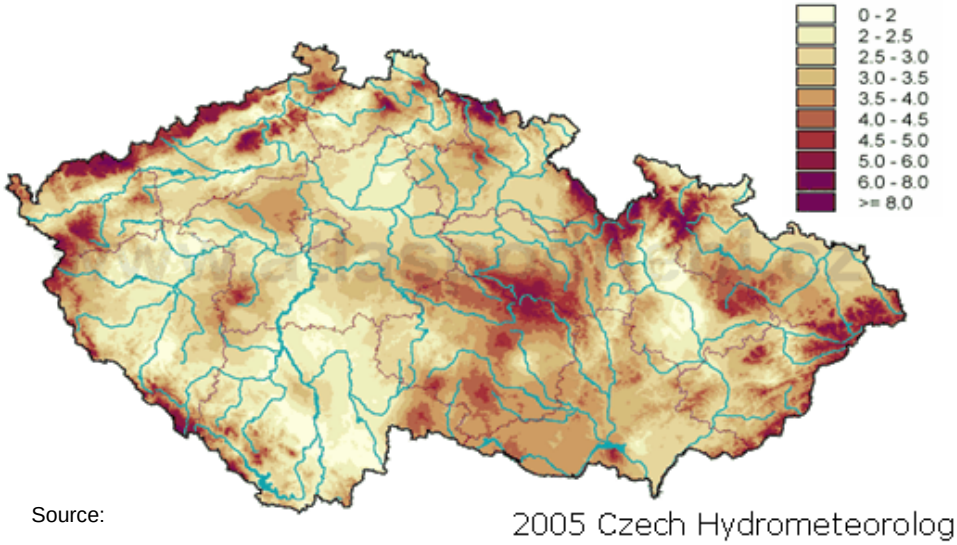
- Expert study “Perspectives of wind energy utilization for power generation in Czech Republic” , chapter IV., elaborated in 1995
- Applications made for EIA (Environmental Impact Assessment) procedure related to developing wind parks
- Current installed capacities of wind turbines in Sachsen country (GER) and in Austria as well as rate of development of wind energy in Germany and Austria

Table 14: The assessment of realisable potential according to regions (in MW)

Northern Bohemia	340
Western Bohemia	55
Eastern Bohemia	90
Middle Bohemia	15
Northern Moravia	200
Southern Moravia	195
Southern Bohemia	18
Total	**900**

Source: in „Renewable energy sources and possibilities of their application in Czech Republic"; ČEZ, a.s., Prague, 2007

Figure 24: Czech Republic - map of wind velocities



Source: 2005 Czech Hydrometeorological Institute

The intense growth of development and construction of wind parks in the Czech Republic nowadays is mainly due to an appropriate legislation (the adoption of the Law on support of electricity generated from RES), available technology and relatively fast construction in comparison to conventional facilities *[9]*. In parallel with this, it is possible to expect 400 MW of installed power and production of 615 GWh in 2010, 600-700 MW and annual production of 920-1,100 GWh in period of 2012-2014 and 800-900 MW in period of 2016-2018 (predicted annual power generation of 1,230-1,380 GWh).

According to the Energy Regulatory Office (ERÚ), the wind turbines with total installed capacity of 43.5 MW (21.5 MW more than in 2005) generated 49.4 GWh of gross power in 2006 (more than twice in comparison to the previous year). The EWEA gives cumulative installed capacity of wind turbines as of the end of 2006 at

50 MW. The fact is that some of the wind power plants have been already constructed but did not feed power to grid till the end of 2006.

The capital investment projects in the wind sector in the Czech Republic must be in line with the following main documents or procedures *[79]*:

- "Act on conservation of nature and land No. 114/1992" (mainly applying to protection of plants, animals and birds
- "Methodical instruction to selected aspects of proceeding of natural conservation authorities at exit of approval in concordance with § 12 and prospective other resolutions according to the Act No. 114/1992 related to localization of structures of high wind power plants" issued by the Ministry of Environment.

  This instruction is a result of an analyse prepared by the Ministry of Environment of the Czech Republic with the goal to avoid conflicts between interests of nature protection and wind park developers. The Ministry of Environment of the Czech Republic processed the data on the localities with wind speed above 4.5 m/s from the regional meteorological stations and physical institutes that are overlapping with the areas of national parks, nature protection areas, NATURA 2000 areas and main migratory routes of birds. All outcomes of this study are at disposal (in map forms also) for natural conservationists as well as for developers, with the aim to avoid construction of wind parks on unsuitable localities from environmental point of view. The methodical instruction includes also a list of environmental impacts that might have negative influence on nature.
- Stands of municipalities – they have a right to give opinions as an involved party
- Rules for operation of transmission and distribution system (PPDS) and Ordinance of Energy Regulatory Office No. 51/2006 about the stipulations of connection to the power / transmission system
- The Act on ground-planning materials and ground-planning documentation No. 50/1976

The average intensity of solar irradiation inclined on horizontal surface is 800W/m^2, but depends on geographical position and climate conditions. The annual sum of

global irradiation on horizontal surface is in the range of 980-1,267 kWh/m^2, with an average value of 1,033 m^2.

Table 15:

Yearly global irradiation (kWh/m^2)			
	horizontal	vertical	optimal
minimum	980	768	1,115
average	1,033	800	1,169
maximum	1,117	858	1,267

Table 16:

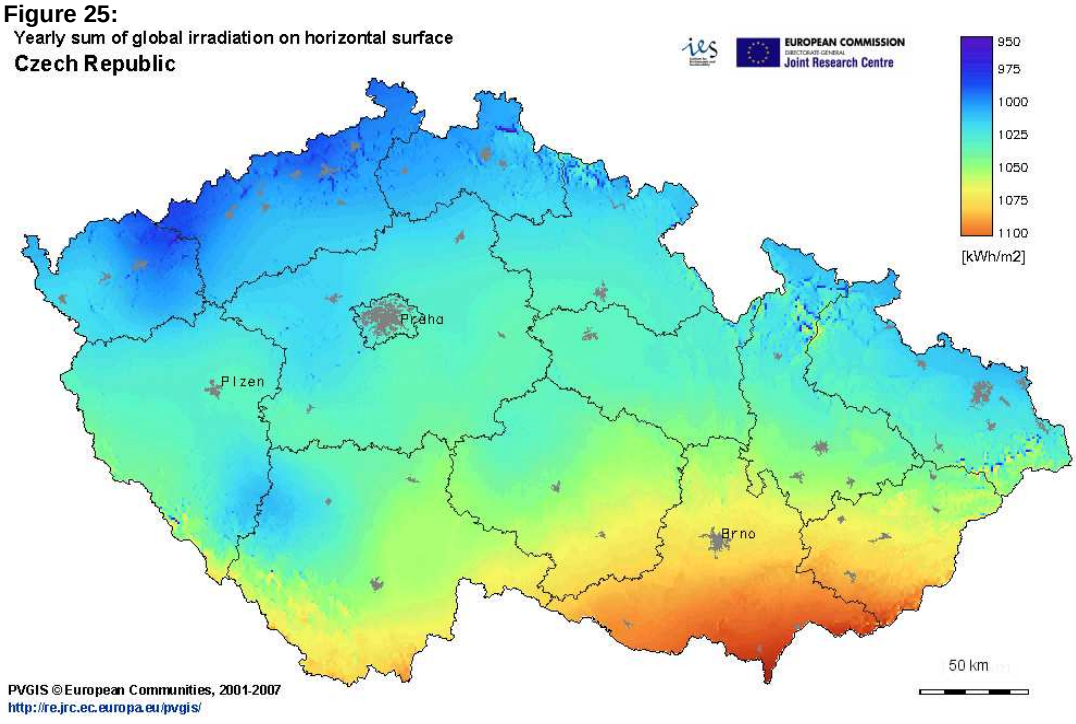
Yearly PV power (kWh/1kWp)			
	horizontal	vertical	optimal
minimum	750	569	839
average	782	609	880
maximum	840	652	948

Table 17:

Optimum inclination angle of PV modules (deg.)	
	Angle
minimum	33
average	34
maximum	36

Source of figures: Photovoltaic Geographical Information System (PVGIS), Geographical Assessment of Solar Resource and Performance of Photovoltaic Technology; http://re.jrc.cec.eu.int/pvgis/index.htm

Figure 25:



The present utilization of ***solar energy*** potential in the Czech Republic is omissible. The solar thermal collectors produced 127,637.9 GJ of heat energy in 2006. This energy served mostly for preparation of domestic hot water (DHW) and production of heat. The share of solar energy on total renewable energies in 2006 was 0.16 % and on the overall primary energy sources 0.01% only.

Table 18: Annual installed surfaces in 2005 and 2006 per type of collector (in m^2) and power equivalent (in MW_{th})

	Installed in 2005	Installed in 2006
Flat plate solar collectors	13,200	18,490
Unglazed solar collectors	3,230	6,000
Vacuum solar collectors	2,350	3,540
TOTAL in m^2	**18,780**	**28,030**
Power equivalent (MW_{th})	**13.1**	**19.6**

Source: Solar Thermal Barometer; EuroObserv'ER, Systémes Solaires – Le Journal dés Énergies Renoulevables no. 180, July 2007

Table 19: Cumulated capacity of thermal solar collectors installed in Czech Republic in 2005 and 2006[6]

	Cumulated capacity in 2005	Cumulated capacity in 2006	Per inhabitant in 2006
in m^2	**87,930**		
in MW_{th}	**61.6**		
in m^2		**115,960**	
in MW_{th}		**81.2**	
m^2/1000 inhab.			**11.3**
kW_{th} /1000 inhab.			**7.9**

Source: Solar Thermal Barometer; EuroObserv'ER, Systémes Solaires – Le Journal dés Énergies Renoulevables no. 180, July 2007

The Czech Ministry of Industry and Trade presents the following statistical data related to the total installed surfaces of all operated solar systems in the Czech Republic (in m^2):

Table 20:

	Overall installed surface of operated systems			
	2003	**2004**	**2005**	**2006**
Flat plate glazed collectors	52,228	60,657	73,768	90,647
Vacuum pipe collectors	6,000	7,768	10,121	13,663
Concentration systems	727	745	805	805
TOTAL	**58,955**	**69,170**	**84,694**	**105,115**

Source: Ministry of Economy, Energy Regulatory Office of Czech Republic (ERU) in *[9]*

All on-grid photovoltaic systems generated 0.2 GWh of electricity in 2006 *[9]*. It is very difficult to evaluate utilization of solar energy for power generation mainly

[6] All technologies, including unglazed collectors; estimate for 2006

because of diversity of the statistical data within this sector. The following data has been provided by the Czech Renewable Energy Agency:

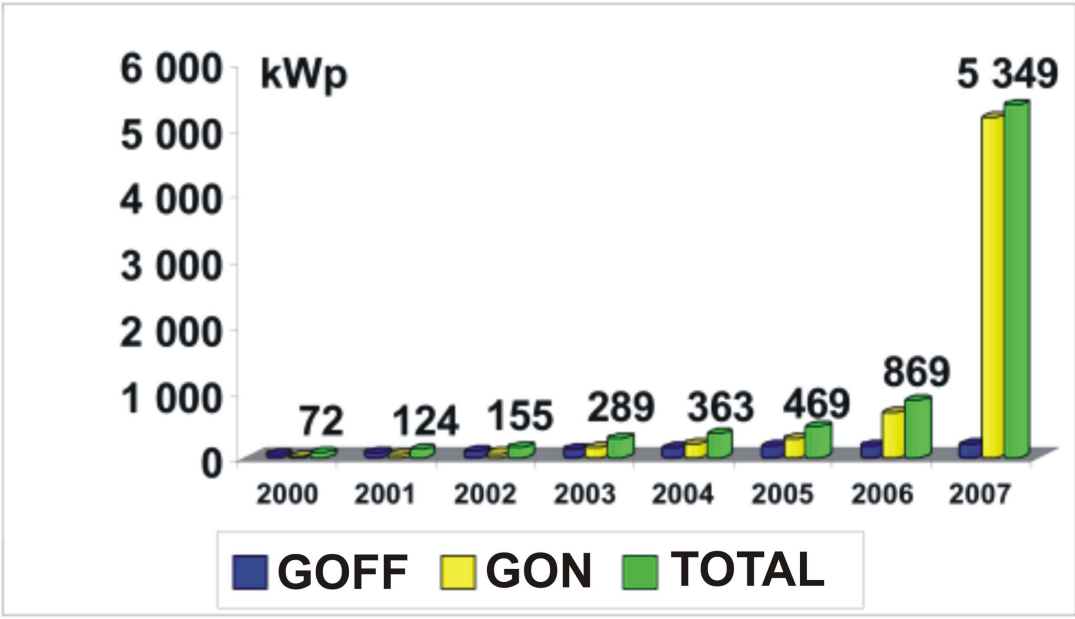
Table 21: Trend of installed capacity of PV systems in Czech Republic

	Off-grid (kW_p)	On-grid (kW_p)	Total (kW_p)
2003	130	200	**330**
2004	147	216	**363**
2005	178	292	**470**
2006	194	546	**740**

Source: in Status of Photovoltaics 2006 in the European Union New Member States; Center of Photovoltaics at the Warsaw University of Technology / the Polish Society for Photovoltaics, Warsaw, 2007

The Czech Renewable Energy Agency (CZ REA) tried in 2007 to map the situation related to the installed capacity of all PV systems in the Czech Republic *[19]*. The information was obtained from a database of the Agency, internet, Energy Regulatory Office and enterprises active in the photovoltaic industry (see the figures below).

Figure 26: PV installed capacity in Czech Republic



Note: GOFF (off-grid systems), GON (on-grid systems)
Source: Czech Renewable Energy Agency; www.czrea.org/cs/druhy-oze/fotovoltaika/vykon-fv

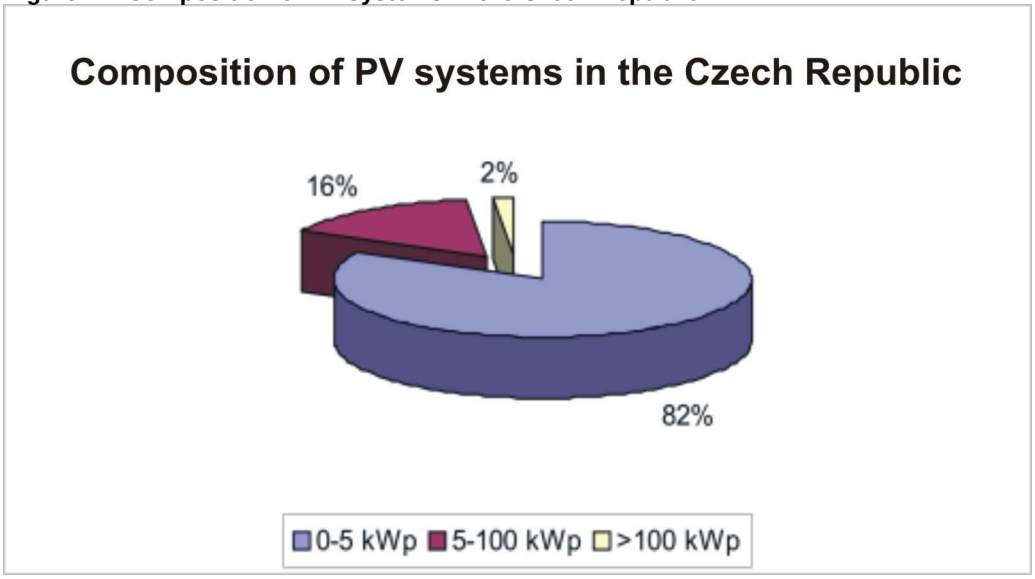
According to this survey, the cumulative installed capacity of all PV systems in the Czech Republic reached 3.8 MW_p by the end of October 2007. Taking into consideration completion of some PV projects, as well as starting operation of some

PV facilities in the last two months of 2007, the cumulative installed power should amounted to 5.3 MW_p by the end of 2007.

A relatively strong growth especially in 2006 and 2007 is a result of a proper legislative and economical conditions in the Czech Republic, especially of the Act on the Promotion of Production of Electricity from Renewable Energy Sources *[1]* that came into effect on May 5, 2005, and implementation of appropriate support schemes (Feed-in tariff / Green Bonus systems).

Feed-in tariffs and green bonuses valid for PV/solar systems for 2008 were set by the Price Decision of Energy Regulatory Office No. 7/2007 of 20 November 2007 that lays down support for electricity generation from renewable energy sources, combined heat and power, and secondary sources *[71]*.

Figure 27: Composition of PV systems in the Czech Republic



Source: Czech Renewable Energy Agency; www.czrea.org/cs/druhy-oze/fotovoltaika/vykon-fv

The utilization of ***geothermal energy*** in the Czech Republic is absolutely absent. Almost 2,000 boreholes with depth of more than 1 km can be found in the Czech Republic, although their distribution is irregular. One borehole with depth of more than 500 meters relates to 36 km^2 of the Czech territory in average. According to expert studies, at least 60 localities suitable for power generation with the total installed capacity of 250 MW and for heat production (the total installed capacity of 2,000 MW) have been identified. Therefore 2 TWh of power and 4 TWh (14.4 PJ) of heat might be annually gained due to utilization of the domestic geothermal

potential. In long-term perspective, there is also a possibility to annually produce 26 TWh of electricity using geothermal energy.

Most of the intended projects would count with utilization of HDR (Hot Dry Rock) technology that is most suitable technology with regard to the geological structure of the country. Very promising is an actual HDR project in Litoměřice. Three wells are supposed to be bored, each one with depth of 5 km. The capacity of the source of 140 l/s and the temperature of about 150 ℃ is expe cted.

After the temperature reduction, the source should bring a heat output of roughly 50 MW. For intended combined heat and power production, the so called Kalina cycle (works on a principle of non-organic Rankin cycle, mixture of water and ammonia is used as a working medium) with power output of 5 MW and efficiency of 12 % will be used *[79]*. The investment costs (without conveyances of hot water) are estimated to reach 1.1 billion CZK (as of November 19, 2007, 1€ = 26.66 CZK according to the National Bank of the Czech Republic / ČNB).

4.3. Romania

The most utilized renewable energy sources nowadays are hydro energy, especially for power generation, and biomass serving for production of heat and preparation of domestic hot water. Utilization of the other RES as wind, solar, geothermal, biogas or biomass for production of biofuels is very low.

The share of RES on gross domestic consumption in 2005 was 12.78 % (i.e. 5,004,000 toe / 209,717,640 GJ). The final energy consumption of RES in 2005 (excluding electricity) was 3,248,000 toe (136,123,680 GJ). The share of RES on total primary energy production in Romania in 2005 was roughly 18.39% (5,048,000 toe). Out of this, 1,737,000 toe covered hydro energy (including large HPP, but excluding pumped storages), the biggest amount (3,229,000 toe) covered biomass and 82,000 toe of energy was obtained from geothermal energy *[31]*.

Out of the entire biomass, wood and wood waste is used for heat production in the largest extent. Geothermal energy is utilized for heat production (in district heating system for instance) in small amount as well.

The power generation from RES in 2005 was as following:

- hydro with installed capacity < 1 MW: 77 GWh (equivalent to installed output of 63 MW)
- hydro with installed capacity > 1 & <10 MW: 599 GWh (equivalent to installed output of 262 MW)
- hydro with installed capacity > 10 MW: 19,530 GWh (equivalent to installed output of 5,964 MW)

Although there was no specific target for renewable energy sources utilization set in The Accession Treaty, the Romanian government set a target for the share of RES (including large HPP) on gross electricity consumption at the level of 33 % by 2010. Despite the share of RES on gross electricity consumption dropped from 31.3 % in 1997 to 29.87 % in 2004, the goal should be achieved till the set deadline.

The government also set targets related to the share of RES on total primary energy consumption: 11 % by 2010 and 11.2 % by 2015, as it is incorporated in the national strategy for the revaluation of RES *[4]*.

Table 22: Potential of RES in Romania[7]

Source	Annual potential	Equivalent energy savings (PJ)	Application
Solar energy - thermal - photovoltaics	 60×10^6 GJ 1,200 GWh	 60 4.32	 Thermal energy Electricity
Wind energy	23,000 GWh	82.8	Electricity
Hydro energy Of which in 780 HPPs < 10 MW	40,000 GWh 6,000 GWh	21.6[8]	Electricity
Biomass	318×10^6 GJ	318	Thermal energy
Geothermal energy	7×10^6 GJ	7	Thermal energy

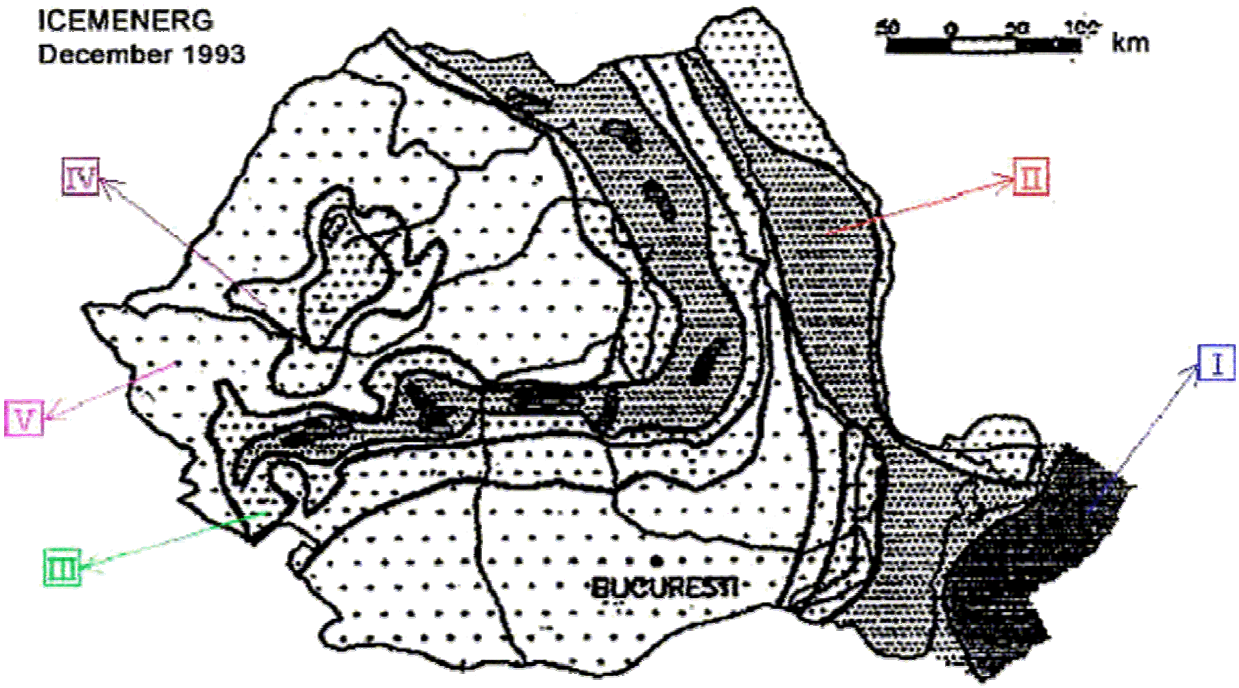
Source: Governmental Decision 1535/2003 approving the national strategy for the revaluation of renewable energy sources, in Apostol, I.: Incentives and barriers for the development of renewable energy sources, Romania – country analysis

Almost the whole power generation from RES depends nowadays on hydro power plants. The overall hydro-electric potential is estimated to be 40 TWh. But the share of small-scale hydro power plants on total electricity generated by HPP in 2005 was very small, approximately 3.35 %. Even the average growth rate of ***hydro power*** was small in the last years (5 % per year in the period of 1997–2004), despite the existence of a significant potential (6 TWh/year). There are henceforth very good opportunities for more accelerated development of hydro-power facilities. For about 5,000 locations are appropriate for small-scale HPPs in Romania *[6]*.

Romania is considered to have the highest ***wind energy*** potential in the region.
The wind atlas of Romania, issued by the Energy Research and Modernizing Institute (ICEMENERG) in 1993, indicated wind speeds of 4.5 to 11.5 m/s at 50 m height in various areas of the country, notably off-shore.
There was 3 MW of installed capacity recorded by the end of 2006 in Romania – only Cyprus, Malta and Slovenia has the lower penetration of wind energy out of all EU-27 member states *[33]*. But the state program includes a resolution to install wind power plants with cumulative installed capacity of 120 MW by 2010 *[35]*.

[7] This potential can be harnessed at any time, there is no action plan to establish that this potential will be revaluated in a specific timeframe.
[8] Figure only for small-scale HPPs

Figure 28: Map of wind potential in Romania



Wind Potential	A high mountains	B open sea	C sea coast	D open plain	E hills
I	>11.5	>9	>8.5	>7.5	>5
II	10 – 11.5	8 – 9	7 – 8.5	6.5 – 7.5	5 – 6
III	8.5 – 10	7 – 8	6 – 7	5.5 – 6.5	4.5 – 5
IV	7 – 8.5	5.5 – 7	5 – 6	4.5 – 5.5	3.5 – 4.5
V	<7	<5.5	<5	<4.5	<3.5

Source: Presentation on Romanian wind parks; EnergoWind Ro, 10 December 2007

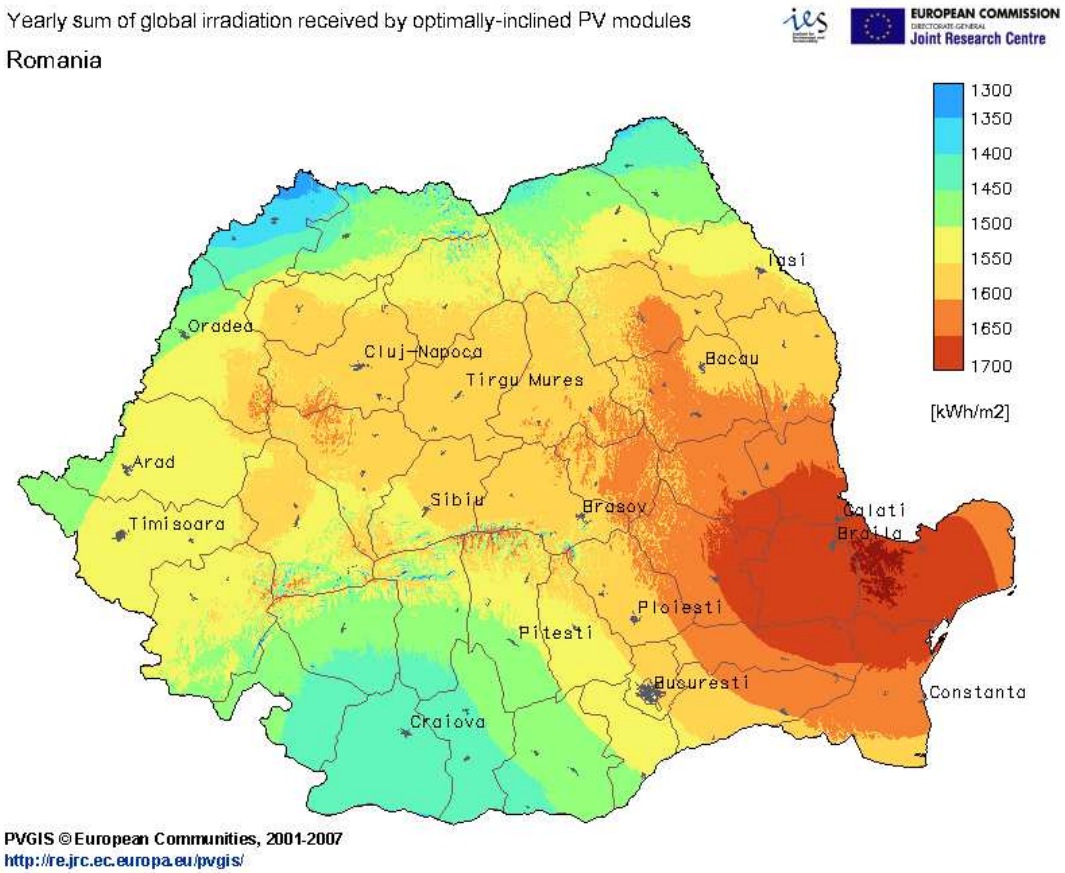
Since the average solar irradiation impinged on horizontal surface in the country ranges from 1,100 to 1,300 kWh/m^2/year, Romania offers also good conditions for ***solar energy*** utilization, especially on south-east and east of the country. It concerns use of solar energy for preparation of DHW and heat production as well as for power generation. A large scale program for various solar applications was implemented there in 1979, such as solar domestic hot water systems for hotels at the Black Sea, for apartment blocks, solar drying for agricultural products, and solar cooling for fish preservation. However, due to a poor quality, lack of maintenance and decrease of activities because of the market transition process in the 90's, only 10 % of the installed 1 million m^2 of collector area is still running. The EBRD, within the scope of its “Renewable Energy Resource Assessment”, estimated that DHW

preparation for public buildings and hotels, passive solar systems, and off-grid systems for sites far from the grid, as the most promising application *[6]*.

However, there is no specific programme related to photovoltaics currently available in Romania *[46]*. For the promotion of generation of electricity from RES, a system of Green Certificates is in place only.

The cumulative installed PV capacities were 190 kW_p by the end of 2006, of which 95 kW_p presented off-grid systems and 95 kW_p grid-connected PV facilities. It was 88.1% growth compared to 2005 (101 kW_p) and circa 121 % growth compared to 2004 (86 kW_p) *[97]*. The biggest photovoltaic system (30 kW) in Romania was mounted on the terrace of the Faculty of Electrical Engineering of the Technological University of Bucharest and put into operation in July 2006.

Figure 29:



Biomass represents a renewable energy source in Romania with the biggest potential. From the overall area of the country, 40 % is covered by agricultural land and 27 % by forests. The biomass potential is regionally distributed over the country.

Fuel wood and wood waste can be found mainly in the Carpathians and Subcarpathians, while agricultural waste is available in the South Plain and Moldavia, biogas in the South and Western plains. EBRD in the „Renewable Energy Resource Assessment“ stated that the South Plain region is the most promising for utilization of agricultural waste, whereas district-heating plants with installed capacity in the range of 1-6 MW, supplied by fire-wood and wood waste, should be installed in the Carpathian and Subcarpathian mountains.

Nowadays, biomass is used just for heat production, DHW preparation and for cooking purposes. Roughly 95 % of the currently used biomass covers fuel-wood and agricultural waste; the rest is wood waste from industrial processes. The share of biomass utilization within the district heating systems is negligible. It is mainly due to non-existence of a coherent national framework for promotion of investments in the RES heat sector. Allocation of funds from the state budget for RES-heat projects in Romania (as well as in Bulgaria) is insufficient *[6]*.

Geothermal resources have been used in Romania since the 1960. The annual potential of geothermal energy has been estimated at 7 PJ. The geothermal water resources are public property according to the Romanian Constitution. Currently, geothermal energy is used for space heating and preparation of DHW – for domestic use (38 %), heating of greenhouses (34 %), balneological and recreational purposes (30 %), industrial processes, e.g. wood drying, milk pasteurization (11 %) and fish farming (2 %). There are a lot of possibilities for development of geothermal projects in Romania, but just thermal applications are recommended. The „Renewable Energy Resource Assessment“ of EBRD takes into accounts mainly installations in the existing district heating systems in cities located near the geothermal resources, construction of new district heating systems supplied by geothermal energy and use of geothermal energy in industrial and agricultural facilities *[6]*.

4.4. Slovakia

In spite of the fact that „increase of the share of renewable energy sources in generation of electricity and heat with the aim of building up adequate auxiliary sources necessary to cover domestic demand" was one of the main priorities in achieving strategic goals defined by the „Proposal on Energy Policy of the Slovak Republic" *[74]*, the current level of RES utilization in Slovakia is still small. The share of renewable energy sources in gross domestic energy consumption[9] was 4.3 % in 2005 (respectively 3.8 % in 2002, 3.2 % in 2003 and 3.9 % in 2004). If the large hydropower plants (over 10 MW) were excluded, the share would be only around 1 % (in 2005). The fact is that utilization of hydro-energy potential in large hydropower plants significantly influences the share of RES in production of electricity. The share of RES in electricity generation was 16.3 % in 2005 (18.6% in 2002, 12.4% in 2003 and 14.4% in 2004).

Table 23: Electricity generation from RES (in GWh) in 2002 – 2005

Years / Sources	2002 [GWh]	2003 [GWh]	2004 [GWh]	2005 [GWh]
Hydropower plants in total	5,483	3,671	4,207	4,741
Hydropower plants - just pumping stations	215	192	107	103
Hydropower plants - without pumping stations	5,268	3,479	4.100	4,638
Wind power plants	0	2	6	7
Biomass	159	84	3	4
Biogas	1	2	2	4
Total	**5,428**	**3,567**	**4,111**	**4,653**
Share in overall electricity consumption	8.6%	12.4%	14.4%	16.3%

Source: Strategy on higher use of renewable energy sources in the Slovak Republic, Ministry of Economy of the Slovak Republic, April 2007

[9] Gross domestic energy consumption is the equivalent of primary energy sources, the statistical indicator used in energy statistics till 2002

Table 24: Heat production from RES (in TJ) in 2002 – 2005

Sources	2002 [TJ]	2003 [TJ]	2004 [TJ]	2005 [TJ]
Biomass	474	643	1,354	1,673
Biogas	1	0	0	116
Geothermal energy	159	139	144	140
Solar energy	36	40	45	50
Total	**670**	**822**	**1,543**	**1,979**

Source: Strategy on higher use of renewable energy sources in the Slovak Republic, Ministry of Economy of the Slovak Republic, April 2007

Table 25: Utilization of RES and share in gross domestic energy consumption

	2002		2003		2004		2005	
	[TJ]	(GWh)	[TJ]	(GWh)	[TJ]	(GWh)	[TJ]	(GWh)
Gross RES consumption	10,950		12,730		16,118		17,414	
Primary power generation from water and wind energy	18,965	(5,268)	12,532	(3,481)	14,782	(4,106)	16,722	(4,645)
Total	**29,915**		**25,262**		**30,900**		**34,136**	
Share RES in gross domestic energy consumption	**3.8%**		**3.2%**		**3.9%**		**4.3%**	

Source: Strategy on higher use of renewable energy sources in the Slovak Republic, Ministry of Economy of the Slovak Republic, April 2007

The original goal declared in the former „Energy Strategy and Policy of the Slovak Republic until 2005“ was to ensure 6 % share of RES in gross domestic energy consumption in 2010. The national indicative target regarding the share of RES in electricity production was originally fixed by the European Commission in the “Act concerning the conditions of accession of the Slovak Republic and the adjustments to the Treaties on which the European Union is founded” at the level of 31 % share of electricity generated from RES in total energy consumption till 2010. This target was a result of a negotiation in the Accession process between the European Commission (which officially required setting the indicative target of 35.1%) and representatives of the Slovak Republic, which proposed to set a realistic target 22.1 % corresponding to the trend of power generation from RES since 1999. However, according to the „Report on progress in development of renewable energy sources“ from 2004, achieving this goal by 2010 is not realistic, mainly due to the economical and natural conditions of Slovakia and existing high level of utilization of hydro energy potential by large HPPs. Thus a new minimal indicative target of 19 % was

recommended – it would corresponded to power generation of 5.9 TWh from RES in 2010, compared to power generation of approximately 4.65–5 TWh in 2005-2006 *[86]*. Slovakia also set a target of 5.57 % biofuels share on energy content by 2010 (the interim targets are 2.5 % in 2006, 3.2 % in 2007, 4.0 % in 2008 and 4.9 % in 2009). The final target corresponds to the indicative target set by the Biofuels Directive 2003/30/EC of the European Commission.

The position of the Slovak Republic, as well as an unflattering status related to RES use, are reflected in a response in one of the latest European Commission's assessments of progress in the individual member states. Slovakia, on the basis of its approaches to compliance with indicative targets related to the share of electricity from RES on gross electricity consumption (average in EU-25 was set on 21 % in 2010) was classified in the category 5 (worst): „Far from commitment". Very poor progress in RES sector as well as necessity of *much stronger support in order to reach the 2010 target* (31 % share of RES on electricity consumption) were clearly emphasized *[43]*.

Regarding the potential of RES in Slovakia, the overall potential (the energy from a renewable source from which it is possible to convert other forms of energy within one year and which size is given by natural conditions) surpasses the gross domestic energy consumption in Slovakia more than 240 times. If the technically utilizable potential (the potential which can be utilized after implementation of available technology and is not limited by economical barriers – just administrative, legislative or environmental barriers) is taken into account only, the renewable energy sources might still cover 25 % of the Slovak gross domestic energy consumption (approx. 810 PJ in 2005).

Table 26: Total and technically utilizable potential of RES in Slovakia

SOURCE	Total potential		Technically usable potential	
	TJ	GWh	TJ	GWh
Water energy:	23,760	6,600	23,760	6,600
Large hydropower plants	*20,160*	*5,600*	*20,160*	*5,600*
Small hydropower plants	*3,600*	*1,000*	*3,600*	*1,000*
Biomass	120,300	33,400	120,300	33,400
Forest biomass	*16,900*	*4,700*	*16,900*	*4,700*
Agricultural biomass	*28,600*	*7,950*	*28,600*	*7,950*
Liquid biofuels	*7,000*	*1,950*	*7,000*	*1,950*
Biogas	*6,900*	*1,900*	*6,900*	*1,900*
Other biomass	*60,900*	*16,900*	*60,900*	*16,900*
Wind energy	*	*	2,160**	600**
Geothermal energy	174,640	48,500	22,680	6,300
Solar energy	194,537,000	54,038,000	34,000	9,450
TOTAL	**194,855,700**	**54,126,500**	**202,900**	**56,350**

***** Total wind energy potential was not assessed
****** Technically utilizable potential was defined in 200
Source: Strategy on higher use of renewable energy sources in the Slovak Republic, Ministry of Economy of the Slovak Republic, April 2007

Table 27: Potential according to single types of RES in Slovakia up to 2010

Source	Technically utilisable potential (TJ)	Utilized by 2002	Available potential (TJ)	Economical potential (TJ)	Market potential (TJ)
Geothermal energy	22,680	1,224	21,456	8,424	4,355
Wind energy	2,178	0	2,178	505	150
Solar energy	18,720	25	18,695	4,460	1,270
Small-scale HPP	3,722	727	2,995	749	299
Biomass	40,453	12,683	27,770	11,868	2,932
TOTAL	**87,754**	**14,659**	**73,094**	**26,006**	**9,006**

Source: Atlas of renewable energy sources utilization in Slovakia, Energy Centre Bratislava, Bratislava, December 2002

The Strategy on higher use of renewable energy sources in the Slovak Republic defines new targets pertaining to shares of RES on power and heat production in 2010 and 2015 as following:

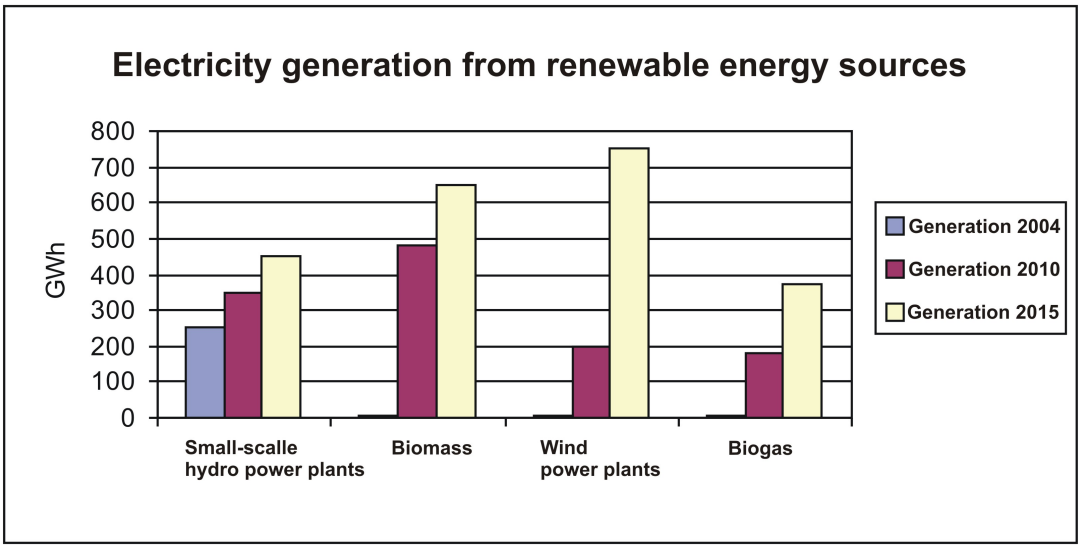
- 4 % (excluding large HPP) of overall power consumption of 31,000 GWh in 2010 i.e. 1,240 GWh
- 7 % (excluding large HPP) of overall power consumption of 32,900 GWh in 2015 i.e. 2,300 GWh

Table 28: Estimation of power generation from RES in 2010 and 2015

Source / Year	2005 [GWh]	2010 [GWh]	Production growth 2005-2010 [GWh]	Growth 2010/2005 [%]	2015 [GWh]	Production growth 2010-2015 [GWh]
Small-scale hydro power plants	250	350	100	40	450	100
Biomass	4	480	476	11,900	650	170
Wind power plants	7	200	193	2,757	750	550
Biogas	6	180	174	2,900	370	190
Geothermal energy	0	30	30	-	70	40
FV systems					10	10
Total	**267**	**1,240**	**973**	**364**	**2,300**	**1,060**

Source: Ministry of Economy, 2006-2007

Figure 30: Expected trend in power generation from RES in 2010 and 2015



Source: Ministry of Economy, 2007; in Strategy on higher use of renewable energy sources in the Slovak Republic

Anyway, the last proposal of a newly developed “Strategy of energy security of the Slovak Republic up to 2030”, which is still not approved by the government, sets less ambitious targets concerning power production from most of renewable energy sources in 2010 (see the figures below):

Table 29: Estimation of installed output and grow of power generation out of RES up to 2010

up to 2010	Production growth [GWh]	Installed power [MW]	Investment costs [in million SKK]
Small-scale HPP	100	20	1,800
Biomass – new sources	120	20	600
Biomass (co-firing)	356	70	1,400
Wind power plants	80	40	1,600
Biogas	240	30	4,200
Photovoltaics	10	6	1,000
Geothermal energy	30	4	400
Total	**940**	**190**	**11,000**

Source: Proposal on "Strategy of energy security of Slovak Republic up to 2030", Ministry of Economy, November 2007

The targets related to production of heat and cool out of renewable energy sources were set by the Ministry of Economy of Slovak Republic as following:

Table 30: Estimated utilization of RES for heat and cool production

Source	Heat and cool production in 2010	Heat and cool production in 2015	Heat and cool production in 2020	Heat and cool production in 2030
	TJ	TJ	TJ	TJ
Biomass (including biogas)	27,000	41,000	50,000	80,000
Solar energy (including the preparation of cool)	200	1,000	8,000	26,000
Geothermal energy (including heat pumps)	300	1,000	4,000	14,000
Total	**27,500**	**43,000**	**62,000**	**120,000**

Source: Proposal on "Strategy of energy security of the Slovak Republic up to 2030", Ministry of Economy, November 2007

The Ministry of Economy of the Slovak Republic in its proposal of "Strategy of energy security of the Slovak Republic up to 2030" defined two scenarios pertaining to development of RES and increase of their share in gross domestic energy consumption by 2020 and 2030.

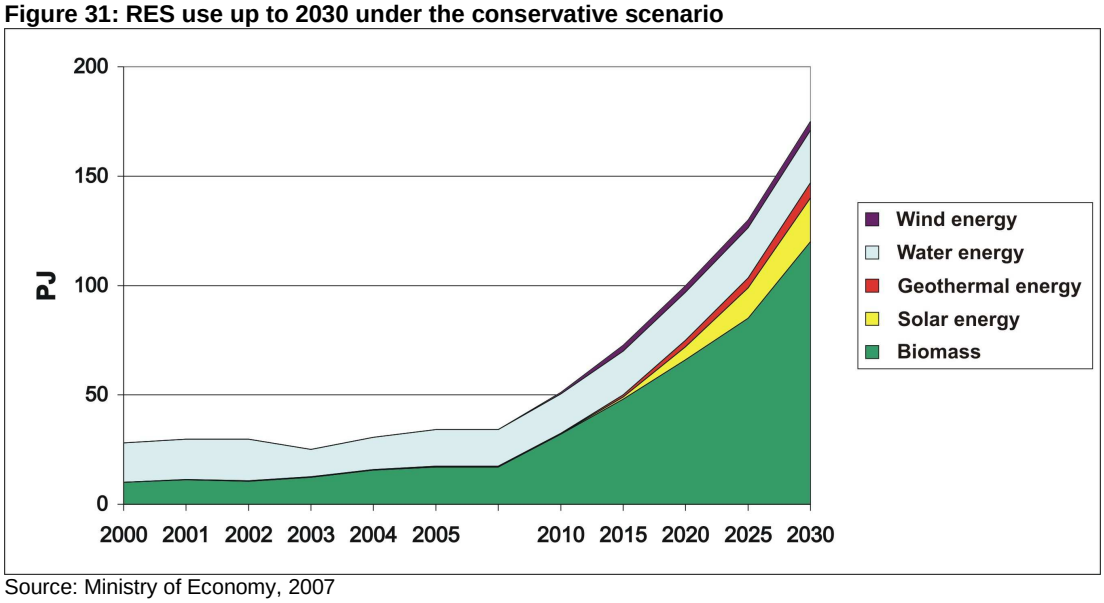
According to the ***Conservative scenario***, the share of RES on gross domestic energy consumption in 2020 should be 12 %:

Table 31: Conservative scenario of RES use

	2010 [TJ]	2015 [TJ]	2020 [TJ]	2025 [TJ]	2030 [TJ]
Biomass	31,000	48,000	66,000	85,000	120,000
Solar energy	300	1,000	6,000	14,000	20,000
Geothermal energy	200	1,000	3,000	4,500	7,000
Water energy	18,000	20,000	2,000	2,000	2,000
Wind energy	300	X	X	X	X
Energy utilizing wastes	200	X	X	X	X
Total	**50,000**	**73,000**	**100,000**	**130,000**	**175,000**
	X	X	X	X	X
RES share [%]	**6.4**	**9.0**	**12,0**	**16.0**	**21.0**

Source: Proposal on "Strategy of energy security of the Slovak Republic up to 2030", Ministry of Economy, November 2007

Figure 31: RES use up to 2030 under the conservative scenario



Source: Ministry of Economy, 2007

The second, so called ***Optimistic scenario***, predicts higher use of biomass, solar and geothermal energy as well as growth of crude oil prices by 100 % in 2015 compared to 2007 and prices of GHG at the level of € 25 per tonne of CO_2. According to experts from the Ministry of Economy, if such an increase of energy prices would continue, RES would gain competitive benefit due to almost negligible operation costs. The share of RES in gross domestic energy consumption in 2020 under this scenario should be 14 %:

Table 32: Optimistic scenario of RES use

	2010 [TJ]	2015 [TJ]	2020 [TJ]	2025 [TJ]	2030 [TJ]
Biomass	31,000	50,000	74,000	90,000	120,000
Solar energy	300	3,000	12,000	22,000	37,000
Geothermal energy	200	2,000	7,000	10,000	14,000
Water energy	18,000	20,000	22,000	23,000	24,000
Wind energy	300	X	X	X	X
Energy utilizing wastes	200	X	X	X	X
Total	**50,000**	**77,000**	**120,000**	**150,000**	**200,000**
RES share [%]	**6.4**	**9.5**	**14.0**	**18.0**	**24.0**

Source: Proposal on "Strategy of energy security of the Slovak Republic up to 2030", Ministry of Economy, November 2007

Biomass - a "biologically degradable fractions of products, waste and residue from agriculture (including plant and animal substances), forestry and relative sectors, as well as biologically degradable fractions of industrial and municipal waste" represents a source with the third largest utilizable potential out of all RES in Slovakia, following solar and geothermal energy. Estimates of overall utilizable potential of biomass (from both forestry and agriculture) vary from 75.6 PJ6 (or 21 TWh) to as much as 120.3 PJ (or 33.4 TWh). In terms of technically utilizable potential (i.e., potential, that can be used after introduction of available technology and that is limited by administrative, legal and environmental obstacles, not only by economical ones) the largest share among RES is held by biomass (60 %). The technically utilizable potential of biomass theoretically represents up to 15 % of annual gross domestic energy production in Slovakia. However, there are problems of objective quantification of technically utilizable potential of biomass (as well as other RES) due to ambiguity of data and missing unified methods for its calculation in Slovakia. According to the Strategy on higher use of renewable energy sources in the Slovak Republic, the overall technically usable potential of biomass was set on 120.3 PJ (see figure below):

Table 33: Technically usable potential of biomass

Sort of biomass	Amount (in thousands tonnes)	Energy potential [PJ]
Agricultural biomass for combustion	2,031	28.6
Forest biomass	1,810	16.9
Wood-processing industry	1,410	18.1
Biomass for biofuels production	200	7.0
Pomace and pot ales in biofuels production	400	8.4
Excrements of animals on farms	13,700	9.3
Purposefully cultivated biomass	300 (thousands hectares)	32.0
Total		**120.3**

Source: Strategy on higher use of renewable energy sources in the Slovak Republic, Ministry of Economy of the Slovak Republic, April 2007

Despite a relatively large technically utilizable potential of biomass in Slovakia and current low level of its use, it is necessary to take into account that development of "biomass industry" depends on reliability of supply and prices of the input raw material for fuel production, as well as on the growth of transport costs and accessibility of biomass from the point of view of the terrain *[50]*.

The biomass was mostly utilized for heat production so far. More massive development of biomass sector was largely limited by wider utilization of natural gas for heating purposes in entire Slovakia. But this state changes gradually, mainly due to increasing prices of natural gas. There is also visible a gradual trend of biomass utilization in central heating systems as well as development of projects for co-firing (with fossil fuels) in thermal power plants and combined heat and power production. Anyway, the combustion of fuel-wood prevails yet (especially in households) in comparison to more sophisticated utilization of wood stock in form of wood-chips, pellets or briquettes, mainly due to higher prices of those biomass products. Even the use of other sorts of biomass is not wide-spread yet.

There was 1,789 TJ (circa 497.3 GWh) of heat produced out of biomass and biogas in 2005 that presented 15.9 % increase compared to 2004 (1,543 TJ). Besides that, further 8 GWh of electricity was produced from biomass and biogas in 2005, compared to 5 GWh in 2004 (60 % annual growth).

There is a possibility to build 374 ***biogas*** stations in Slovakia processing of 13.7 million tons of animal excrements (manure etc.) with daily production of average

biogas station of 2,000 m^3. Subsequently, from 27.4 million m^3 of biogas would be possible to produce 9.27 PJ of heat per year within the combined heat and power production in cogeneration units.

Another roughly 1,000 biogas stations with installed power of one cogeneration unit of 500 kW and 1,000 installations with installed power of unit of 350 kW for heat production could be constructed, just to utilize the energy potential of agricultural "green biomass" (maize, grains, legumes etc.) for production of biomass and consequent combined heat and power production as well as "energy plants", such as marsh dock - Rumex, sorghum, scorpion shell, technical hemp etc. for production of heat or DHW or for drying processes. Altogether, 300,000 ha of field can be earmarked for cultivation of plants for energy purposes.

The Directive 2003/30/EC of the European Commission on the promotion of the use of biofuels or other renewable fuels for transport has been completely transposed to legal order of the Slovak Republic. Practical implementation of the Program for ***biofuels*** is currently ordained mainly by the Act No. 98/2004 on excise tax from mineral oil (in force since 1 May 2004) and by Statutory order No. 246/2006 on minimal amount of fuels produced from renewable sources in motor petrol and diesel fuel in the Slovak market.

Producer and seller are obliged to offer a minimal amount of biofuels (or other renewable fuels) in motor petrol and diesel fuel used for transport purposes as following:

- to 31 December 2006 in reference value of 2 %, calculated out of energy content of total amount of motor petrol and diesel fuel put to the market
- from 1 January 2007 to 31 December 2009 in reference value of 2 %, calculated out of energy content of total amount of motor petrol and diesel fuel put to the market
- from 1 January 2010 to 31 December 2010 in reference value of 5.75%, calculated out of energy content of total amount of motor petrol and diesel fuel put to the market

Practical implementation of the Program for biofuels has started in the second half of 2006, mainly due to a possibility to blend the esters (5 % of volume at most) in diesel fuel and blend the ETBE (15 % of volume at most) in petrol.

The reference value (percentage of bio-compounds on energy content of engine fuel) attained 2.18 % in December 2006. Also in the period of January – March 2007 was this value kept over 2 % *[80]*.

There was 42,169 tons of MERO produced as of 31 August 2006, out of those 14,423 tons was used in Slovakia and the remaining amount was imported abroad (mainly to Austria and Germany). The MERO production capacities are sufficient and can cover in full extent the needs for fulfilment of reference values required by the Directive 2003/30/EC. 100,000 hectares were earmarked for cultivation of rapeseed as a main raw stock for production of methylesters of plant oils that serve as a biological substance of diesel oil (biodiesel). That area can be also used for cultivation of suitable commodities for production of bioliquors, specifically bioethanol *[35]*. But the current overall capacities for production of bioethanol as a main raw stock for ETBE (ethyl tert-butyl ether) are insufficient.

Putting the diesel fuel with content of esters and motor petrol with content of ETBE on natural base on the fuel market, Slovakia became the first out of all Visegrad countries that practically produces and sells diesel fuel and motor petrol with bio-compounds on domestic market *[80]*.

Water energy is the most utilized renewable energy source for power generation in Slovakia, with long-term tradition. But the fact is that most of power is being generated in 25 large hydro power plants with the overall installed power of 2,446 MW. The total technical potential of water energy in Slovakia is 6,600 GWh, of which 1,000 GWh (15.15 %) cover small-scale HPP (with installed capacity up to 10 MW). However, only less than 25 % of the technical potential is utilized in small-scale HPP so far. There were 201 installations of small HPP in 2005 in Slovakia with the cumulative installed output of 70 MW, which generated 250 GWh of power (247 GWh in 2004) [93]. Even when considering all environmental aspects, there is a possibility to use annually 400-450 GWh out of remaining 750 GWh for power production. This production would correspond to the installed capacity of 100 MW roughly *[98]*.

Except the environmental limits, especially limitations in natural protected areas and water-courses that are biotopes of protected species, the other barriers of development of small-scale HPP include higher investment costs related to a longer

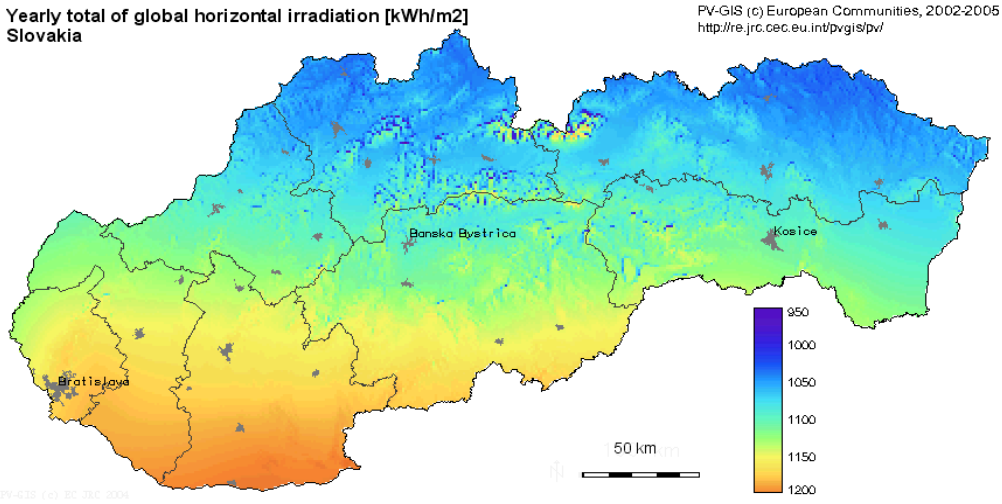
operating life (50-70 years), higher payback period, lower level of cooperation of engaged groups, associations and individuals etc.

On the other hand, higher efficiency of conversion of primary energy to electric energy, high reliability of operation and its security, ecological acceptance of technological process, high life span of installations and almost non-limited life-cycle of primary energy source allow utilization of hydro power plants as a back-up power facilities in power and transmission system / provision of auxiliary services for power system.

The largest total potential of RES in Slovakia (54,038 TWh / 194,537 PJ) refers to ***solar energy***. The technically utilisable potential of solar energy was set by the Ministry of Economy at 9,450 GWh / 34,000 TJ per year. The experts from THERMO/SOLAR Ltd. (one of the most significant European producers of solar thermal collectors and a leader in the Slovak market) set an amount of technically utilisable potential of solar heat at 45,100 TJ annually; this would make 17.6 % share of total heat consumption in Slovakia *[107]*. Anyway, the current utilization of solar energy is very small, almost omissible.

The overall amount of global horizontal irradiation in Slovakia is approximately 240 times higher than the current gross domestic energy consumption. The average annual number of global horizontal irradiation in Slovakia is 1,122 kWh/m^2 (minimum 1,016 kWh/m^2 and maximum 1,203 kWh/m^2); of this, roughly 800 kWh/m^2 is obtained from April to September. Regarding the global vertical irradiation, the average annual amount in Slovakia is 878 kWh/m^2 (minimum 779 kWh/m^2, maximum 939 kWh/m^2).

Figure 32:



The average sum of global irradiation received yearly by optimally-inclined panels and modules (south oriented surface, inclination – 35°) in Slovakia is 1,282 kWh/m^2 (minimum 1,159 kWh/m^2 and maximum 1,372 kWh/m^2); of this roughly 50 % is obtained from May to August.

As it was mentioned above, solar energy is utilized in Slovakia only to a small extent. The use of solar energy by means of solar thermal collectors clearly prevails. Application of photovoltaic (PV) systems is still limited due to their lower efficiency, economical intensity, a dense public electrical grid and legislative, fiscal and institutional barriers as well. Solar energy use by medium of passive systems in connection with solar and eco-architecture (simple solutions as winter gardens, glazed balconies and loggias, special films on outer glasses and roof windows or sophisticated ones as low-energy or passive buildings) is also very low.

Solar thermal energy

Advantages of solar thermal collectors in Slovakia clearly outweigh their disadvantages.

Pros of solar thermal energy use:

- steady price of heat during 20-30 life span of device (in comparison with fossil fuels as well biomass prices – e.g. wood chips)
- decentralized heat generation, independence from suppliers and increase of fuels prices; there is no necessity of capital and operationally intensive distribution grids
- no negative environmental impacts during entire life span and the possibility of 100 % recycling of used construction materials; the main construction materials of collectors are aluminium, copper and glass, also a substantial part of remaining components is recyclable
- very low or omissible running costs
- relatively high efficiency (40 - 65 %) of conversion of solar irradiation to heat
- technological maturity
- short period of energetic amortization i.e. period of solar installation operation, during which the amount of produced energy by this device equals the energy consumed upon its manufacture in the whole production cycle- from the exploitation of raw materials to assembly; if new raw materials are

used, this period is less than two years; the period is much shorter (a couple months) if recycled materials are used

- no pressure on un-built urban areas is made (roofs, facades, parking spaces etc. are utilized)
- sizeable potential of increase of the solar heat use in area of accumulation and solar cooling
- mutual connectivity with other RES
- disposable know-how and existing production of high-tech solar collectors in Slovakia

Cons of solar thermal energy use:

- relatively high investment costs, of which long pay-back periods result; there is sizeable overflow of solar irradiation, however with low density (with clear sky and normal incidence of solar rays it is 1,000 W/m^2 at the most); solar irradiation is characterized by seasonal and daily variability, influenced by weather as well
- limited effectiveness of systems; the systems are most effective in the range of temperatures up to 100 ℃; at the superior tempe ratures efficiency, as well as effectiveness, of utilization drops quickly
- necessity of auxiliary energy sources; it is technically possible to reach 100 % coverage of energy needs of a building, but only at the expense of extremely high investment costs
- systems do not cover the consumption all year round; in conditions of Central Europe they can provide domestic hot water (DHW) for a maximum of 9 months per year; solar heat usage is mainly limited by the consumption of low-potential heat in summer period; if there is a large overflow of solar heat in summer months, the effectiveness of solar system usage falls and economical parameters become worse
- the installation of panels on listed buildings is problematic

In Slovakia, the overall collector area of solar thermal collectors in function was 72,670 m^2 in 2006. 8,500 m^2 of solar thermal collectors were installed in 2006, of which 7,700 m^2 was composed of glazed flat plate collectors and the remaining

800 m^2 were vacuum collectors. Market growth in 2006 was approximately 14.6 % higher compared to 2005.

Table 34: Annual installed surfaces in 2005 and 2006 per type of collector (in m^2) and power equivalent (in MW_{th})

	Installed in 2005	Installed in 2006
Flat plate solar collectors	6,510	7,770
Unglazed solar collectors	-	-
Vacuum solar collectors	910	800
TOTAL in m^2	**7,420**	**8,500**
Power equivalent (MW_{th})	**5.2**	**6.0**

Source: Solar Thermal Barometer; EuroObserv'ER, Systémes Solaires – Le Journal dés Énergies Renoulevables no. 180, July 2007

Table 35: Cumulated capacity of thermal solar collectors installed in the European Union in 2005 and 2006[10]

	Cumulated capacity in 2005	Cumulated capacity in 2006	Per inhabitant in 2006
in m^2	**64,170**		
in MW_{th}	**44.9**		
in m^2		**72,670**	
in MW_{th}		**50.9**	
m^2/1000 inhab.			**13.5**
kW_{th} /1000 inhab.			**9.4**

Source: Solar Thermal Barometer; EuroObserv'ER, Systémes Solaires – Le Journal dés Énergies Renoulevables no. 180, July 2007

Regarding the total installed capacity (in kW_{th}); the overall installed output of solar thermal collectors operated in Slovakia in 2006 was 50.900 kW_{th}. In 2006 there were collectors installed with the capacity of 6.000 kW_{th}. The capacity of newly installed solar thermal collectors in 2005 was 5.200 kW_{th}.

The majority of solar thermal collectors were installed in last years in family houses and serve mainly for the preparation of domestic hot water (DHW), partially in the heating of pools (exterior and interior) and in the support of heating of properties (or as a combination of all three kinds of utilization). In general, the production of technological heat, as well as solar cooling, is absent.

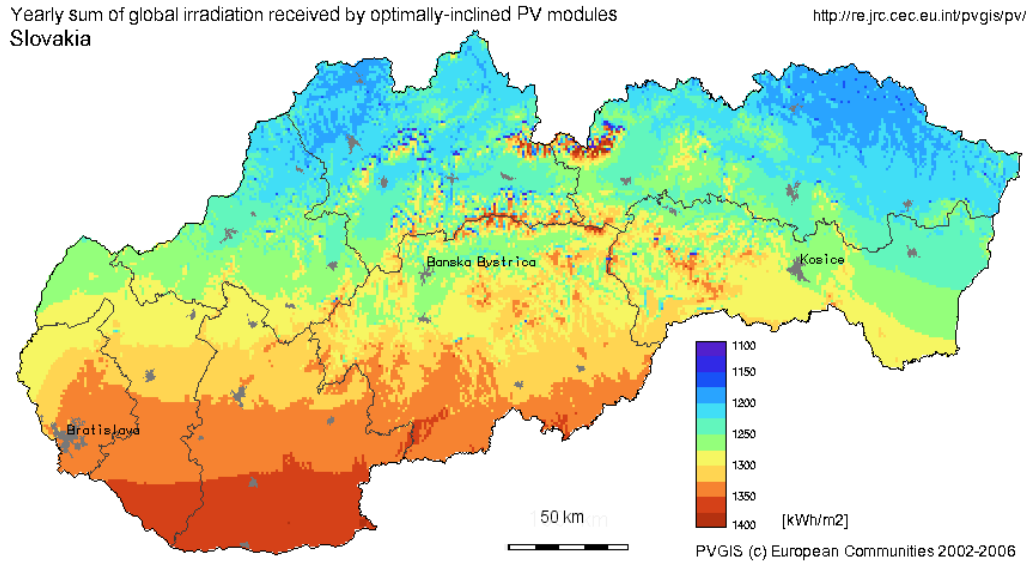
Solar photovoltaics

If only the officially announced technically utilizable potential (1,540 GWh) was considered, the solar energy would be able to cover roughly 5.2 % of the total annual electricity consumption in the Slovak Republic in 2006 (29,624 GWh).

[10] All technologies, including unglazed collectors; estimate for 2006

However, the overall utilization of solar energy in Slovakia is low. And especially the use of solar energy for electricity production via photovoltaic (PV) systems is extremely low in Slovakia nowadays. The total amount of electricity generated by PV systems in the last years was roughly 1 MWh / year. It is necessary to mention that this electricity was generated by off-grid (stand alone systems) only. Grid-connected PV systems are completely absent. There was only 4 kW_p of PV modules installed in 2006. The cumulative installed capacity of all off-grid PV systems in Slovakia reached 64 kW_p by the end of 2006 (60 kW_p as of end of 2005) *[68]*. There are quoted slightly lower figures related to the installed PV capacity in Slovakia in the "Status of Photovoltaics 2006 in the European Union New Member States" i.e. 20 kW_p of stand-alone PV systems as of the end of 2006 [97]. The fact is that such low or even lower penetration of PV systems within EU-27 can be observed only in the Baltic States (Estonia, Latvia and Lithuania) and in Malta.

Figure 33:



Source: PVGIS (c), Institute for Environment and Sustainability, Joint Research Centre, Ispra (VA), Italy, http://re.jrc.cec.eu.int/pvgis/pv/imaps/imaps-sk.htm

Table 36: Yearly sum of global irradiation and potential of electricity generation by PV modules in town residential areas in Slovakia

	PV module assembly							
	horizontal		vertical		optimal inclination		tracking system	
	G	E	G	E	G	E	G	E
Minimum	1,015	760	780	585	1,160	870	1,450	1,090
Mean	1,120	840	880	660	1,280	960	1,615	1,210
Maximum	1,205	905	940	705	1,370	1030	1,760	1,320

G - Yearly sum of global irradiation (kWh/m^2)
E - Potential of electricity generation by PV modules (kWh / 1kW$_p$)
Optimal inclination of PV modules is 35°(minimum 32° , maximum 38°)

Source: http://re.jrc.ec.europa.eu/pvgis/pv/; M. Šúri: Solar Electricity and Prospects of its Generation in Slovakia, Životné prostredie „Living Environment", Vol. 40, No. 3, 2006

Pros of solar photovolatics use:

- enhanced flexibility, modularity, reliability
- multiple ubiquitous potential that surpasses needs
- very low running costs
- minimal impact on environment
- decentralized generation and supply of electricity
- possibility of integration into reconstructed or newly build buildings (sophisticated architectural solutions)
- decrease of dependency on imports of fossil fuels
- reduction of volume of GHG emissions
- effectiveness of PV does not depend on size of system (as in the case of conventional energy devices)

Cons of solar photovoltaics use:

- seasonal and daily variability of climate and fluctuation of weather influence the total output
- low capacity factor
- high specific investment costs
- electrical grid covers 98 % of the territory of Slovakia, which has an influence on market potential

A typical PV system with the most utilizing technology – crystalline silicon with installed capacity 1kW$_p$ consists of modules with an area of 8 - 10 m^2. This system is

able to generate (at optimal inclination and total efficiency of a system of 75 %) at an average 960 kWh of electricity annually. It is possible to achieve 1 % share of solar electricity generation from annual consumption within the horizon of 15 years in Slovakia. To achieve this, it would be necessary to install PV systems with the installed capacity of 300 MW_p, meaning roughly 0.6 m^2 of PV modules per capita.
In Slovakia, the Energy Pay Back Time (= „ratio of the total energy input during the system life cycle and the annual energy generation during system operation, both should off course be expressed in the same unit, either in primary energy or in final electrical energy"; or by another words „the amount of energy, which the PV system must produce in order to pay back the energy consumed in its manufacture, installation, maintenance and liquidation"; expressed in years) is 2.8 – 4.2 years, but depends on a type and assembly of modules (lower bound years concerns roof-top mounted PV systems and upper bound PV systems mounted on a facade). Therefore, during the expected life span (25 – 30 years), the Energy Return Factor (= „ratio of the total energy generation during the system operation lifetime and the total energy input during the system life cycle; ERF equal to ten means that a PV system produces ten times more energy than it consumes throughout its life cycle"; the ERF is expressed as a single figure with no unit) can be in the range from 6.1 (systems mounted on a facade) to 9.8 (roof-top mounted PV systems) *[38]*.
Under the Slovak natural circumstances, each installed kWp of the roof-top mounted PV system during its life cycle can save approximately 5.7 t of CO_2 and each installed kWp of PV system mounted on facade approximately 3.8 t of CO_2 *[38]*.

A wider application of photovoltaic systems in Slovakia is still limited due to a lower efficiency, economical intensity, a dense public electrical grid as well as legislative, fiscal and institutional barriers. These facts also influence outlooks of the state authorities and decision makers according whom utilization of solar energy for electricity generation is non-efficient nowadays, mainly because of its high financial demandingness. Therefore, according to those authorities, in the close future only stand-alone / off-grid PV systems should be taken into account. However, these official standpoints are being reflected into official documents related to the energy sector. According to the Strategy on higher use of renewable energy sources in the Slovak Republic *[98]*, the electricity generated by PV systems in 2015 is estimated in amount of 10 GWh only. The ministerial proposal on the "Strategy of energy

security of Slovak Republic up to 2030" has shifted generation of 10 GWh of power by PV to 2010 already, but it does not solve the problem in general. The evidence of lax approach of the state authorities to development of the PV industry in Slovakia was also almost zero budget earmarked for R&D, as well as dissemination and demonstration activities within PV / solar sector in 2006. Just for comparison, in the Czech Republic the budget for those actions in 2006 was € 2,420,000 (including national as well as other funds), in Romania € 1,000,000 and in Bulgaria € 78,000. The funds spent for R&D as well as dissemination and demonstration activities within the PV sector in Slovakia have been gradually decreasing since 2004 (€ 23,000 in 2004, € 15,000 in 2005) *[97]*.

The standpoints of the decision makers are however in contradiction with the outcomes of some expert studies according which the decentralized electricity generation of PV systems (penetration to several percent) will not disrupt the security of electricity supply in the current grid structure, but on the contrary could cover an increase in demand for peak electricity. A higher penetration of PV installations will require completion of grids, improved integration with other sources and enhancement of capacities for storage of energy in the future.

Wind power in Slovakia is currently utilized in a very small extent only. Even if the potential related to wind energy is not very large in comparison with other RES, the wind energy still can have an important position within an energy mix in the near future. The potential calculated in 2002 that took into account use of wind turbines with installed power only 500 – 1,000 kW was decreased to 600 GWh / year. Later on, this potential was reassessed (wind turbines with 1,500 – 2,000 kW of installed power were considered) and set on 1,135 GWh (the cumulative capacity of 600 MW). In parallel with the development of technology, this potential can raise up to the capacity of 1,200 MW and yearly power generation of 2,280 GWh. According to the official papers, it is possible to install 300 – 400 MW (5 % share on total electricity mix of the Slovak Republic) without any negative influence on security and reliability of electricity supply in Slovakia. Taking into account 1,500 – 2,000 full load hours, this would correspond to an annual electricity generation of 600 GWh. The Association for Wind Energy in Slovakia has presented the following usable potential of wind energy in Slovakia:

Table 37: Usable potential of wind energy in Slovak Republic

Year	Installed capacity (MW)	Power generation (GWh)
2008	50	105
2009	120	252
2010	150	315
2011	150	315
2012	100	210
2013	50	105
TOTAL	**620**	**1,302**

Source: The Association for Wind Energy in Slovakia (ZVES), 2006

According to the "Strategy on higher use of renewable energy sources in the Slovak Republic" approved in April 2007, the electricity generated by wind turbines should reached 200 GWh by the end of 2010 (it would be an astounding 2,757 % growth compared to 2005) and 750 GWh by the end of 2015 *[98]*.

But the reality of the last years is much different. In the period 2003-2005, there was 2, 6 and 7 GWh generated by wind turbines and the share of wind energy on total electricity consumption in Slovakia in 2005 was only 0.024%. According to EWEA, the cumulative installed capacity was just 5.14 MW (nine turbines) by the end of 2006 *[33]*. Lower penetration of wind power in the EU-27 is just in four member states – Cyprus, Malta, Romania and Slovenia. Slovakia is lagging behind its neighbouring countries – Austria (965 MW of installed output by the end of 2006), the Czech Republic (50 MW), Hungary (61 MW), Poland (152.5 MW) as well as Ukraine, which is not member of the EU (85.5 MW).

Despite the existence of official declarations and indicative targets, wind energy is the most discriminated source out of all RES, mainly by the decision makers / state authorities (e.g. representatives of the Slovak Electricity Transmission System PLC, the Ministry of Economy and the Ministry of Environment). Their attitudes were clearly reflected in the final version of the Proposal on the "Strategy of energy security of Slovak Republic up to 2030" from November 2007 where the estimated power generation by wind turbines in 2010 was decreased to 80 GWh/year (roughly 40 MW of installed power) from 193 GWh/ year quoted in the first proposal of the "Strategy" from September 2007.

The main reservations towards wind power plants concern variability and intermittency of these energy sources. Naturally, wind turbines are influenced by variability of weather. Despite factual variability of this source of power, which has obviously a certain undeniable influence on system functioning (mainly in regions

with a high share of wind power on electricity supplies); it is not correct to speak unambiguously about its unreliability, as it is often being not-correctly presented *[49]*.

It is absolutely possible to agree with the claim that the ability of transmission power grids to absorb large amounts of electricity generated by wind power plants is determined more by economical factors and regulation frameworks than technical or practical barriers. Therefore, it is absolutely inevitable to develop soon "The analyse of influence of wind power plants on security and reliability of transmission and power system", as well as to implement sophisticated prediction models and tools and implement intelligent concepts of supporting system in order to contribute to mitigation of intermittency problem.

From the environmental and social point of view, it is also necessary to develop „Standards and limits for positioning of wind parks and wind power plants in Slovakia". The first draft of such standards and limits was prepared by the Slovak Environmental Agency (SAŽP) in December 2006. This draft defines basic standards that must be implemented under each project in the wind energy sector *[14]*:

- Monitoring of birds and bats in terms of BACI methodologies at least 1 year ahead of construction and 1 year during the operation
- Landscape view impact assessment
- Archeological study
- All power lines within a wind park must be under ground
- In accordance with presumed impacts, implementation of compensatory measurements
- Close collaboration with municipalities in which cadaster the project is accomplished and provable contribution to a local community (e.g. involvement of local enterprises in the realization process, direct compensatory payments to the municipality, co-operation in other developing projects of the municipality etc.)

This draft includes also additional provisions, such as:

- In case of possibility of a distribution grid set on the basis of conditions of networking defined by a distribution company, to connect all wind turbines in the wind park to one spot that transfers current to the public grid

- Prior use of underground lines VVN 22 kV
- Prior construction of wind parks near the places with high electricity demand
- The connection of a wind park to a high voltage distribution grid will be set by a competent distribution company
- Mandatory use of biodegradable oils and lubricants during the wind power plants operation
- Necessity to conduct measurements of wind speed on the tower at height of 60 metres above the surface for one year at least
- Breach of provisions set in EIA process will result in disapproving of the feed-in tariff for such a project
- Occupation of protected agricultural land (according to the quality of soil – grade 4) must be minimized
- Maximum 20 wind turbines at one site are allowed and local conditions and restrictions from environmental and health point of views must be considered.

The document also tried to set the limits related to the size and location of a wind park and defines that investors and developers are in the project phase supposed to take into accounts following limits and distances:

- highways and roads for vehicles – maximum height of a moving part of a turbine + 40 metres
- water courses and water surfaces – minimum 200 metres
- residential areas – minimum 600 metres, except of areas with special protection against noise – minimum 400 metres
- elements of Territorial System of Ecological Stability (ÚSES) – minimum 200 metres
- significant natural landscape structures (besides the ÚSES elements – e.g. lines of trees, wind-barriers etc.) – minimum 150 metres
- compact forest complexes – minimum 400 metres
- gas lines, supply lines, transmission lines - maximum height of a moving part of a turbine + 40 metres

As it is visible from this document, the limits and standards set by the Slovak Environmental Agency are often biased and do not take into accounts all relevant aspects – therefore a more detailed elaboration based on scientific findings as well

as practical experiences is required. The nation-wide standards and limits must be a result of a broad consensus of all stakeholders – developers and investors, politicians, state authorities, environmentalists and nature conservationists, local citizens and municipalities.

The Slovak Republic has due to its natural conditions a significant potential of ***geothermal energy*** – estimated at 5,538 MW_{th}. This potential is based mostly on geothermal waters, bounded to hydro-geological collectors located in the range of 200 – 5,000 meters under the surface. There were realized and verified several drill holes with depth in the range of 92 – 3,616 m with flowrate of 1,787 l/s, influx temperature of 18-129 ºC and total installed power of 306.8 MW_{th} (under the utilization up to a reference temperature of 15 ºC) *[99]*. These sources cover approximately 5.54 % of the total geothermal energy potential. Currently, geothermal energy is used at 36 localities with thermal usable output of 131 MW_{th}.
According to the "Strategy on higher use of renewable energy sources in the Slovak Republic", there was 140 TJ of heat produced by geothermal energy in 2005. It was only 0.62 % out of the total utilizable potential of geothermal energy (22,680 TJ). The utilization of geothermal energy is intended for power production as well. The estimated potential for power production presents roughly 60 GWh per year *[98]*.
There were identified some obstacles restraining larger utilization of geothermal energy in Slovakia:

- low capacity of wells, which is below the bottom limit of energy output (0.6 MW_{th})
- low temperature of the geothermal water
- chemical structure of the geothermal water that is not suitable for energy use
- chemical structure of the geothermal water that does not meet the criteria related to discharging of thermally used water to water courses
- high investment costs

5. Legislative frameworks, financial and supporting mechanisms

5.1. Bulgaria

Regarding the RES support scheme, there have been used the Green Certificates / Quota obligation scheme in Bulgaria since July 2006. Till June 2007, the following superior legislation had a strong influence on development of RES in the country *[72]*:

- Energy Law published in the State Gazette no.107 (9 December 2003)
- Energy Efficiency Act (2004)
- Ordinance on Setting and Applying prices and Rates of Electric Energy
- Regulation for certification of the origin of electric power generated by renewable and/or combined generation sources, issuance of green certificates and their trading

Recently, in June 2007, the Bulgarian Parliament adopted a new „Renewable and Alternative Energy Sources and Biofuels Act“ (*Prom. SG.* 49/19.06.2007). According to this Act, all transmission system operators / distribution companies as well as the National Electricity Company (NEK EAD) are obliged to purchase all electrical energy generated by RES – wind turbines, small-scale hydro power plants (up to 10 MW) and biomass power plants with contracts for 12 years. The power generated by installations utilizing RES (including small-scale HPPs) is being purchased at preferential prices. Those preferential prices apply to all RES utilizing power plants that started generation of power before December 31, 2010. Each year, no later than 31st March, the State Energy and Water Regulatory Committee (SEWRC) shall determine the preferential prices for sale of electricity generated from renewable or alternative energy sources, except for electricity generated by large hydroelectric power plants (with installed capacity over the 10 MW) *[87]*. The preferential price of electricity generated from RES shall be determined at 80 % of the average sale price for public utilities or energy-end suppliers for the preceding calendar year plus an addition set by the SEWRC depending on the type of primary energy source. The addition for the next calendar year may not be less than 95 % of the addition for the current year *[77]*. No licence is required for generation of electricity from RES with the capacity of up to 5 MW and for thermal energy production as well *[46]*.

Regarding production of heat out of RES, currently there are no direct financial incentives for the purchase of heat produced by RES. Mandatory connection to power transmission and distribution system currently applies just to combined heat and power production facilities with installed power up to 10 MW utilizing biomass, biogas or other bio-fuels. But even these incentives concern only preferential prices for power produced in co-generation units and heat energy is excluded out of this support mechanism.

In case of biofuels, important is the fact that biodiesel and bioethanol are not subject to excise taxes *[87]*.

Besides the above mentioned scheme directly related to purchase of power generated by RES that is from economical standpoint one of the most transparent and most efficient tool to achieve higher RES penetration, there are also other national or international programmes that provide opportunities to obtain funds in form of grants, favourable loans etc. for projects focused on wider utilization of RES and energy efficiency (including capital investment projects).

From the perspective of amount of allocated funds, one of the most important mechanism in the RES sector (but in the whole economy as well) are the European (Structural) Funds for the period 2007-2013. Allocation of funds is based on the National Strategic Reference Framework that is an outcome of cooperation of state, regional and local authorities and other actors based on analyses of their priorities and need and even their compliance with the common priorities of the EU *[37]*. The partial activities related to RES use can be found in various Operational Programmes and Priorities e.g.:

OP Regional Development

Priority 1: Sustainable and integrated urban development

Operation 1.1.: Social infrastructure

Operation 1.2.: Housing;

Operation 1.5.: Sustainable urban transportation system

Priority 2: Regional and local accessibility

Operation 2.3.: Access to sustainable and efficient energy resources (one of the supported actions is "construction of renewable energy installations that and connection to renewable energy supply")

Priority 4: Local development and co-operation

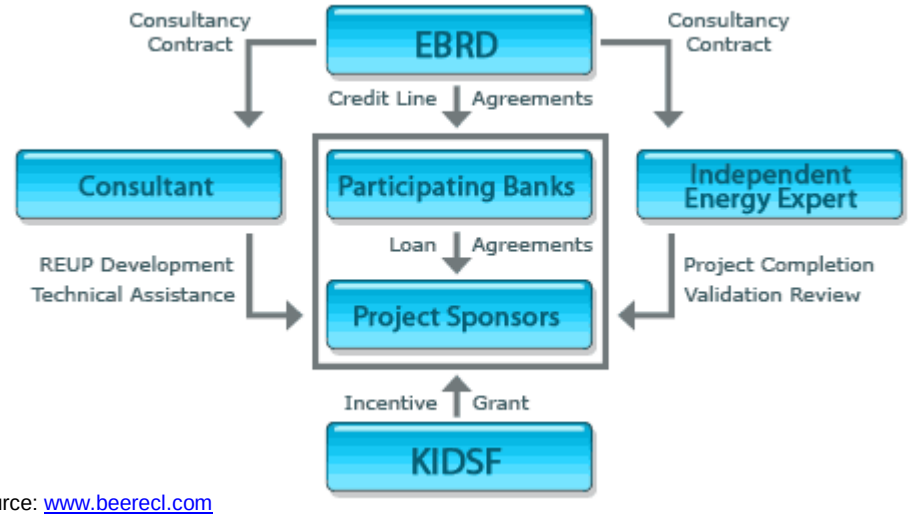
Operation 4.3.: Small-scale local investments

The most significant Operational Programme is **OP Development of Competitiveness of the Bulgarian Economy**. The funds are from the European Regional Development Fund (ERDF) and amount to 988 million EUR. The managing authority is the Directorate "European Funds for Competitiveness" and implementing authority the Bulgarian Small and Medium-sized Enterprises Promotion Agency. The co-financing from ERDF is 85 % and actions supported within the ***Priority 2: Increasing efficiency of enterprises and promoting a supportive business environment*** and *Operation 2.3. Introduction of energy saving technologies and the use of renewable energy sources include investments in RES sector and introduction of energy saving technologies*. The eligible beneficiaries are Bulgarian enterprises, both from the productive and service sectors *[37]*.

The important role in field of RES financing has the **Bulgarian Energy Efficiency and Renewable Energy Credit Line (BEERECL)**. This Credit Line has been founded in 2004 by the European Bank for Reconstruction and Development (EBRD) in close co-operation with the Bulgarian Government and the European Union in order to extend credit lines to participating banks (PBs) *[11]*. The aim is to support industrial energy efficiency and small renewable energy projects in the private sector [95]. The administrator of the Credit Line is EBRD that provides loans and grants intermediated by seven of the Bulgarian PBs: Bulgarian Postbank, DSK Bank, Raiffeisen Bank, UniCredit Bulbank, Unionbank**,** United Bulgarian Bank**,** Piraeus Bank. *Loan component* amounts to € 50 million and was provided by EBRD and *grant component* of 13.2 million EUR that was provided by the Kozloduy International Decommissioning Support Fund (KIDSF) [48]. There is no limit for the size of the project to be financed under the BEERECL. Each Participating Bank would evaluate the project sponsor creditworthiness and make a decision on its borrowing capacity. However, there is a limit on the amount of the loan principal, on which the grant can be received. This limit differs among the Participating Banks as follows: Bulgarian Post Bank (€ 750,000), DSK Bank (€ 1,500,000), HVB~BankBiochim (€ 1,500,000), Raiffeisenbank (€ 2,000,000), Union Bank (€ 500,000), UniCredit Bulbank (€ 2,000,000). The Participating Bank can choose to extend to a client a loan larger than the limit however upon successful completion the borrower (project sponsor) will receive a grant on the portion of the loan principal

up to the limit *[11]*. The average sub-loan within this program amounts to € 700,000 *[66]*. In case of renewable energy projects, 20 % of the total investment is refunded to investor after the completion of project (in case of energy efficiency projects it is only 15 %).

Figure 34: Structure of the BEERECL



Source: www.beerecl.com

Almost identical structure is as well in the **Residential Energy Efficiency Credit Line (REECL)**, only it is targeted to households and its goal is to support the implementation of energy efficiency measures (including small renewable installations) in residential buildings. The administrator of Credit Line is also EBRD and provides loans and grant's financing using intermediation of six Bulgarian PBs. G*rant component* is being provided by the Kozloduy International Decommissioning Support Fund (KIDSF) as well [48]. Average sub-loan amounts to € 1,089 *[66]*.

The following list includes other possible financial mechanisms providing funds for energy efficiency and RES projects:

Bulgarian Energy Efficiency Fund (BgEEF)

The main aim of the Fund from the environmental point of view is support identification, development and financing of viable EE projects, resulting in substantial reduction of greenhouse gases.

The Fund has been established by the medium of the Energy Efficiency Act adopted by the Bulgarian Parliament in February 2004. The initial capitalization of BgEEF is realized entirely by grant funds, its major donors being: the Global Environment Facility through the International Bank for Reconstruction and Development (the World Bank) - USD 10,000,000; the Government of Austria - € 1,500,000; the Government of Bulgaria - € 1,500,000 and several private Bulgarian companies.

This fund provides financial support to municipalities, corporate clients and individuals with aim to improve the energy efficiency of at least 50 %. The fund took up an activity at the beginning of December 2005 and accepts applications for financial support those can be either in the form of loans or partial credit guarantees for loans from other financing institutions. In case of direct loans, the minimum equity contribution from the developer / investor for the proposed project ranges from 10 % to 25 % of the total cost of the project (at least 10 % for co-financing mode "BgEEF - commercial bank" and minimum of 25 % for “BgEEF stand-alone financing”.

Besides the above mentioned activities, BgEEF serves also as a consulting company and provides technical assistance to Bulgarian enterprises, municipalities and private individuals in developing energy efficiency investment projects. Despite the fact that BgEEF pursues an agenda fully supported by the Government of Bulgaria, it is an independent legal entity separated from any governmental, municipal and private agency or institution *[10]*.

Enterprise for Management of Environmental Protection Activities (EMEPA)

The EMEPA is a legal (state owned) entity, incorporated pursuant of the Environment Protection Act - Art. 60 para 1. (SG issue 91, dated 25.09.2002). The Enterprise was established in 1992 and is a successor of the National Environment Protection Fund. *The main goal* of EMEPA is to implement environmental projects and activities pursuant of national and municipal strategies and programmes in the environmental area. The EMEPA also provides funding in the form of *grants* and *interest-free* or *low interest* loans to municipalities, individuals and legal entities. The main sources of income are taxes, fees and sanctions imposed under the special environment protection legislation. Priority areas of financing include for instance improvement of air quality in “hot spot” areas, improvement of the liquid fuel quality in order to reduce harmful emissions in the ambient air etc. *[54]*.

The National Trust EcoFund

The National Trust EcoFund has been established in October 1995 as an independent institution to manage the financial resources under the conditions of the first Debt-for-Environment Agreement between the Government of the Swiss Confederation and the Government of the Republic of Bulgaria as well as funds provided under other agreements with international and national funding sources *[106]*. The Fund contributes to the implementation of the Bulgarian Government environmental policies and the enforcement of its international commitments in this field. The main priority areas include also reduction of the air pollution, especially GHGs: carbon dioxide, methane, CFCs as well as pollutants of health concern such a particulate matters, sulphur dioxide, nitrogen oxides, lead and other toxic chemicals in urban areas *[59]*.

National RES Programme

The Energy Efficiency Agency developed the National RES Programme, which main goal include: reduction dependency on energy imports, introduction of modern clean and green energy generation technologies from EU, creation of more than 2,000 jobs by 2010 and saving of 4,378,000 tons of CO_2 per year. Until 2003, there had been accomplished 86 PV projects in the frame of this program, 509 solar thermal projects, 30 wind power plants, 89 projects utilizing biomass or biogas and 48 projects focused on utilization of geothermal energy *[13]*. For the years 2004-2014, the program is linked to an action plan for the development of 83 capital investment RES projects (most of them are small and medium sized projects) by 2010 amounting to 156.7 million USD in total. The implementation is supposed to be covered by state funds *[87]*.

Use of Flexible Mechanisms under the Kyoto Protocol related to reduction of harmful GHG emissions e.g. Joint Implementation (JI)

Applicants for funding under the joint implementation mechanism must to submit directly to the Joint Implementation Unit (JI-Unit Bulgaria) under the Ministry of the Environment and Waters *[87]*.

Nordic Funds

The Nordic Funds have been established by the governments of Denmark, Norway and Sweden within the United Nations Development Programme (UNDP) in order to support some consulting services and activities such as pre-design studies, project development, monitoring and assessment missions, whole or partial projects. Those activities are supposed to be aligned with UNDP's sustainable development framework and donor policy. Eligible candidates within this mechanism are institutions, NGOs, personal entities and private sector entities. Application should be submitted to countries' offices of UNDP; projects as such are administered by the United Nations Office of Project Service (UNOPS) in Copenhagen (Denmark). The renewable energy sources belong among priority areas.

Third-party financing or Energy Performance Contracting by medium of Energy Service Companies (ESCO). The ESCOs provide project identification, funding, installation, operation and maintenance services. This kind of contracting does not require any funds from recipients of services. Investors are rewarded for their investments on the basis of the effects, benefits and savings achieved after the installation of RES utilizing device *[42]*.

5.2. The Czech Republic

Though the feed-in tariff system for RES-E and cogeneration has been established in 2002 (but without guaranteeing of prices for a period longer than one year), the main driving engine of RES development in the Czech Republic was adoption of the "Act of 31 March 2005 on the promotion of electricity production from renewable energy sources and amending certain acts (the Act on promotion of Use of Renewable Sources), No. 180/2005 Coll" *[1]*. This system offers two possibilities related to prices of electricity from RES – a guaranteed favourable purchase price (feed-in tariff) or "green bonus" (an amount paid on the top of the market price) *[35]*. Those two methods may not be combined. Feed-in tariff (purchase price) "apply to electricity supplied and metered at the delivery point between the generating plant and the respective distribution system operator's network, or the transmission system operator's network, which (the delivery point) appears in the clearing of imbalances to the entity subject to clearing ('cleared entity') responsible for losses in the regional distribution system, or to the cleared entity responsible for losses in transmission system". Green bonuses (premiums) "apply to electricity supplied and metered at the delivery point between the generating plant and the respective distribution system operator's network, or the transmission system operator's network, and supplied by the generator to an electricity trader or eligible customer, and also to the 'other house load' under a separate legal regulation" *[72]*.

For specification of the Act on promotion of Use of Renewable Sources, there was issued the Ordinance No. 475/2005 of 30 November 2005, by which there are carrying out some provisions of the Act on promotion of Use of Renewable Sources *[63]* as well as Ordinance No. 502/2005 of 8 December 2005 about the setting the method of declaration of quantities of power within the co-firing of biomass and non-renewable source *[BZ]*. The stipulation related to co-firing of biomass and non-renewable source (fossil fuel) was the reason why the final version of Renewable Act did not get full support of some of well respected experts in field of environment and alternative energies, but on the other hand due to this stipulation the Act got such a broad political support and was passed in the Parliament.

The feed-in tariffs are being set annually by the Energy Regulatory Office (ERÚ) for the on-coming year and in case of new installations they can not dropped below 95

% of the price in the preceding year *[71]*. The green bonuses are being set by the Energy Regulatory Office annually as well *[108]*.

Besides the feed-in tariffs or green bonuses, this act includes as well very important provisions:

- obligation of issuance of certificate / confirmation about the origin of electricity from RES by the distribution grid operator
- obligation of prior connection into grid system and obligation of (preferential) power take-off by distribution company
- assumption of responsibility for variation (by distribution company)
- non-discriminatory approach to each sustainable and environmentally acceptable energy source
- guarantee of validity of feed-in tariffs during first 15 years of operation of installation

The actual Ordinance of Energy Regulatory Office No. 150/2007 from 19 June 2007 in relation to prices regulation in energy industries and procedures for regulation of prices states that:

- feed-in tariffs and green bonuses will be enforced during the whole life span of power generation facilities
- during the life span of power generation facilities the feed-in tariffs will be related to the price index of industrial producers increased inter-annually by 2 % at least and by 4 % at most, with an exception of installations combusting biomass and biogas

Another important current secondary legislation is the Ordinance of the Ministry of Environment No. 5/2007 laying down categories, forms of use and parameters of biomass at the support of power generation from biomass.

However, even in the Czech Republic, the superior legislation related to support of heat production from RES is absent. This issue was reflected in a former version of the Act on renewable energy sources No. 180/2005, but from the final version was excerpted. Anyway, the Ministry of Economy has already developed an expert analysis and also the Ministry of Environment considers the preparation of this Act. There are two ways considered as far as increasing heat production from RES *[105]*:

- setting obligations to the owners of heat energy producing facilities to ensure the part of heat production from RES
- setting obligations to the house and flats owners to ensure the part of heat consumption from RES

As well in the Czech Republic, the European (Structural) Funds (2007-2013) present one of the most important financial mechanisms. Concerning the capital investment projects in RES field, there are two Operational Programmes directly focused on support of RES projects.

The first one is **OP Environment** with total budget € 4,917.90 million, of what € 4,215.38 million comes from the Cohesion Fund and € 702.48 million from the European Regional Development Fund. The managing authority is the Ministry of Environment and the implementing authority the State Environmental Fund. The maximum co-financing from the Cohesion Fund is 85 %, further 4 % at most can be provided by the State Environmental Fund and 1 % from the State budget. Remaining 10 % must be secured from a municipal budget, budget of regional administration, by final beneficiaries etc.

Actions supported within the ***Priority 3: Sustainable use of energy*** and *Measure 3.1. Construction of the new installations and a reconstruction with the aim to increase a use of renewable energy sources for heat and electricity production and support for combined heat and power (CHP) production* include support of all RES sources (solar and PV systems, heat pumps, biomass boilers, CHP units, small-scale HPP, geothermal systems, wind farms). The total sum allocated for the overall priority amounts to € 672,971,000 and specifically for the Measure 3.1. it is € 300,431,000. The list of eligible beneficiaries includes public sector (municipalities, schools, health care facilities, social houses etc.), self-governing regions, foundations and NGOs, charity and church organizations, public institutions, associations of flat owners, companies owned by public sector institutions.

The personal entities (e.g. owners of family houses used for living) can also apply within this ***Priority 3***, *Measure 3.3. Environmentally friendly systems for production of heat and domestic heat water for personal entities*. Supported actions include RES installations for production of heat and domestic heat water mainly (solar systems, biomass boilers, heat pumps, waste heat utilization etc.). The sum

allocated for this Measure amounts to € 207,189,000 and subsidy can reach maximum 50 % *[47]*.

The second important Operational Programme, but the most significant one in relation to enterprises is **OP Business and Innovation, *Priority 3: Efficient Energy*** and *Operation 3.1.1. Energy savings and renewable energy sources* with the total budget of the whole OP of 3,040 million EUR from ERDF. The managing authority of this OP is the Ministry of Industry and Trade and implementing authorities are: Czech Energy Agency (administration), CzechInvest (administration and consultancy in regional offices), CzechTrade and the Czech-Moravian Guarantee and Development Bank / CMZR Bank (provision of advantageous credits and banker's collaterals). The administration of the Programme has been shifted from the Czech Energy Agency over to a sole administrator – a company CzechInvest on 1 October 2007. Eligible beneficiaries are all commercial subjects (small, medium, big-sized enterprises) by course of law §2 Law No. 513/1991 Coll. 2 except multinational companies, parts of such companies, or companies with more than 1,250 employees. The maximum level of co-financing from ERDF is 85 % *[37]*. The official domestic name of this program is *"EKO-ENERGIE"*. The first call for proposals within this program was opened on 25 April 2007. The planned allocation of funds for this call was 850 million CZK. Support can be provided either in the form of a direct grant or in the form of a loan with financial contribution. The maximum grant amount per one project can be 100 million CZK *[19]*. The maximum amount of direct grant support within the first call for proposals has been set as follows:

Table 38:

Supported action	**Grant support**
Small-scale HPP	35%
Biomass – autonomous power generation or combined heat and power production	30%
Photovoltaics	30%
Biogas – autonomous power generation or combined heat and power production	30%
Geothermal electricity	20%
Construction of facilities for production of pellets and briquettes from renewable and secondary sources	15%
Heat from RES	30%
Efficiency increasing at the energy generation / consumption, secondary energy sources utilization	40%

Source: www.czrea.org

The deadline of the latest call within the Program "EKO-ENERGIE" was set on 28 February 2008. The total allocated sum for this call is 1,700 million CZK *[67]*.

A complementary program to the energy programs supported from the Structural funds of the European Union is the **State program on support of energy savings and renewable energy sources use** (program **EFEKT**). The program was announced by the Ministry of Industry and Trade with the aim to meet the goals declared in the State Energy Conception approved by the Resolution of the government of the Czech Republic No. 211 from 24 March 2004 and in the National program of efficient disposal with energy and utilization of its renewable and secondary sources. The program is administered by the Czech Energy Agency (since 1 January 2008 by the Ministry of Industry and Trade) and the State Environmental Fund. There were altogether 6,205 small-scale investment actions in total amount of 2,914 million CZK supported within this program in the period of 1999-2006. Out of that, 929 actions amounting to 88.136 million CZK were supported in 2006 (e.g. 166 biomass boilers installation in total grant amount of 6.66 million CZK, 532 solar systems in total grant amount of 25.08 million CZK, 220 heat pumps = 10.89 million CZK etc.) *[47]*.
The program EFEKT for the year 2007 was announced by the Ministry of Industry and Trade according to the Decree of the government of the Czech Republic No. 1326 from 22 November 2006. The list of eligible beneficiaries for 2007 includes small and medium enterprises, municipalities, schools, health care facilities, self-governing regions, associations of flat owners. The maximum amount of direct grant support for projects in the category C – *Renewable and secondary sources of energy* (entrepreneurs were the only eligible beneficiary in this category) in 2007 was 40 % (i.e. 2 million CZK), but RES have been included also in some other categories where grant support was higher (in special cases up to 80 % for investment projects) *[19]*.

Another opportunity to obtain financial support for RES projects offers the **Norwegian Financial Mechanism** (one of the European Economic Area (EEA) / European Free Trade Association (EFTA) Financial Mechanisms).
One of the main priorities of this program is protection of the environment. Parts 2.5. and 2.6. under this priority are focused on „Support of use of biofuels and alternative

energy sources as a secondary source at local level“ and „Reduction of GHGs in the Czech Republic“.

Maximum extent of grant support can reach 85 % of the overall eligible project costs In case an applicant comes from the public sector, 15 % of the total costs will be covered by public sources.

5.3. Romania

Concerning the development of RES in Romania, the great impact on RES sector had the following superior legislation *[72]*:

- Electricity Law No. 318/2003
- Government Decision No. 1535/2003 (on the approval of the Strategy for the use of renewable energy sources)
- Government Decision No. 443/2003 (on the promotion of electricity produced from renewable energy sources)
- Government Decision No. 1429/2004 (on the approval of the Regulation on the guarantee of origin for electricity produced from renewable energy sources)
- Government Decision No. 1892/2004 (on the system for promotion of electricity produced from renewable energy sources)
- Electricity Law No. 13/2007 (9. January 2007)

Romania has adopted the **Quota Obligation System** combined with the **Green Certificates**. The Quota Obligation System is a mechanism used to promote production of electricity from renewable energy sources by means of an acquisition by the suppliers of a specified quota of electricity produces from renewable energy sources in order to sell it to their consumers.

The Green Certificate Trade is being operated by medium of the following market mechanisms:

- Bilateral contracts concluded between producers and suppliers
- Centralized auction within the Centralized Market of Green Certificates. The Green Certificates Market Operator is OPCOM**.** It is a legal person which assures Green Certificates trading and determines the prices on the Centralized Green Certificates Market, performing the functions established by the Regulation for organizing and functioning of the Green Certificates Market (Order No. 15 / 2005 issued by ANRE).

Centralized Green Certificates Market

The Centralized Green Certificates Market is supposed to assure competition, transparency, non-discrimination; trading prices reduction and determination of the reference prices for other transactions on the Green Certificates Market.

The document which proves that a quantity of 1 MWh of electricity was produced from renewable energy sources is called *Green Certificate*.

Other regulations in force applicable in settlement activity (settlement activity is effectuated in accordance to in force regulations and according to developing contracts) are:

1. Commercial code on wholesale electricity market – 2004
2. ANRE Order No. 21/2004 (8. September 2004)
3. ANRE Order No. 30/2005 (24. June 2005)
4. ANRE Order No. 36/2005 (31. August 2005)
5. ANRE Order No. 48/2005 (14. December 2005)
6. ANRE Order No. 52/2005 (16. December 2005)
7. ANRE Order No. 61/2005 (28. December 2005)
8. ANRE Decision No. 81/2006 (20. January 2006)
9. ANRE Decision No. 8/2006 (31 March 2006)
10. Operational procedure concerning DAM Settlement approved by ANRE notification No. 7/2005 (14. January 2005)
11. Operational procedure concerning the standard content and format of settlement notes, settlement information notes, regulation notes or account regulation notes, approved by ANRE notification No.6 /2005 (14. January 2005)

The Green Certificates Trading System applies to electricity produced from wind, solar, biomass, geothermal, waves, hydrogen that is produced from RES and hydro power plants with installed capacity up to 10 MW those are in operation or were modernized from 2004 year *[4]*. The annual mandatory quota is established according to the target committed by the Romanian Government in negotiation within the EU accession process, i.e. 33 % E- RES in national electricity gross consumption by 2010-2012. The annual mandatory quota produced from renewable energy sources for the period 2005-2012 have been set as follows: 0.7 % in 2005;

2.22 % in 2006; 3.74 % in 2007; 5.26 % in 2008; 6.78 % in 2009 and 8.3 % in 2010-2012.

The price of Green Certificates varies in the range established by the Government Decision, [Pmin ÷ Pmax]. The minimum price is imposed in order to protect the producers and the maximum price to protect the consumers.

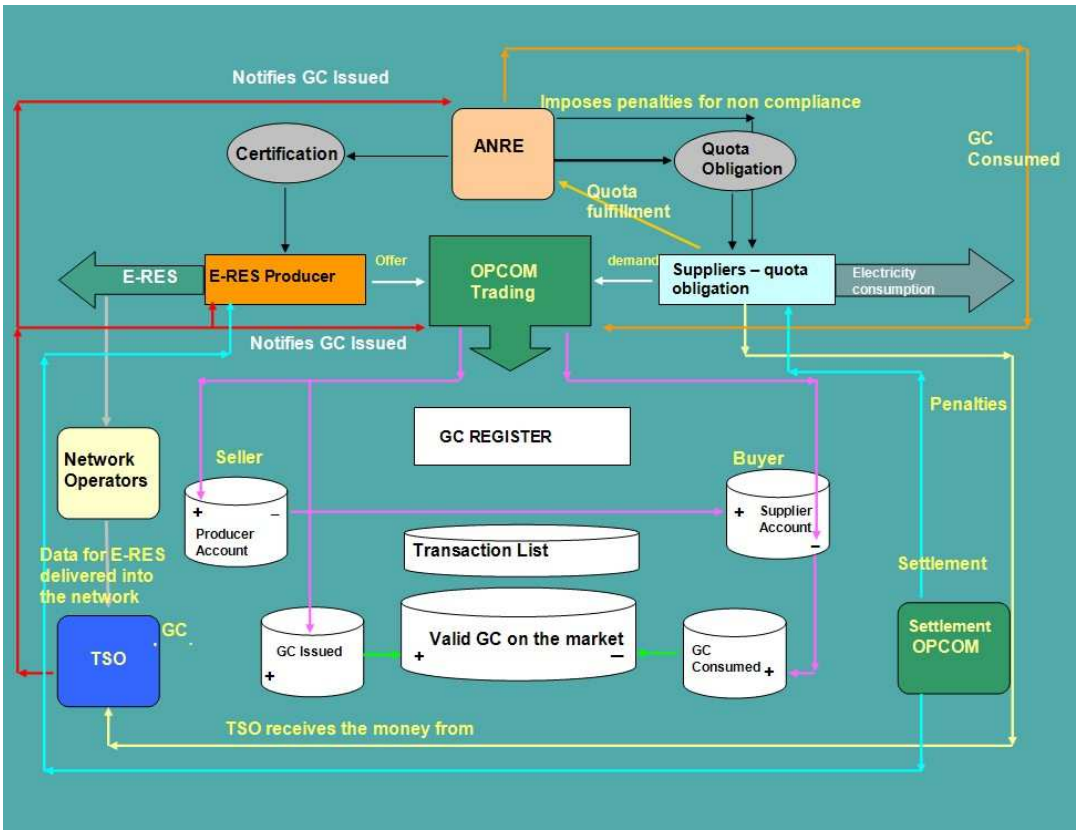
The annual maximum and minimum value for Green Certificates trading for the period 2005-2012 has been set in the amount of € 24 /certificate, respective € 42 /certificate, calculated at the exchange course established by the Romanian National Bank, for the last working day of the December of the previous year *[61]*.

If the suppliers are not able to cover the annual quota of green certificates, they are supposed to pay to the Transmission System Operator the value of the certificates they didn't purchase:

→ 150 % of green certificates maximum value in the period 2005-2007

→ 200 % of green certificates maximum value, since the January 1st 2008

Figure 35: Centralized Green Certificates Market



Source: www.pcom.ro

Bilateral contracts market

The energy is traded *on competitive component of bilateral contracts* market by medium of:

→ bilateral contracts concluded between producers and suppliers, in order to assure the consumption afferent to eligible consumers

→ import / export contracts concluded by producers / suppliers

→ bilateral contracts concluded by suppliers, others than the ones which sell to captive consumers on regulated prices

The prices of these contracts are negotiated and confidential and in some cases the quantities are firm. The System Operator sends Settlement Notes based on accomplished/contracted quantities.

On regulated component of bilateral contracts market are processing contracts to tariffs/prices regulated by ANRE decisions. The contracts concluded between producers and captive consumer suppliers have fixed quantities and System Operator sends the Settlement Notes based on these quantities and on regulated prices *[61]*.

Day Ahead Market

Another significant "component of electricity wholesale market on where is traded active electricity for each trading interval of the corresponding delivery day, based on the offers submitted by the registered participants" inside is the Day Ahead Market (DAM). The Day Ahead Market rules (provided in chapter 5 of the Commercial Code of the Wholesale Electricity Market, approved by Ordinance of ANRE No. 24 from 22 October 2004) create a centralized market framework where the Romanian wholesale electricity market participants sell and buy electricity. That centralized framework is necessary to:

- facilitate the setting up of a competitive, transparent and non-discriminative wholesale electricity market in Romania
- reduce the trading prices for electricity
- establish the reference prices for other wholesale electricity market transactions
- optimize the use of the limited interconnection capacities with the neighbouring countries integrating the use of the respective capacities in the Centralized Day Ahead Market *[61]*

Sale of renewable electricity on the Day Ahead Market has the priority on the electricity market transactions. The price of renewable electricity is the market clearing price and if it is not accepted during a certain dispatch interval (the generation-consumption is balanced only through bilateral contracts), the renewable electricity producer submits physical notifications for imbalance and receives the price set up for such situations *[4]*.

According some experts, the Quota Obligation and Green Certificate Systems have proven ineffective. The following deficiencies of currently used systems have been noted down *[4]*:

a) The system has not stimulated the renewable energy market because green certificate prices have been limited to € 24-42 per MWh; just for comparison – in some European countries the prices can go up to € 100/ MWh (e.g. Italy)

b) According to the experts the green certificates market isn't and it will never be a real market, as the number of green certificates will always be lower than the annual quota. The system is reduced to collecting penalties for non-compliance with the volume of green certificates distributors need to have.

c) The energy regulatory body has the right to modify the annual mandatory quota at the end of the year if demand for green certificates would be higher than the offer; thus power distribution companies need not to acquire/produce green certificates to avoid penalties. It provides no incentive to increase renewable energy capacity and makes the system useless.

The energy regulatory body adjusted the mandatory quota in 2006 to 2.38 % of the initial amount. Although the quota for 2006 should have been covered by 1,291,440 certificates, only 22,745 green certificates were issued in 2006. The level of adjusted quota meant that power distribution companies only had to purchase 23,497 green certificates (just 752 more than the number of certificates that were actually issued). Thus roughly € 99 million were written off by this way. And the fact is the instrument that should have acted to stimulate investments in renewable energy production facilities was thus rendered useless *[4]*.

d) As it was stated above, the Green certificates are awarded in the present also for modernization of older power facilities, especially small-scale HPP (up to 10 MW of installed power). Therefore the investors very often buy small-scale HPP from the former state-owned hydro operator and outcome is that increase in renewable

energy production due to power uprate is marginal. This regulation related to modernization (renovation) prevents to a certain extent construction of new RES facilities.
Taking into account those facts and with the aim to increase the share of RES on energy mix in the country, some energy and economy experts propose to substitute the Quota Obligation and Green Certificate Systems by more efficient and flexible feed-in tariff system.

Pertaining to financial mechanisms for support of RES development in Romania, the significant role play the Structural Funds as well. RES projects are supported by two large Operational programmes *[37]*. The first one is the **Operational Programme Environment** with the total budget of 4,512 million EUR allocated from the Cohesion Fund and the European Regional Development Fund. The managing authority is the Ministry of Environment and Sustainable Development. Eight Intermediate Bodies under the authority of the Ministry of Environment and Sustainable Development act as the implementing authorities. Actions supported within the ***Priority 3: Restructuring and renovating urban heating systems towards energy efficiency*** among others include introduction of Best Available Techniques (BAT) for SO_2, NO_x and dust reductions; rehabilitation of boilers and turbines etc. Anyway, more important programme in relation to RES use is the **OP Competitiveness and Economic Growth**, especially ***Priority 4: Increasing energy efficiency and security of supply, in the context of combating climate change*** and *Measure 4.3. The improvement of energy efficiency at the end user*. The managing authority of this programme is the Ministry of Economy and Finance and as an implementing authority acts the Intermediate Body delegated by the Ministry of Economy and Finance. The program is supported by ERDF in total amount of 2,500 million EUR. The maximum co-financing from ERDF is 95 %, plus additional 2-5 % can arise from a local budget. The most important actions supported within this programme are “valorisation of renewable energy sources for production of green energy” as well as “efficient and sustainable energy (improving energy efficiency and environmental sustainability of the energy system)”.
The eligible beneficiaries of both Operational Programmes are local authorities.

As well, development of RES can be partially supported by other Operational Programmes, for instance development of ecological means of transport in the **Regional OP**.

Beside the Structural Funds, the finances for RES installations can be obtained from the **Environmental Fund** as well. The Environmental Fund is a financial and economic instrument which main goal is to support the development of the projects comprised within the National Environmental Action Plan in compliance with the national and international environmental norms and standards in force and envisages, as a main objective, the necessary investments for the adoption of the Aquis Communautaire. The Environmental Fund was established by the Law No. 73/2000 as a special fund, outside the budget. That law has been consequently adjusted and completed by other regulations: Government Emergency Ordinance No. 93/2001, endorsed by Law No. 293/2002, and, after being re-published into issue No. 889/2002 of the Official Bulletin of Romania, it was adjusted and completed by Government Emergency Ordinance No. 86/2003, endorsed by Law No. 333/2004 and by Government Emergency Ordinance No. 41/2005 as well *[20]*.
The income sources of the Environmental Funds are mainly environmental taxes and fines, taxes for the exploitation of natural resources, taxes and fines for polluting as well as state budget and local budget subsidies, financial support provided by individuals, private and public organizations and institutions, international organizations and bodies, governments and governmental agencies, sponsorships, payments and donations etc.
The eligible beneficiaries are enterprises, NGOs, local public authorities and education institutions and support can be provided by medium of loans or grants or by combination of these two funding mechanisms. The area of support includes also increase of production from renewable sources and financing value ranges from € 14,000 to € 5,700,000.
The maximal amount of grant support for investment projects was laid down for respective subjects as follows *[4]*:

- 30 % of eligible project costs for businesses
- 40 % of eligible project costs for small and medium enterprises
- 40 % of eligible project costs, if the project includes energy recovery
- 60 % of eligible project costs for municipalities / local public authorities

- 90 % of eligible project costs for NGOs and educational institutions and organizations
- comprehensive or partial settlements of interest of loans for applicants implementing environmental projects

There is also a possibility for enterprises to get reimbursement of their investment costs. Reimbursement may go up to 75 % of all eligible costs. Another possibility for businesses is a mix of reimbursement of investment costs and grant support as follows:

- subsidy up to 30 % of all eligible project costs at most (40 % for SMEs or if the project includes energy recovery)
- loan of 40 % of all eligible project costs at most

In this case, co-financing of an applicant has to cover 30 % of all eligible project costs at least, plus all non-eligible project costs *[4]*.

Great opportunity to attain financial means for RES projects offers also the **Romanian Energy Efficiency Fund (FREE)**. The Romanian Energy Efficiency Fund is the (client-oriented) financial institution of public interest having its own legal personality, independence and financial autonomy. It provides commercial financing of capital investments projects focused on increase of energy efficiency, rational use of energy, reduction of final energy intensity of country, mitigation of greenhouse gases and other pollutant emissions as well wider development of renewable energy sources. The Fund was established by Law No. 287/2002 and its headquarter is located in Bucharest. FREE manages the funds received by Romania from the Global Environment Facility (GEF) by medium of the International Bank for Reconstruction and Development (IBRD), according to the Grant Agreement signed between the Romanian Government and IBRD and ratified through Emergency Ordinance no. 188/2002. Co-financing opportunities within this Fund include:

- involvement of local banks in providing loans for the investment projects evaluated by the Fund
- partnership of the Fund with all financial institutions in traditional financing/co-financing arrangements

The requested amount of finances should be in the range 100,000 – 1,000,000 US$ and own contribution of applicant at least 20 % of the requested amount. Project payback period is supposed to be 4 (5) years at most. The investments in simple and verified technologies are preferred. The Romanian Energy Efficiency Fund has concluded 19 financing agreements amounting to 10,431 million US$ till 21 November 2007 *[84]*.

Joint Implementation (JI)

The National Focal Point coordinating the climate change activities and the EU ETS in Romania is the Ministry of Environment and Water Management. The priority areas for JI projects include also construction (or modernization) of energy facilities producing clean energy (especially hydro-electric, geothermal, wind, solar, biogas or biomass), reconstruction of district heating systems, fuel-switching in energy producing installations and reduction of GHG emissions in the transport sector *[103]*.

5.4. Slovakia

Because of non-existence of a special act on renewable energy source, the development of RES in Slovakia is influenced by the following superior legislation:

- Act No. 654/2004 in the Collection of Laws of 26 October 2004 on Energy and consequential amendments
- Act No. 657/2004 in the Collection of Laws of the Slovak Republic on Heat Energy (26 October 2004), amended by the Act No. 99/2007 (7 February 2007)
- Act No. 658/2004 (26 October 2004) that modifies and complements Act on Regulation of Network Industries No. 276/2001, last time amended by the Act No. 107/2007 (7 February 2007)
- Act No. 555/2005 in the Collection of Laws of the Slovak Republic on Energy Performance of Buildings (8 November 2005)

The Act No. 654/2004 is being currently amended. The biggest negative change incorporated to this Amendment in relation to RES is lowering the range of installed capacity to which the business license in energy sector is not required. Till now the business license in energy sector was not required for power production in facilities based on RES (small-scale HPP, wind power plants, solar power plants, facilities utilizing geothermal energy, biomass and biogas) and for gas production in biomass and biogas installations with total installed output up to 5 MW. But this range should be cut down to 1 MW of installed output.

Regarding the type of support scheme, Slovakia uses the feed-in tariff system since January 2006. The first really objective feed-in tariffs for all renewable energy sources - wind, geothermal, biomass, solar, small-scale hydro etc. have been issued by the Regulatory Office for Network Industries for the very first time on June 30, 2005 *[21]*.

The feed-in tariffs are issued annually by the Regulatory Office for Network Industries (by medium of Decrees) and are valid for the whole subsequent calendar year. The feed-in tariffs are fixed prices that are calculated in order to allow a return of investment to 12 years and are differentiated for particular renewable energy sources (hydro, solar, wind, geothermal, biomass, biogas) *[72]*. These prices should be adapted to the inflation according to the index of inflation published by the

Statistical Office of the Slovak Republic, but detailed calculations prove that annual increase of feed-in tariff for some installations was often under the officially published inflation rate. Another crucial problem is the guaranteed validity period of feed-in tariffs. The Regulatory Office for Network Industries can guarantee, by medium of annual Decrees, the validity of those special prices for the maximum period of 4-5 years. But from the point of view of accountable planning of investment, it is absolutely inevitable to have guaranteed feed-in tariffs for the period of 12-15 years at least. Therefore it is absolutely unavoidable to include this stipulation to a special superior legislation, i.e. into the Act on renewable energy sources or the Act on support of electricity generated by renewable energy sources.
According to the Resolution of Government of the Slovak Republic No. 383 on proposal of the Strategy on higher use of renewable energy sources in the Slovak Republic from 25 April 2007, the Ministers of Economy and Agriculture were supposed to develop the Act on renewable energy source till the 31 December 2007. Unfortunately, this deadline was extended till spring / summer 2008 and the detailed date is not known so far.

From the standpoint of volume of financial sources, the most significant support mechanisms in Slovakia are the Structural Funds. It is especially the **Operational Programme Competitiveness and Economic Growth** with the total budget of 772 million EUR coming from ERDF. The managing authority of this OP is the Ministry of Economy and as the Implementing authority the Slovak Innovation and Energy Agency (SIEA).
Actions supported within the ***Priority 2: Energy sector*** and *Measure 2.1.: Increasing energy efficiency both on the side of generation and consumption and introducing advanced technologies in the energy sector* besides the others include „Utilisation of renewable energy sources (small-scale HPP, solar and geothermal energy, biofuels, biomass and biogas)“, „Reconstruction of existing thermal devices for distribution of heat“ and „Combined heat and power production“. The maximum co-financing from ERDF and the state budget of the Slovak Republic within this Programme is 50 % and eligible beneficiaries are representatives of the private sector (e.g. SMEs, large businesses with more than 2,500 /in case of de-minimis scheme more than 500/ employees) *[62]*.

The second programme of great importance in relation to RES is the **OP Environment**. The total budget of this Operational Programme is € 2,117,647,059 as of this € 1,800,000,000 comes from the EU Funds (€ 230,756,935 from EFRD and € 1,569,243,065 from CF). The managing authority is the Ministry of Environment. ***Priority 3: Air protection and climate change mitigation*** and *Measure 3.2. Mitigation of severe impacts of climate change, including support of renewable energy sources* includes also „reduction of GHG emissions along the reduction of emissions of fundamental pollutants in the field of heat production, including the conversion of fossil fuels as an energy sources by the renewable energy sources". The maximum co-financing from the EU Funds is 85 %. The maximum amount of irreclaimable financial contribution to project is a subject to indicative financial allocation for this Measure and will be stated more precisely in forthcoming call for proposals. Eligible beneficiaries are specified subjects of public administration, municipalities and higher-tier territorial units, associations of towns / cities, micro-regions, religious communities and specified NGOs focused on environmental protection and specified personal and legal entities licensed to carry business *[73]*.

Some smaller RES installations can be supported in the frame of other Operational Programmes as well: **OP Research & Development**, **Regional OP**, **OP Bratislava (Self-governing) region** and **OP Transport**.
It is necessary to mention that in case the investment is supported from the Structural (EU) Funds or from the state budget, the feed-in tariffs will be reduced by 8 % if the EU subsidy or the state support amounts to the maximum of 40 % of the total acquisition costs and by 15 % if the EU subsidy / the state support was higher than 40 % of the total acquisition costs *[52]*.

As well in Slovakia, an interesting opportunity to obtain financial support for RES projects offers the **Financial Mechanism of the European Economic Area** / **Norwegian Financial Mechanism**. On the basis of agreement between the EU and the EFTA countries, the Norwegian Kingdom, Iceland and Liechtenstein provide to the Slovak Republic, in the period of 1 May 2004 – 30 April 2009, the overall amount of € 67 million (out of that 95 % of the total amount will be provided by Norway). The annual allocation will be € 13.36 million. The National Focal Point for implementation

of the Financial Mechanism of the European Economic Area / Norwegian Financial Mechanism in Slovakia is the Government Office of the Slovak Republic. Payment organ for the mechanisms is the Ministry of Finances – Department of National Fund *[36]*.

The priority area ***Protection of the environment*** includes actions focused on "Improvement of the air quality and reduction of greenhouse gases in Slovakia". In direct relation to RES, more important is the priority area ***Promotion of sustainable development*** that includes also actions aimed at "Promotion of renewable energy sources" and "Promotion of the use of biofuels and alternative energy resources as a secondary source of energy at municipality and regional level" *[12]*. The total allocation for one actual call within the priority area ***Protection of the environment*** is € 902,100 and within the priority area ***Promotion of sustainable development*** it is € 1,587,200 *[36]*.

The support within both mechanisms can be made by two forms:

1. Through the support of so called **Individual projects**. Those projects can be submitted by small and medium enterprises. Minimal amount of support for individual project is € 250,000. The maximum financial amount for individual project is set by the total allocation for respective priority areas and maximum rate of co-financing for eligible projects is 50 %. The projects within this category must be completed before 30 April 2011. The most actual call for proposal has been announced on November 19th 2007 and deadline was set on January 21st 2008.
2. By medium of **Block grants,** i.e. specially defined funds where financial support can be provided to individuals, organizations or institutions. The block grants are focused on assistance in implementation of projects where the final beneficiary is too small for administration of its project on individual base, mainly from the point of view of cost effectiveness *[12]*.

Just recently, in December 2007, EBRD in cooperation with the Ministry of Economy launched new Credit Line **SLOVSEFF (Sustainable Energy Finance Facility)**, where the same financing model as in the case of the Bulgarian Energy Efficiency and the Renewable Energy Credit Line (BEERECL) is used. The goal of this facility is to support increase of energy efficiency and wider use of renewable energy sources. *Loan component* amounting to € 60 million is provided by EBRD and *grant*

component in total amount € 15 million comes from the Bohunice International Decommissioning Support Fund (BIDSF). The administrator of Credit Line will provide loans and grant financing also through intermediation of four participating banks (PBs) *[53]*. Private companies and associations of flat owners can get the credits for investment projects aimed at increasing energy efficiency and RES installations ranging from € 20,000 to € 2,000,000, as well as irreclaimable grant (from BIDSF) amounting to 7.5 - 20 % from the total loan as well as a free technical support from local PBs. An additional free expert technical support will be provided to potential bank clients by the project consultant – a Czech based company ENVIROS Ltd. *[89]*.

One of the few possibilities for households and personal entities to obtain financial resources for smaller RES installations offers the **Environmental Fund**.

The Environmental Fund was established by the Law No. 587/2004 on 21 October 2004. Its income sources comes mainly from fines imposed by the state power bodies responsible for conservation of environment, charges for air and water polluting, sponsorships, payments, donations, financial support provided by individuals, private and public organizations and institutions, profits from own properties of Fund, entrance fee to protected areas etc.

One of the six priority areas, the ***priority A: Protection of air and ozone layer*** includes two sub-priorities pertaining to RES: *A/1a, A/1b – Production of heat and domestic hot water by means of use of low-emission and renewable energy sources* and *A/1c – Support of production of heat, domestic hot water and electricity by means of use of renewable energy sources for personal entities [32]*.

The support within this Fund can be accomplished by two modes:

a) Credit with special interest rate of 1 % p.a. and loan maturity in range of 5-15 years. Liability to the extent of 130 % of the overall credit is required.
b) Subsidy (grant) – in this case, co-financing from own or other sources in the amount of 5 % is required.

Unfortunately, one of the biggest problems of this Fund remains very high level of bureaucracy, and vice versa, low margin of flexibility and transparency. Therefore, the financial sources within this Fund are not utilized to the extent as would be needed.

For the households (family houses and multiple dwelling houses), which are not eligible to obtain the support from the Structural Funds, the **Program of higher use of biomass and solar energy in households** was constituted. The program will be funded by the state budget of the Slovak Republic and its aim is to reach the targets in heat sector by 2015. The program of higher use of biomass and solar energy in households was approved by the Resolution of Government of the Slovak Republic No. 383 and was expected to be launched by the Ministry of Economy on 30 September 2007 at the latest. The financial support within this program will be assigned in a form of subsidies for biomass boilers and solar thermal systems. The total amount of grant support will be 100 million SKK (€ 2,999,670 as of January 4th 2008) per year, of what 25 million SKK (€ 749,917.50) will be allocated for biomass boilers and 75 million SKK (€ 2,249,752.50) for solar thermal collectors. A subsidy for 1 m^2 of surface of solar collector has been set at 3,000 SKK (€ 89.99 as of January 4th 2008). Should the surface be bigger than 8 m^2, the state financial support will be 24,000 SKK (€ 719.92) plus additional 1,500 SKK (€ 45.00) for each 1 m^2 over 8 m^2 of surface. According to the „Strategy on higher use of renewable energy sources in the Slovak Republic", in order to achieve the defined goal of 300 TJ, it will be necessary to install 25,000 m^2 of solar-thermal collectors annually during the period 2007-2010 *[98]*.

Unfortunately, the program has not been launched till the end of 2007 and it is still not clear when it might be carried out. However, altogether with a lax development of the crucial Act on renewable energy sources, it is just another proof of negative attitudes of the state authorities towards higher development of RES in Slovakia.

6. Conclusion

Level of utilization of renewable energy sources in Bulgaria, Czech Republic, Romania and Slovakia is still low, despite its economic as well as technically usable RES potential. On one hand, this status is a consequence of the negative legacy of the second half of 20th century. An inappropriate energy structure was developed in each of those countries. It was characterized by a strong energy dependency on the former Soviet Republic (Russia), especially on imports of fossil fuel and uranium, high industrial energy intensity, high level of energy inefficiency and extensive and unsustainable use of sources.

On the other hand it is also a consequence of underestimation of importance of local potentials and energy sources, which could increase the security of supply of energy and energy independency. The political authorities, representatives of municipalities as well as other decision-makers in these countries are still not aware of the significant role of renewable energy sources in energy supply as well as their contribution to the mitigation of environmental problems, especially to the problems related to global warming and climate change.

Thus nowadays the most important role in the energy sector in all four countries still plays the fossil fuels. Their share on the gross domestic consumption is more than 70% in each country. The second biggest share falls on nuclear power, except of Romania where the second place belongs to renewable energy sources (mainly due to the usage of biomass and hydro energy). However, the share of nuclear power is clearer in electricity generation and announced construction of brand new nuclear facilities or completion of existing ones in all countries indicates bigger shares of nuclear energy in power production.

Water energy (for power generation) and biomass (especially for production of heat and preparation of domestic hot water) belong to the mostly used sources from all RES so far. But however, in case of water energy this status is a result of operation of large-scale hydro power plants (above the 10 MW) that are not considered the renewable energy source by the European Commission.

The utilization of small-scale hydro power plants is still very weak in each country. The process of penetration of other RES sources – wind, solar and geothermal energy, biogas etc. needs to be speeded-up as well.

It seems to be also absolutely unavoidable to set up appropriate frameworks in RES sector, as the current legislative frameworks are belong to the main obstacles towards the wider utilization of RES in these CEE countries.

The accession of all four countries to the EU in 2004 / 2007 and the necessity of the implementation of the EU Directives related to the energy and climate issues was surely a positive matter of fact. It exacted their transposition to the national legislations. Another great importance has also fulfilment of the EU obligations related to the share of RES in gross domestic energy consumption and on gross inland electricity production as well. The positive proofs are to be: Renewable and Alternative Energy Sources and Biofuels Act in Bulgaria and Act on the promotion of electricity production from renewable energy sources and amending certain acts (Act on promotion of Use of Renewable Sources) in the Czech Republic. Those may serve as an inspiration for Romania and Slovakia. But also other progressive incentives (including proper and flexible support mechanisms) will be required in all four countries, especially in relation to the increase the heat production out of RES.

Renewable Energy Framework Directive can have a great influence on intensifying of RES utilization in the CEE countries. The proposal of this Directive that includes electricity, heating & cooling and biofuels is supposed to be released by the European Commission at the end of January 2008.

7. Acknowledgment

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Appendices

Appendices A:

- Power System of Bulgaria
- Power Transmission Network of the Republic of Bulgaria
- Bulgarian Power System (Power distribution companies – majority owners)
- Bulgaria: Total gross generation in 2005 (in GWh)
- Small-scale, medium and large scale PV systems in the Czech Republic
- Wind power plants with installed capacity > 100 kW in the Czech Republic
- Spatial distribution of wind power density [W/m^2] above the area of the Czech Republic in elevation of 40 metres above the ground (model VAS/WAsP)
- Power System of Central Europe
- The Czech Republic: Total gross generation in 2005 (in GWh)
- Power System of Romania
- Romanian Power System (Power distribution companies – majority owners)
- Romanian Power System – subsidiaries
- Romania: Market share of dispatchable generators by delivery electricity (January-August 2007)
- Romania: Total gross generation in 2005 (in GWh)
- Power System of the Slovak Republic No. 1
- Power System of the Slovak Republic No. 2
- Power System of the Slovak Republic No. 3
- Slovakia: Total gross generation in 2005 (in GWh)

Appendix B:

- Bulgaria: Renewable and Alternative Energy Sources and Biofuels Act (*Prom. SG.* 49/19.06.2007)

Appendix C:

- The Czech Republic: Act of 31 March 2005 on the promotion of electricity production from renewable energy sources and amending certain acts (Act on promotion of Use of Renewable Sources), No. 180/2005 Coll.

Power System of Bulgaria

Source: Natsionalna Elektricheska Kompania EAD (National Electricity Company EAD), www.nek.bg

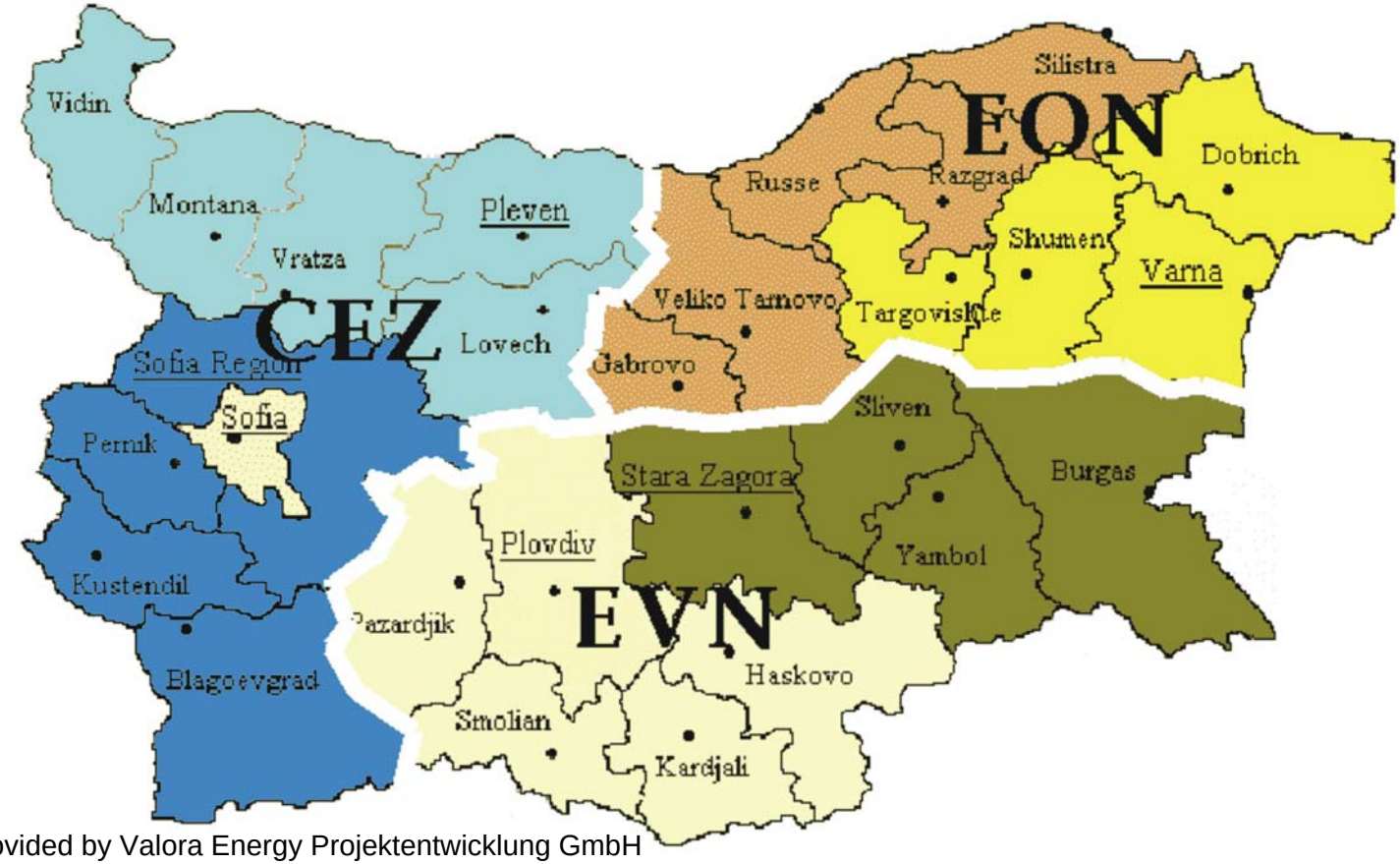
POWER TRANSMISSION NETWORK OF THE REPUBLIC OF BULGARIA

Overhead Power Lines	400 kV - 2 356 km long 220 kV - 2 692 km long 110 kV - 9 562 km long
Transformer Substations	32 grid substations 400/220/110 kV, 400/110 kV, 220/110 kV of total transformer capacity 16 817 MVA 247 step-down substations 110/20/10/6 kV of total transformer capacity 13 716 MVA
Switching Substations	400 kV switching substation 110 kV switching substation

Source: Natsionalna Elektricheska Kompania EAD (National Electricity Company EAD), www.nek.bg

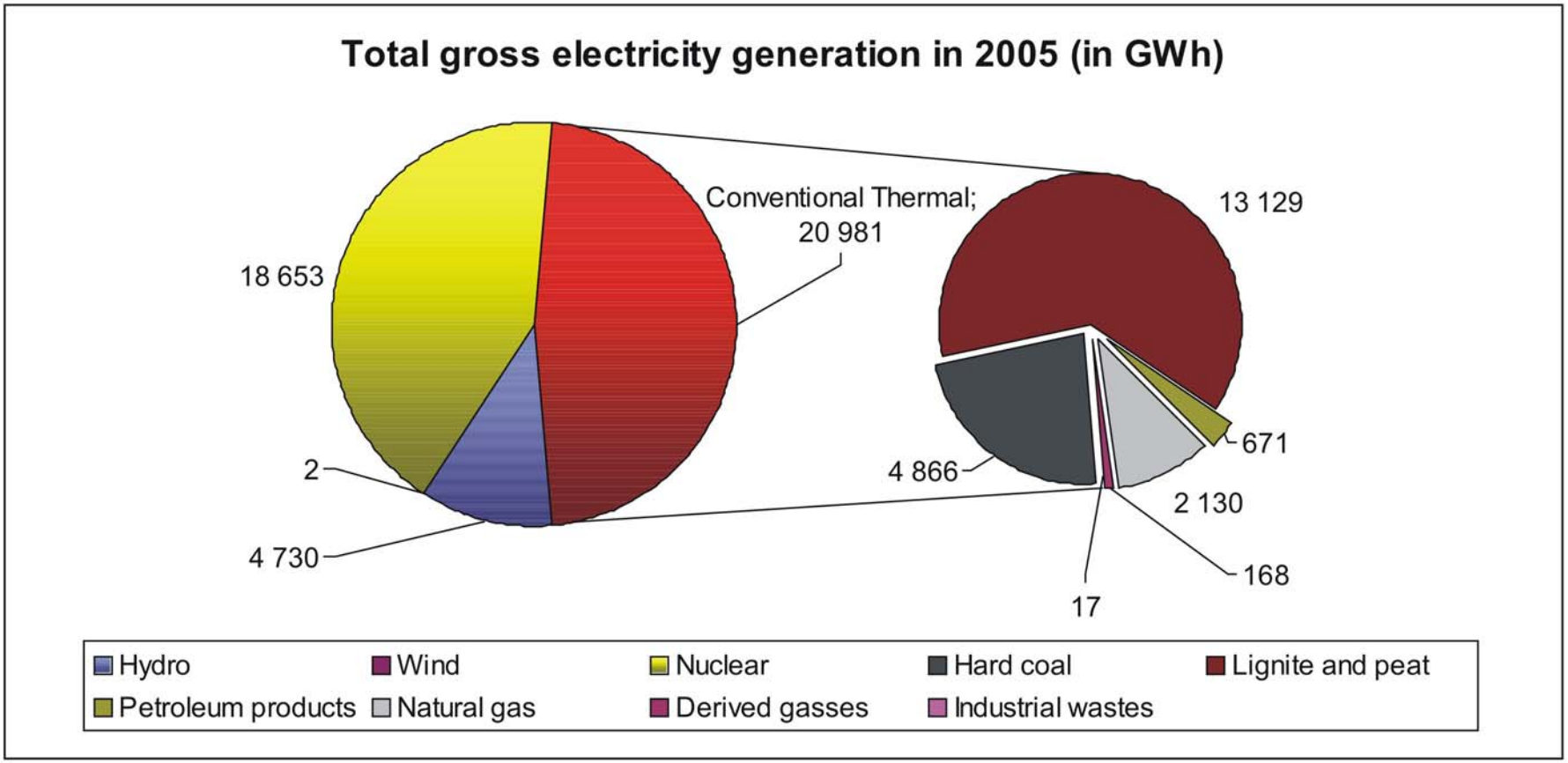
Bulgarian Power System

Power distribution companies - majority owners



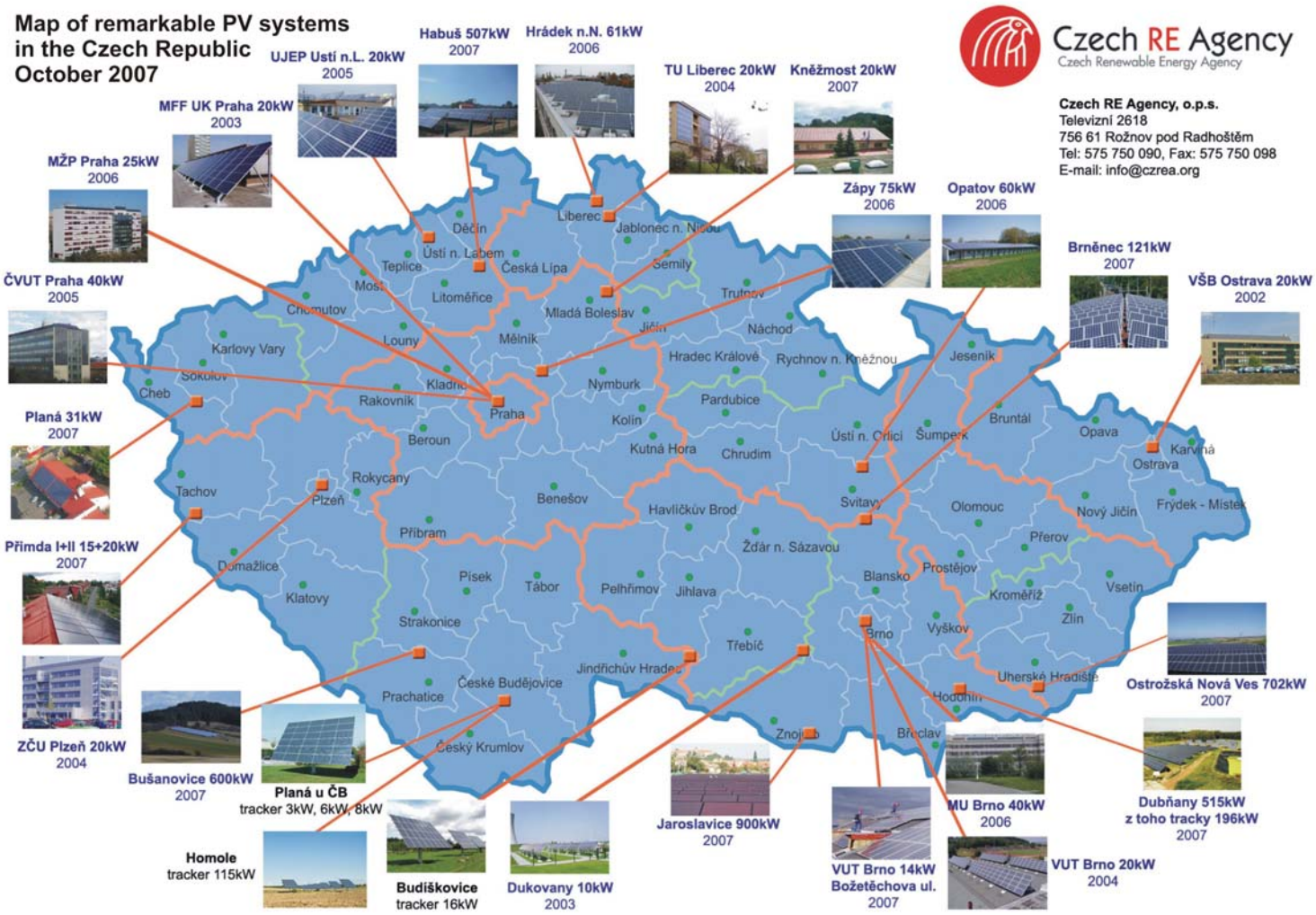
Source: map provided by Valora Energy Projektentwicklung GmbH

Bulgaria

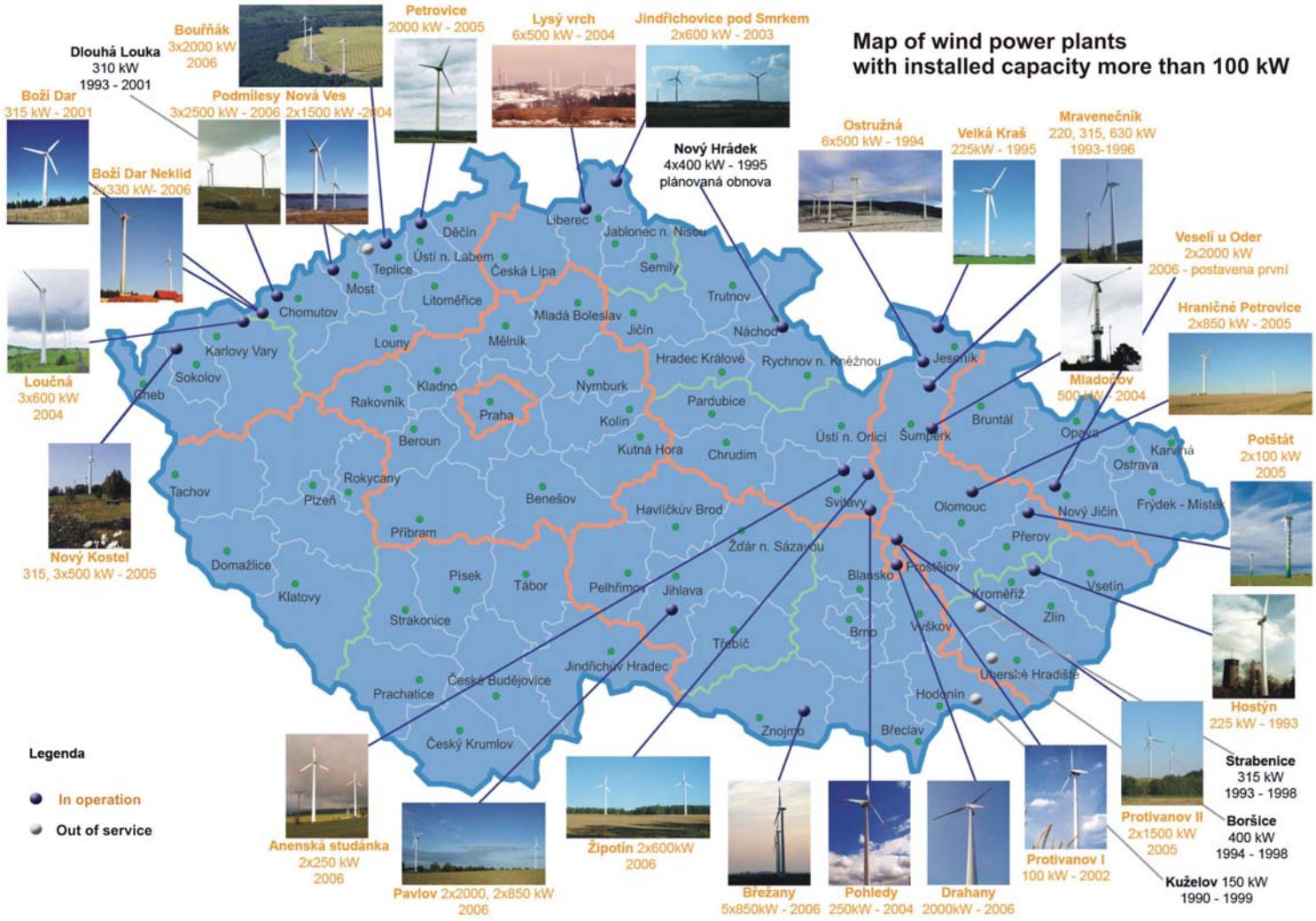


Source: Energy – Yearly Statistics 2005 (2007 Edition); Office for Official Publications of the European Communities, Luxembourg, 2007

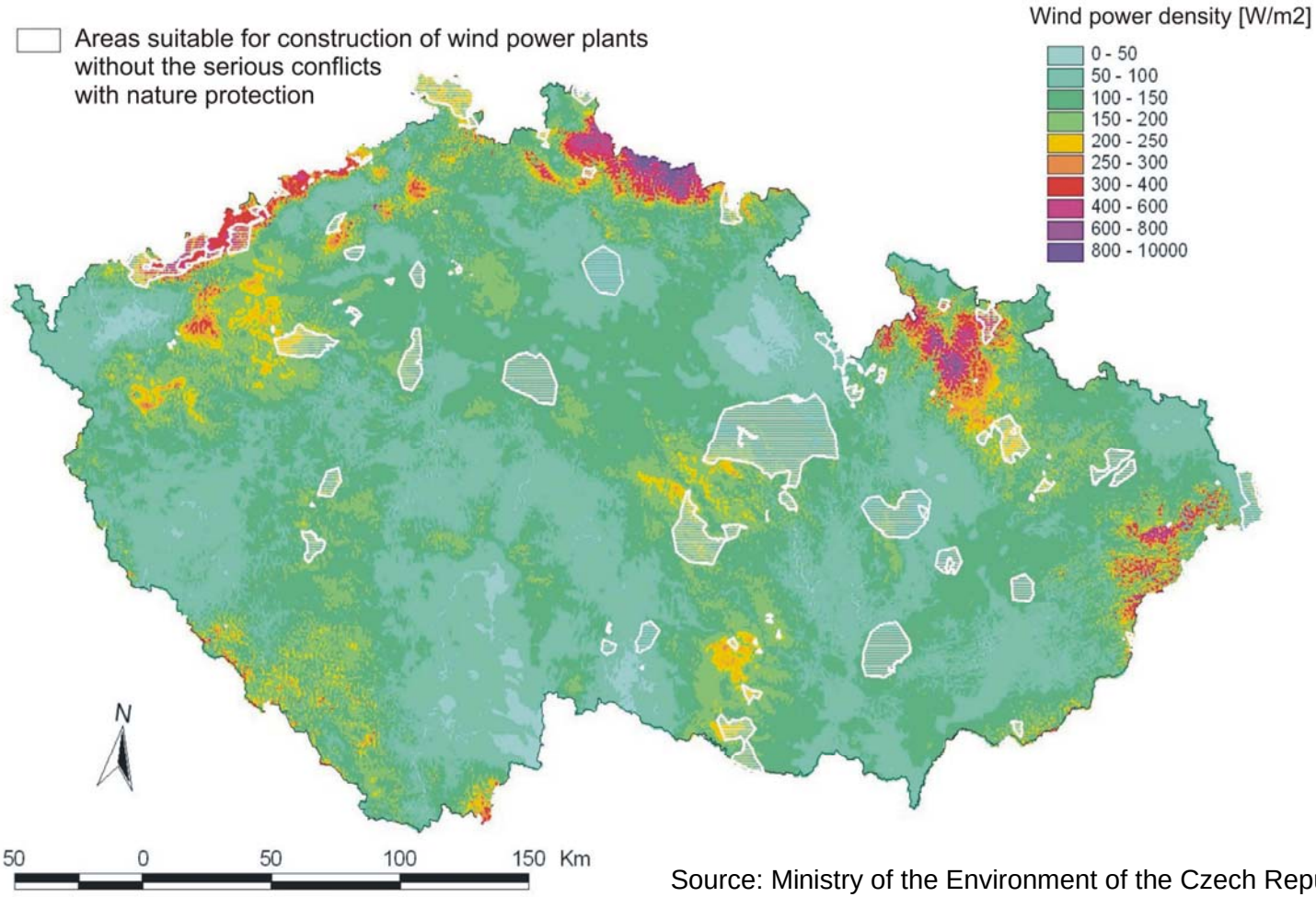
Small-scale, medium and large-scale PV systems in the Czech Republic



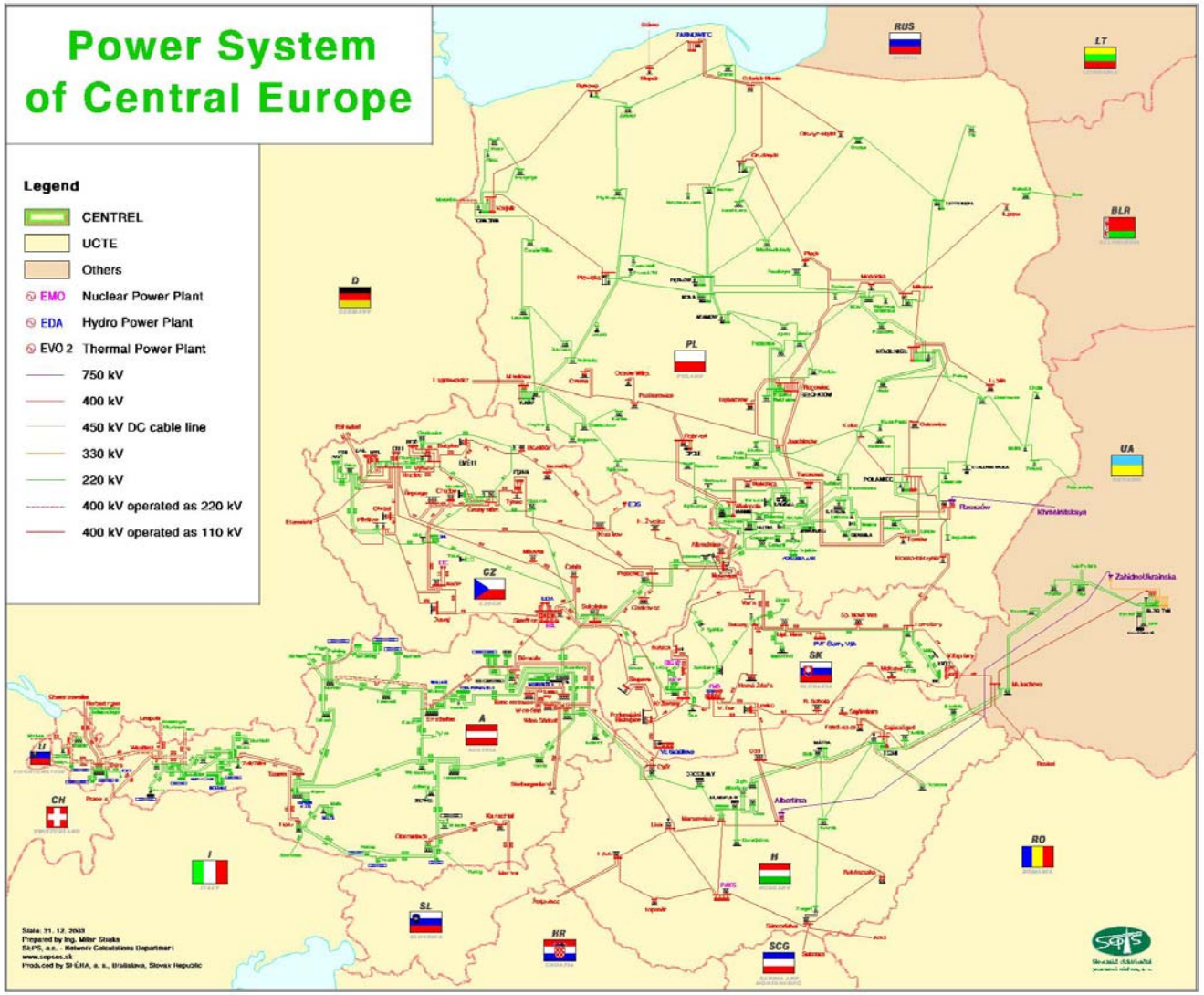
Wind power plants with installed capacity > 100 kW in the Czech Republic



Spatial distribution of wind power density [W/m²] above the area of the Czech Republic in elevation of 40 metres above the ground (model VAS/WAsP)



Source: Ministry of the Environment of the Czech Republic


Power System
of Central Europe
Legend
CENTREL
UCTE
Others
EMO Nuclear Power Plant
EDA Hydro Power Plant
EVO 2 Thermal Power Plant
750 kV
400 kV
450 kV DC cable line
330 kV
220 kV
400 kV operated as 220 kV
400 kV operated as 110 kV
RUS
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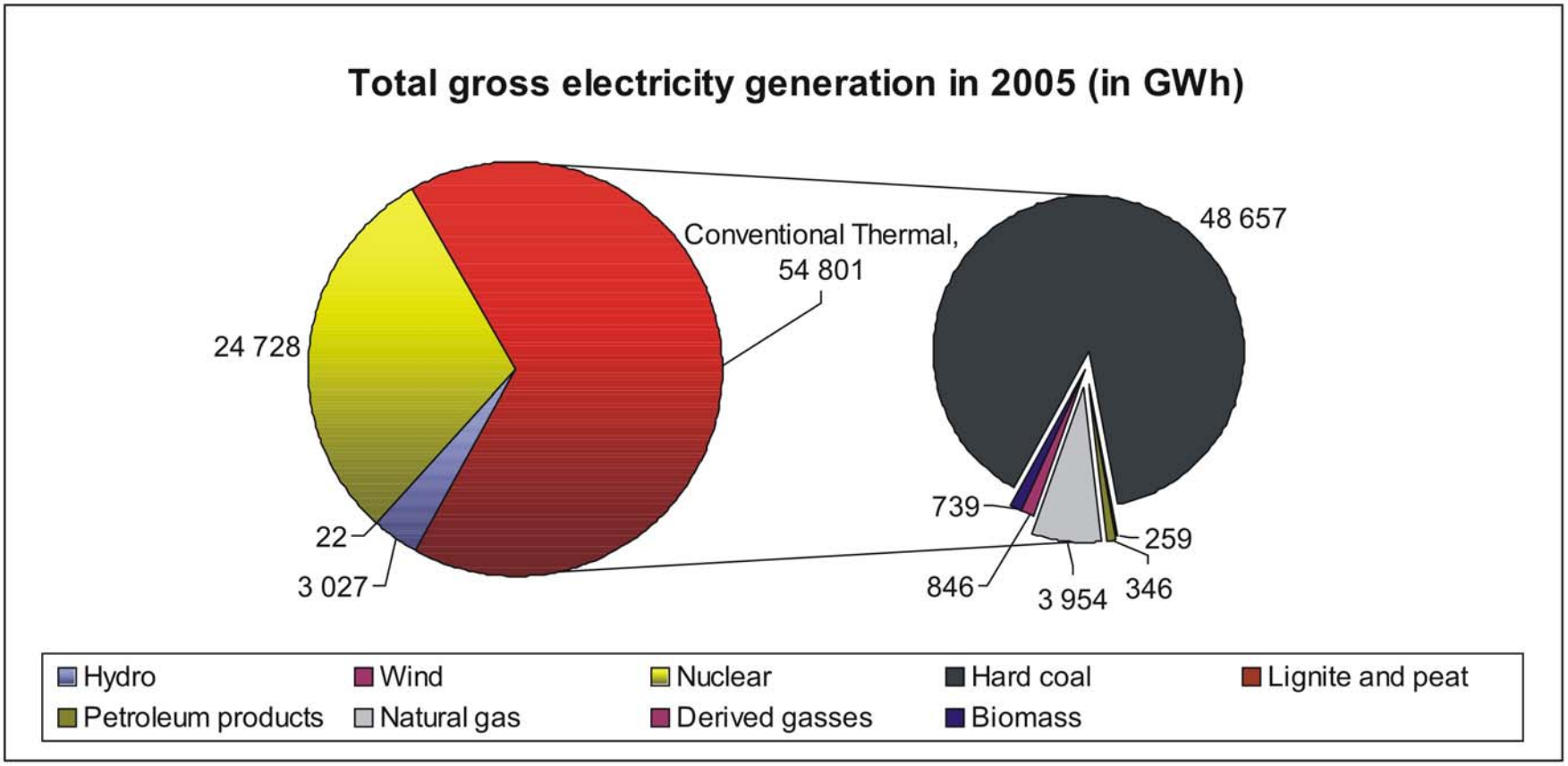
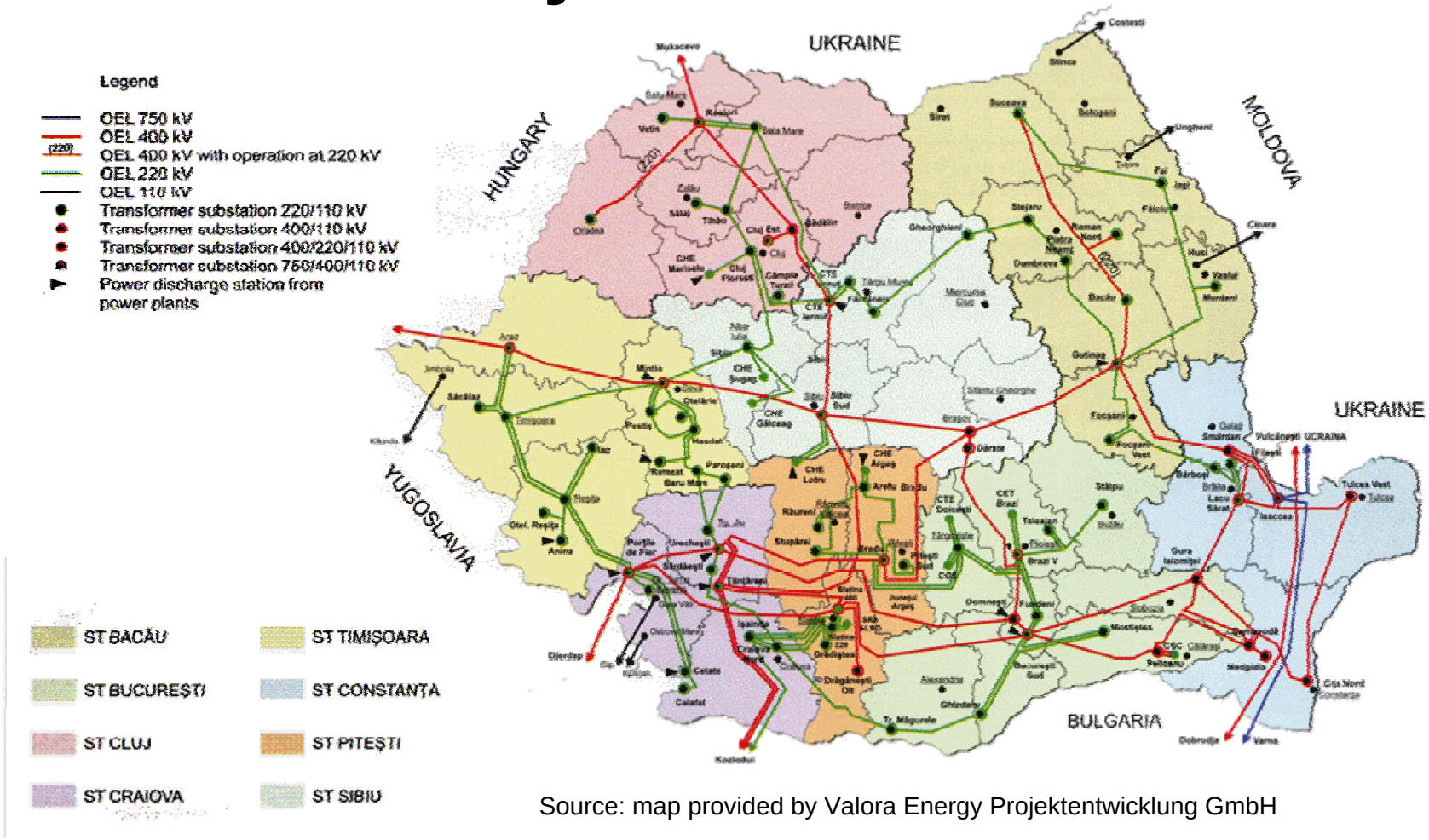
The Czech Republic



Source: Energy – Yearly Statistics 2005 (2007 Edition); Office for Official Publications of the European Communities, Luxembourg, 2007

Power System of Romania



Source: map provided by Valora Energy Projektentwicklung GmbH

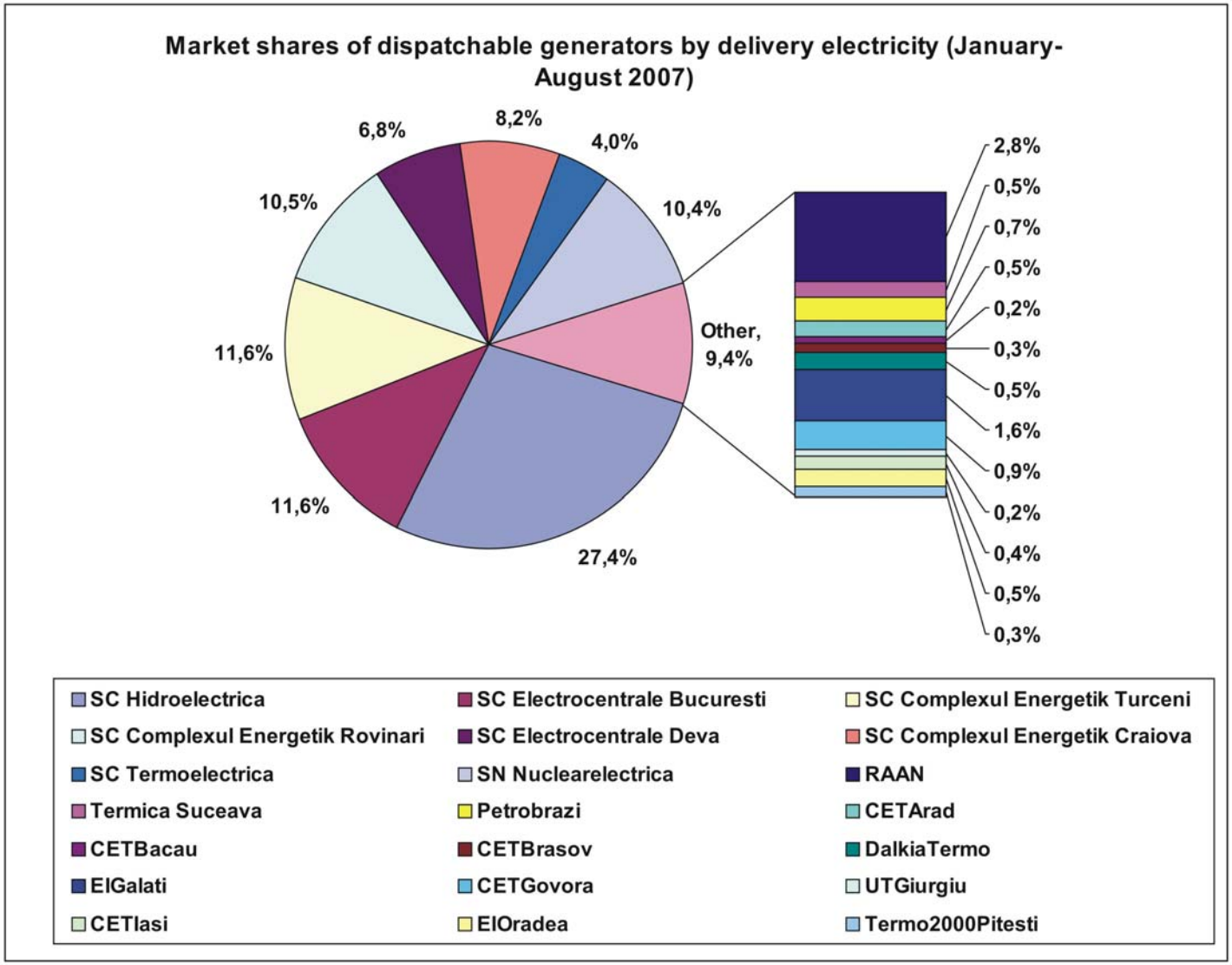
Romanian Power System
Power distribution companies – majority owners

Source: Electrica S.A., www.electrica.ro

Romanian Power System - subsidiaries

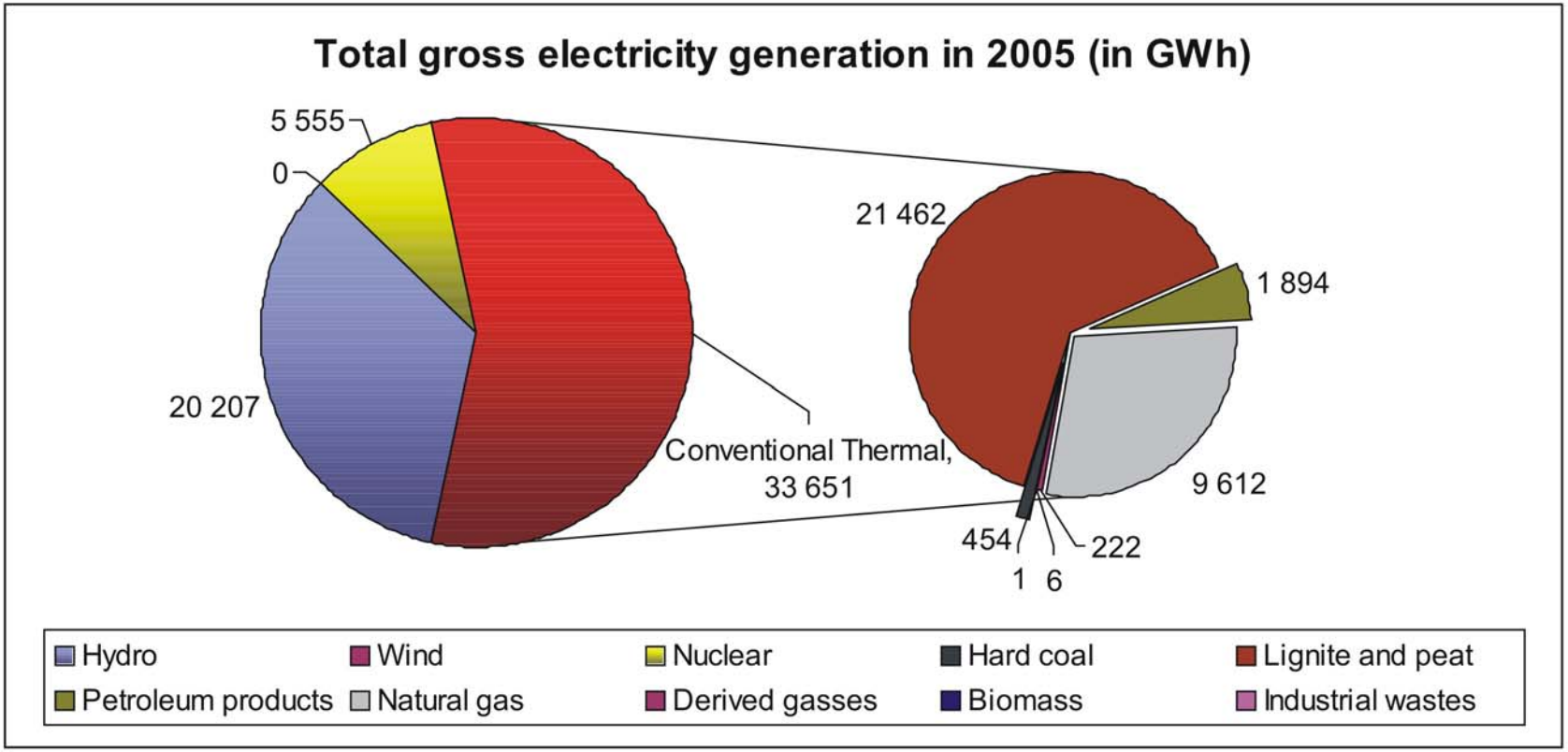
Subsidiary	Electric lines 110 kV km	Electric lines MT km	Electric lines JT km	Stations 110/MT si MT/MT nr	Stations 110/MT si MT/MT MVA	Transformation points Supply points no	Transformation points Supply points MVA
MOLDOVA	2,688.2	16,903.12	30,250.26	134	4,184.6	10,010	3,008.91
DOBROGEA	2,134.9	11,411.2	10,062	205	4,979.9	5,776	3,466.20
MUNTENIA NORD	2,155.414	15,872.71	21,625.16	206	5,455.3	9,138	3,174.47
OLTENIA	4,034.5	20,035.1	27,223.62	247	6,981	10,223	3,258.70
BANAT	1,953.956	13,614.27	18,342.07	140	4,733.5	6,813	2,068.33
TRANSILVANIA NORD	2,244,848	14,089.66	22281,63	124	3,859.77	7,174	2,624.22
TRANSILVANIA SUD	2,332.53	12,694.1	19,141.97	106	3,741.8	7,032	2,300.16
MUNTENIA SUD	784.968	13,098.42	21,028	60	3,710.2	5,588	2,934.05
Total SC ELECTRICA SA	18,329.32	117,718.6	169,954.7	1,222	37,646.07	61,754	22,835.02

Source: Electrica S.A., www.electrica.ro



Source: Report on monitoring results of the electricity market; Romanian Energy Regulatory Authority (ANRE), August 2007

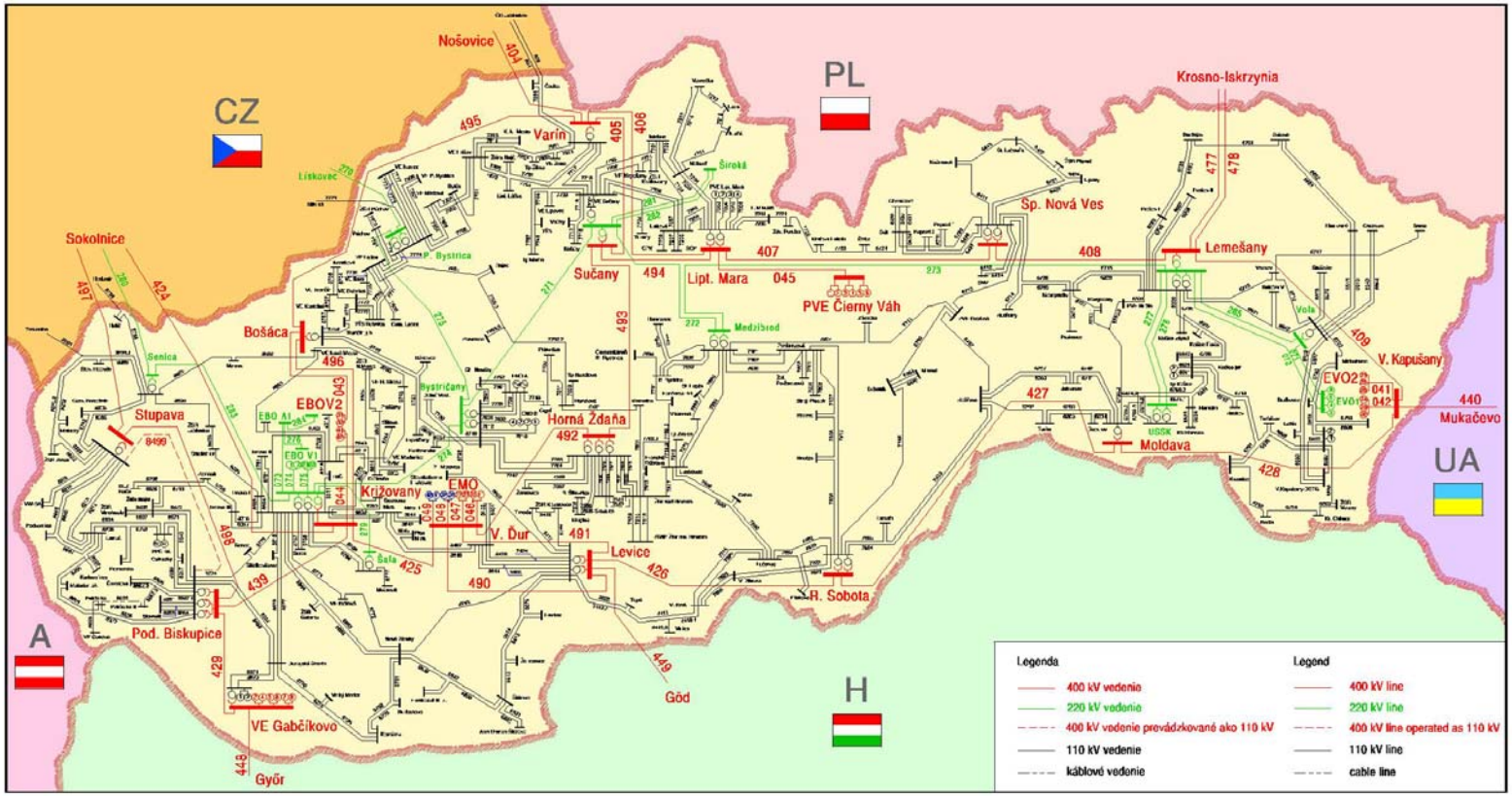
Romania



Source: Energy – Yearly Statistics 2005 (2007 Edition); Office for Official Publications of the European Communities, Luxembourg, 2007

Slovenská elektrizačná prenosová sústava, a. s.

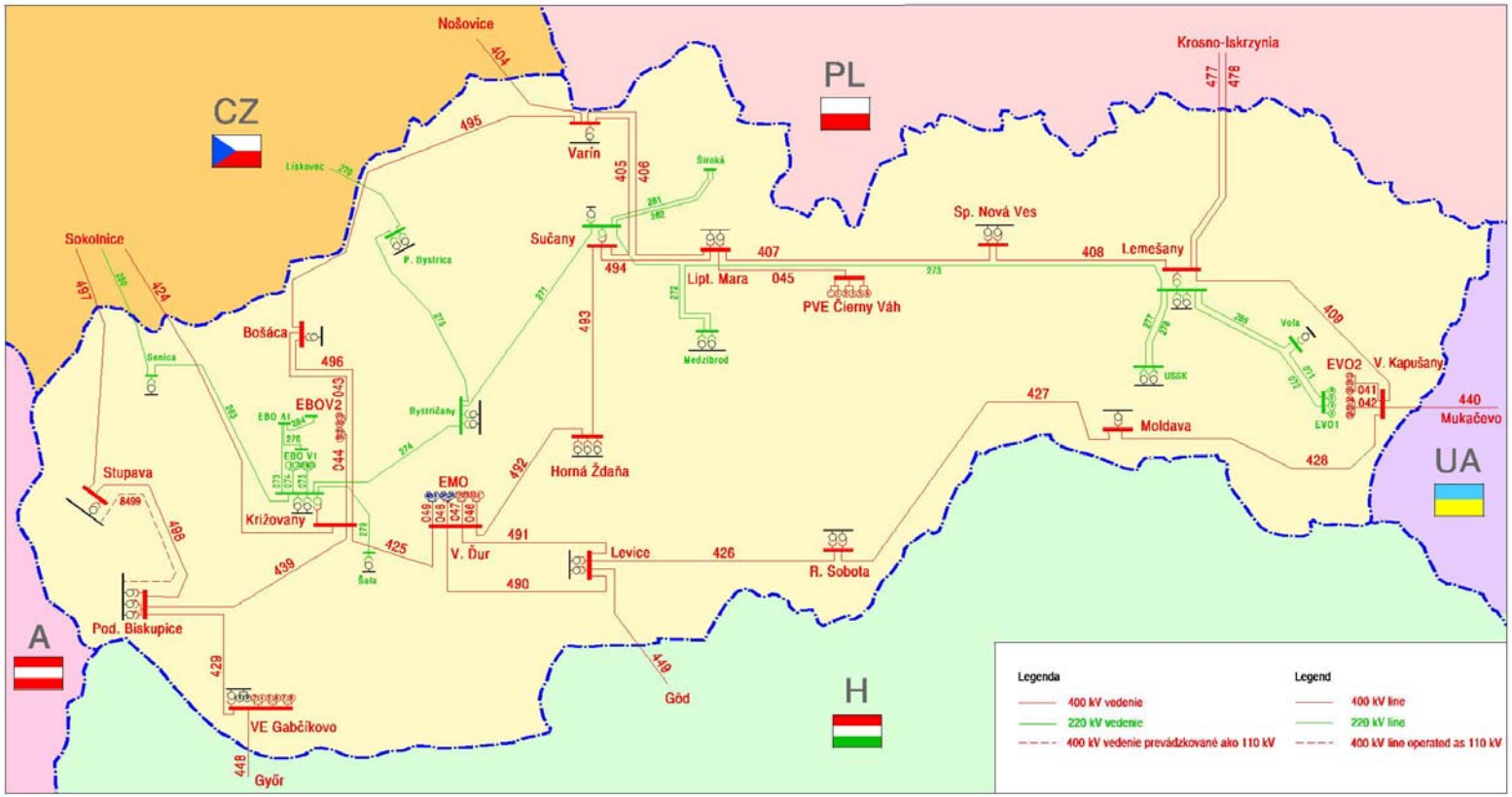
Elektrizačná sústava Slovenskej republiky
Power System of The Slovak Republic



Stav ku dňu: 31. 12. 2003
Vyhotovil: Ing. Milan Straka
SEPS, a. s., Oddelenie sieťových výpočtov
www.sepsas.sk
Technická spolupráca: stáfra, a. s., grafický systém MicroNT

Slovenská elektrizačná prenosová sústava, a. s.

Prenosová sústava Slovenskej republiky
Power System of The Slovak Republic



Stav ku dňu 31. 12. 2003
Vyhotovil: Ing. Milan Straka
SEPS, a. s., Oddelenie sieťových výpočtov
www.sepsas.sk
Technická spolupráca: ŽilinaMap, a. s., grafický systém MicroStation

Slovenská elektrizačná prenosová sústava, a. s.

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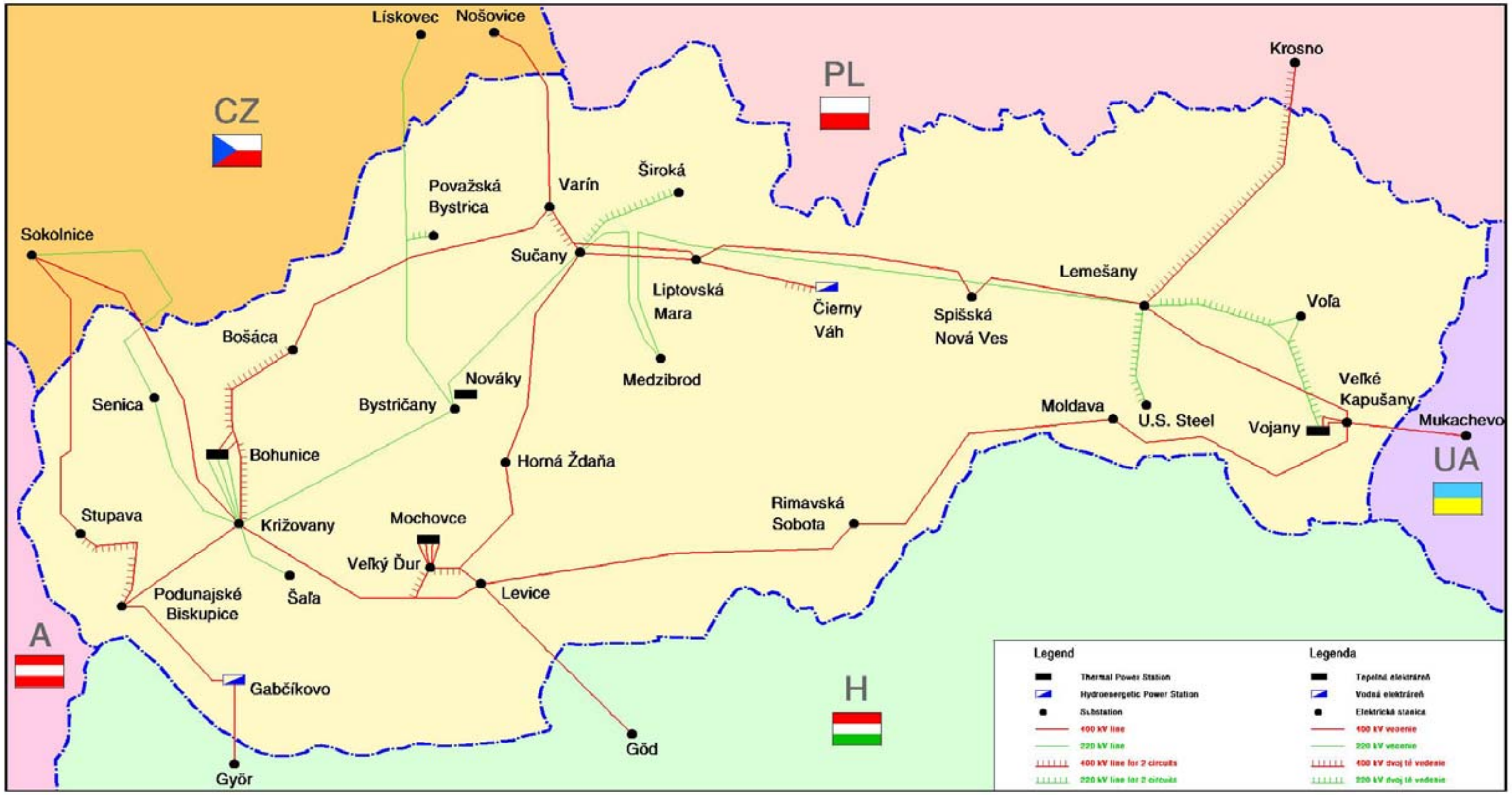
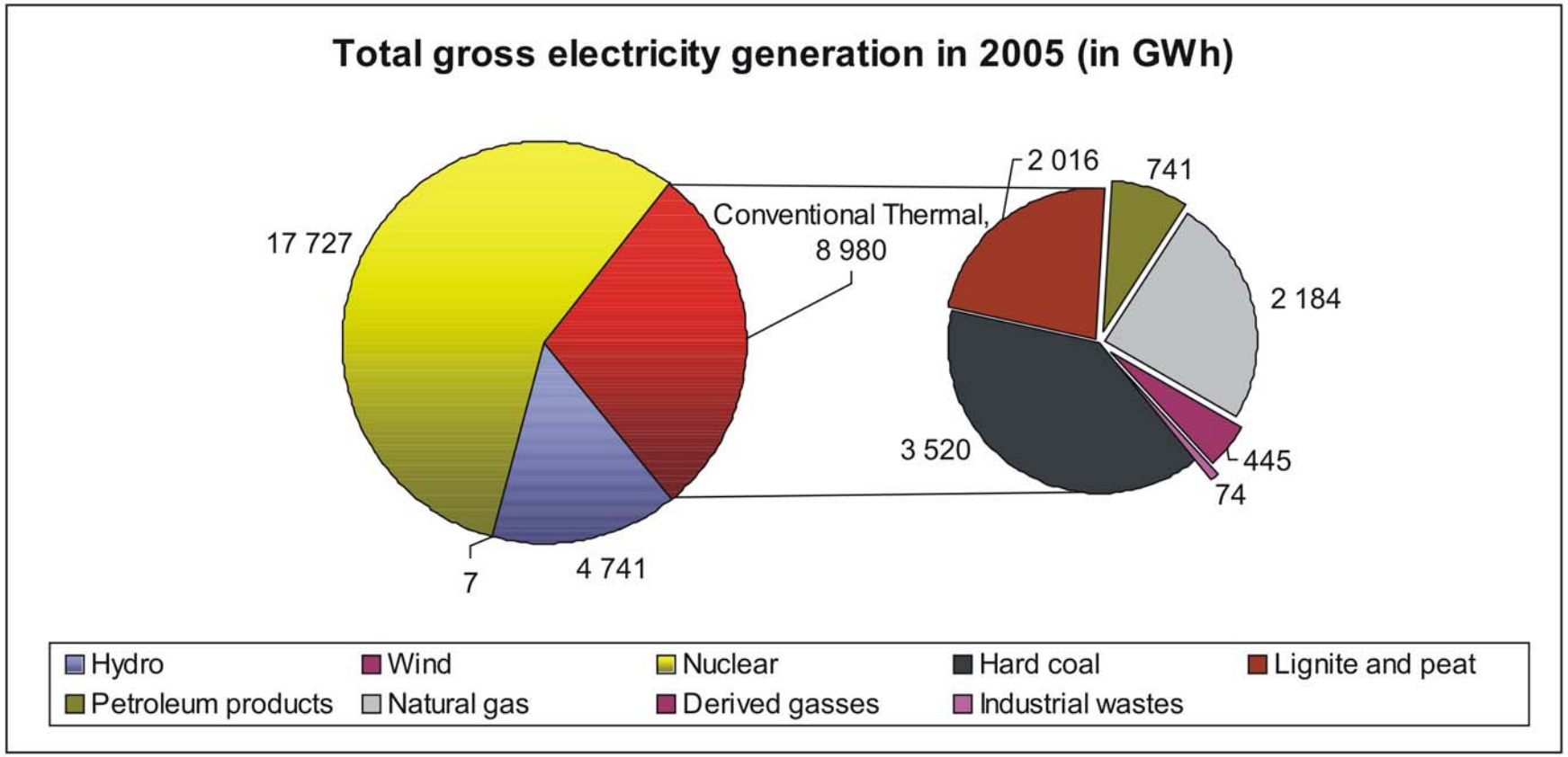


Stav ku dňu: 31. 12. 2003
Vyhotovil: Ing. Milan Straka
SEPS, a. s., Oddelenie sieťových výpočtov
Technická spolupráca: a. s., grafický systém NT

Slovakia



Source: Energy – Yearly Statistics 2005 (2007 Edition); Office for Official Publications of the European Communities, Luxembourg, 2007

Renewable and Alternative Energy Sources and Biofuels Act

Prom. SG. 49/19.06.2007

Chapter one

GENERAL PROVISIONS

Art. 1. This Act regulates the public relations aiming to promote the production and use of electrical, heating and/or cooling power generated from renewable and alternative energy sources, as well as the production and use of biofuels and other renewable fuels in the transport sector.

Art. 2. The basic objectives of this Act are:

1. to promote development and implementation of technologies for production and use of energy generated by renewable and alternative energy sources;

2. to promote the use and development of technologies for production and consumption of biofuels and other renewable fuels in the transport sector;

3. to diversify energy supplies;

4. to increase the output of small and medium-size enterprises generating energy from renewable and alternative energy sources, and producers of biofuels and other renewable fuels;

5. environment protection;

6. to set the grounds for sustainable local and regional development.

Art. 3. The objectives of Art. 2 can be achieved through:

1. introducing mechanisms for promoting the production and use of energy generated from renewable and alternative energy sources, as well as production and use of biofuels and other renewable fuels in the transport sector;

2. regulating the rights and responsibilities of executive authorities and local governments in implementing the state policy measures towards promoting use of renewable and alternative energy sources, biofuels and other renewable fuels;

3. creating a public national information system covering:

a) available renewable energy resources, biofuels and other renewable fuels;

b) producers of energy generated from renewable and alternative energy sources;

c) producers of biofuels and other renewable fuels;

4. supporting research and development related to production and use of renewable and alternative energy sources and biofuels.

Chapter Two

STATE POLICIES TOWARDS ENCOURAGEMENT OF USE OF RENEWABLE AND ALTERNATIVE ENERGY SOURCES, BIOFUELS AND OTHER RENEWABLE FUELS

Art. 4. (1) The Council of Ministers shall:

1. determine the state policies for promotion of production and use of energy generated from renewable and alternative energy sources, as well as the production and use of biofuels and other renewable fuels in the transport sector;

2. define the national indicative targets for use of electricity generated from renewable energy sources and the periods for their implementation;

3. define the national indicative target use of biofuels and other renewable fuels and determine the period for its achievement.

(2) For the purpose of achieving the national indicative targets, the Council of Ministers shall adopt long- and short-term national programs for promotion of renewable energy sources in the transport sector, which shall include measures for achieving the targets set forth in para. 1, item 3.

(3) For the purpose of achieving the national indicative targets, the Council of Ministers shall adopt long- and short-term national programs promoting the use of biofuels and other renewable fuels in the transport sector, which shall include measures for achieving the targets set forth in para. 1, item 3.

Art. 5. (1) The Minister of Economy and Energy shall:

1. implement the state policies towards promotion of the production and use of energy generated from renewable and alternative energy sources, as well as the production and use of biofuels and other renewable fuels in the transport sector;

2. develop and present to the Council of Ministers for adoption national indicative targets under Art. 4, para. 1, item 2 and shall prepare annual implementation reports, indicating also the level of compliance of undertaken measures with the obligations for prevention of climate changes, as well as measures taken to ensure reliability of the certificates of origin under art. 19, para 1 ;

3. in cooperation with the Minister of Transport, define and present for adoption by the Council of Ministers the national indicative targets under Art. 4, para. 1, item 3 ;

4. define and present for adoption by the Council of Ministers the long- and short-term national programs promoting the use of renewable energy sources and shall monitor the implementation of such programs;

5. in cooperation with the Minister of Transport, develop and present for adoption by the Council of Ministers the long- and short-term national programs for promotion of biofuels and other renewable fuels in the transport sector and shall monitor the implementation of such programs;

6. approve programs for promotion of alternative energy sources;

7. collect and store information about the use of renewable and alternative energy sources and biofuels;

8. organize the establishment and maintenance of the national public information system specified in Art. 3, item 3 ;

9. submit to the competent authorities of the European Communities the information envisaged in the *acquis communitaire* according to the relevant ordinance referred to in Art. 9, para. 4 of the Energy Act;

10. organize promotion to the public of the policies measures encouraging production and use of energy generated from renewable and alternative energy sources, as well as the production and use of biofuels and other renewable fuels in the transport sector;

11. cooperate with branch chambers and organizations and other non-profit organizations in implementation of the policy measures promoting production and use of energy generated from renewable and alternative energy sources, as well as production and use of biofuels and other renewable fuels in the transport sector.

(2) The national long-term programmes mentioned in para. 1, items 4 and 5 shall be developed for a period of 10 years, while the short-term programmes mentioned in para. 1, items 4 and 5 shall cover a period of 3 years.

Art. 6. The regional governors shall:

1. work for implementation of the state policy promoting production and use of energy generated from renewable and alternative energy sources, as well as the production and use of biofuels and other renewable fuels in the transport sector on the territory of the region;

2. coordinate the activities pertaining to the implementation of policy measures promoting production and use of energy generated from renewable and alternative sources, as well as production and use of biofuels and other renewable fuels in the transport sector within their region;

3. submit information to the Minister of Economy and Energy about the implementation on the territory of their region of the programs mentioned in Art. 7, item 1;

4. organize the update and maintenance of the public information system, stipulated by Art. 3, item 3, on the territory of their region.

Art. 7. The Mayors shall:

1. workout and present to the Municipal Councils for approval long- and short-term municipal programs for promotion of renewable and alternative energy sources and use of biofuels and other renewable fuels in the transport sector, and shall monitor the implementation of such programs;

2. develop and implement mechanisms promoting the use of renewable and alternative energy sources and biofuels suitable for the specific needs and conditions of their municipality;

3. organize public awareness campaigns in line with the national programs for promotion of renewable and alternative energy sources, and biofuels in the transport sector;

4. submit to their respective regional governors information about the implementation of programs provisioned in item 1;

5. organize and update the public information system (stipulated in Art. 3, item 3) on the territory of their municipality.

Chapter Three

PRODUCTION OF Energy From Renewable and Alternative Energy Sources

Section I

General Provisions

Art. 8. (1) Construction of facilities for generation of energy from renewable and alternative sources shall only commence after completion of investment surveys in conformity with the regulation stipulated by Art. 83, para. 3 of the Energy Act, integral part to which shall be the assessment of availability and estimated potential of the resource.

(2) The terms and conditions for carrying out the assessment under para. 1 shall be determined by an ordinance of the Minister of Economy and Energy.

(3) The provisions of para. 1 shall not apply to cases when the electric power from renewable and alternative energy sources is produced by household consumers of electric power.

Art. 9. Generation of electric power from renewable and alternative energy sources shall be encouraged with view of:

1. the characteristics of the various renewable and alternative energy sources and the technologies for generation of electricity;

2. the mechanisms of the energy market;

3. providng equal preferential treatment to the producers of electric power in respect of their income per unit of electricity produced in case of change in the mechanisms promoting the energy generated from renewable and alternative energy sources;

4. mandatory inclusion of utilities generating electricity from renewable and alternative energy sources, and biofuels into the national grid;

5. setting up preferential prices for purchasing energy generated through the use of renewable and alternative energy sources;

6. reducing the administrative burdens for the producers of energy from renewable and alternative energy sources and on construction of relevant facilities.

Section II

Encouraging Production of Electricity Generated From Renewable Energy Sources

Art. 10. (1) The national indicative targets for promotion of the consumption of electricity produced from renewable energy sources shall be set as percentage of the national gross annual electricity consumption in the ten years following the year of adoption of these targets by the Council of Ministers on a motion by the Minister of Economy and Energy.

(2) The national indicative targets under para. 1 shall be updated every 5 years.

Art. 11. (1) Each year not later than 31 March, the Minister of Economy and Energy shall present for approval by the Council of Ministers a report on the achievement of the indicative targets under Art. 10, para. 1 for the preceding calendar year.

(2) The report under para. 1 shall contain a review and analysis on the progress of the measures for achieving the indicative targets pertaining to consumption of energy generated from renewable energy sources set forth in the programmes under Art. 5, item 4.

(3) The Minister of Economy and Energy shall publish the approved report under para. 1 on the web site of the Ministry of Economy and Energy.

Art. 12. The provisions of the Act on Promotion of Investments shall apply to all investment projects for construction, expansion or rehabilitation of facilities for production of electric and heat power from renewable and alternative energy sources, as well as the related infrastructure - public or municipal property.

Section III

Rights and Obligations of Participants on the Renewable and Alternative Energy Market

Art. 13. (1) Each year, while the preparing their investment and maintenance programmes, the transmission and distribution enterprises shall allocate resources for grids development aiming to promote production of electric power from renewable and alternative energy sources.

(2) The transmission company and/or distribution companies shall be obligated to assign priority to connecting all facilities for production of electric power from renewable and alternative energy sources, which comply to the specific conditions for connection to the grid as defined by the ordinance stipulated by Art. 116, para. 7 of the Energy Act.

(3) The producers of energy from renewable and alternative energy sources shall request in writing from the transmission company or the relevant distribution company a survey of the terms and conditions for connecting the power plant to the grid, enclosing to its request all documents specified by the ordinance stipulated by para. 2.

(4) In case the information contained in the request or the enclosed documents under para. 3 do not comply with the provisions of the ordinance stipulated by para. 2 and/or are incomplete, the transmission company or the relevant distribution company shall, within 14 days from receipt of the request, notify the producer about such incompleteness and deficiencies in the documentation and may request additional information about the parameters of the energy plant for which connection is requested.

(5) In case the producer fails to rectify the missing information and deficiencies in the request, or fails to present additional information about the parameters of the energy plant within 30 days from receipt of the notification under para. 4, the procedure for connecting the energy plant to the grid shall be terminated.

(6) Within 90 days from receipt of the request under para. 3, the transmission company or the relevant distribution company shall perform the survey, inform the producer in writing about the terms and conditions for connecting the energy plant to the grid and conclude a preliminary contract for connection.

(7) The contract shall determine the period for connecting the energy plant to the transmission grid or the respective distribution grid, which period may not exceed the term specified by the producer for putting the energy plant into operation.

(8) In case the applicant is also a household consumer of electric power, the transmission company or the relevant distribution company shall inform the latter in writing about the terms and conditions for connecting the energy site to the grid within 30 days from receipt of the request under para. 3. The period for connecting the energy site to the grid may not exceed 3 months from receipt of the request.

Art. 14. (1) The obligation for connecting a producer of electric power generated from renewable energy sources shall arise for the transmission company or the

relevant distribution company, which is located in the closest proximity to the energy plant.

(2) The property boundaries of the electric power facilities of the producer and the location of the commercial metering devices shall be determined according to the relevant ordinance referred to in Art. 116, para. 7 and Art. 83, para. 1, item 6 of the Energy Act. In cases where the interconnection point is not located within the property boundaries of the producer's facilities, the provisions of Art. 116, para. 5 of the Energy Act shall apply.

(3) The distribution company shall be obligated to connect to its network every producer of energy generated from renewable energy sources, which is also a household consumer of electric power. The property boundaries of the electric facilities of the producer and the location of the commercial metering devices shall be in close proximity to the existing ones owned by distribution company and the producer.

(4) The transmission company and the distribution company shall determine minimum connection requirements by specifying the connection point, which is closest to the transmission or distribution grid, and the provisional connection fee. The transmission company or the distribution company shall also inform the producer about the possibility to connect the facilities of other produces or consumers who have already been connected or are being connected to the same grid.

Art. 15. (1) The costs related to the connection of the energy plant of the producer incurred within the property boundaries of the electric facilities shall be borne by the producer.

(2) The costs pertaining to the connection of the energy site of the producer to the relevant grid outside the property boundaries of the electric facilities up to the interconnection point shall be borne by the transmission company or the relevant distribution company, whereby the producer shall pay connection fee covering only the direct connection costs incurred by the transmission company or the relevant distribution company according to the relevant ordinance referred to in Art. 36, para. 3 of the Energy Act.

(3) The costs pertaining to the expansion and reconstruction of the transmission and or distribution network with regard to the connection of the energy plant of the producer under Art. 13, para. 2, shall be borne by the transmission company or the distribution company, respectively, and may not be included in the fee for connecting the producers of renewable energy.

Art. 16. (1) The public utility company and the end suppliers, respectively, shall purchase the entire quantity of generated electric power, for which there is a certificate of origin in place according to the relevant ordinance referred to in Art. 19, para. 3, except for the contracted quantities in accordance with Chapter Nine, Section VII of the Energy Act or the quantities subject to balancing transactions, as well as the quantities generated for producer's own needs.

(2) The public utility company and the end suppliers, respectively, shall purchase the entire quantity of energy generated from renewable and alternative energy sources, except for the power generated by hydroelectric power plants with installed capacity

over 10 MW, at preferential purchase prices according to the relevant ordinance referred to in Art. 36, para. 3 of the Energy Act.

Art. 17. (1) The public utility company and the end suppliers, respectively, shall purchase the entire quantity of energy generated from renewable energy sources through the use of combined generation technology, except for quantities generated by the producer for its own needs or the contracted quantities in accordance with Chapter Nine, Section VII of the Energy Act, or the quantities subject to balancing transactions according to the relevant ordinance referred to in Art. 36, para. 3 of the Energy Act.

(2) The producer of energy generated from renewable energy sources through use of combined generation technology may sell the quantities produced at one of the following preferential prices:

1. preferential price for purchasing electricity generated from renewable energy sources in accordance with the provisions of Art. 16, para. 2 , or

2. preferential price for purchasing electricity generated in combined heat and electric power production in accordance with the provisions of Art. 162, para. 2 of the Energy Act.

Art. 18. The public utility company, respectively the end suppliers, shall purchase the electricity generated from combined use of renewable and non-renewable energy sources, depending on the share of input renewable energy sources, at prices set in accordance with the ordinance referred to in Art. 36, para. 3 of the Energy Act.

Art. 19. (1) The State Energy and Water Regulatory Committee (SEWRC) shall issue to the producers certificates of origin of the energy generated from renewable energy sources, called hereinafter <>

(2) The State Energy and Water Regulatory Commission shall accepts the validity of certificates of origin issued by competent authorities in other EU member states based on the principles of reciprocity.

(3) The form, content, terms and procedure for issuance of certificate of origin shall be established by an ordinance adopted by the Council of Ministers on a motion by the SEWRC.

Art. 20. (1) On the grounds of the certificate issued under Art. 19, para. 1, the SEWRC shall issue to the producers of energy from renewable energy sources a<>green certificate<>

(2) The rules and procedures for implementing market mechanisms for encouraging production of electric and heating power from renewable energy sources shall be determined by a special law.

Section IV

Prices of Electricity Generated from Renewable Energy Sources

Art. 21. (1) Each year no later than 31 March, the State Energy and Water Regulatory Committee shall determine the preferential prices for sale of electricity generated from renewable or alternative energy sources, except for electricity generated by hydroelectric power plants with installed capacity exceeding 10 MW.

(2) The preferential price of electricity generated from renewable energy sources under para. 1 shall be determined at 80 percent of the average sale price for public utilities or end suppliers for the preceding calendar year plus an addition determined by the SEWRC depending to the type of primary energy source as indicated by the relevant ordinance stipulated by Art. 36, para. 3 of the Energy Act.

(3) The addition referred to in para. 2 for the next calendar year may not be less than 95 percent of the addition for the current year.

Chapter Four

ENCOURAGING USE OF BIOFUELS AND OTHER RENEWABLE FUELS IN THE TRANSPORT SECTOR

Section I

General Provisions

Art. 22. (1) Biofuels and related byproducts are used in the transport sector in pure form or blended into petroleum-based liquid fuels for internal combustion engines.

(2) The production and use of biofuels is encouraged by:

1. setting up national indicative targets for promoting the use of biofuels and other renewable fuels in the transport sector;

2. ensuring efficient operation of engines through compliance with the technical and quality standards for production of biofuels;

3. sustainable development of the agriculture and forestry;

4. reducing the harmful emissions released in the atmosphere by the transport sector.

Art. 23. (1) The national indicative targets for the use of biofuels and other renewable fuels in the transport sector shall be determined by the Council of Ministers on a motion of the Minister of Economy and Energy and the Minister of Transport as a minimum percentage of the annual consumption of gasoline and diesel fuel.

(2) Each year no later than 30 April, the Minister of Economy and Energy shall present for approval by the Council of Ministers a report on the achievement of the indicative targets under para. 1 for the previous calendar year.

(3) The report under para. 2 shall contain a review and analysis on the progress of the measures for achieving the indicative targets pertaining to use of biofuels and other renewable fuels set forth in the programs under Art. 5, para. 1, item 5.

(4) The Minister of Economy and Energy shall publish the approved report under para. 2 on the web site of the Ministry of Economy and Energy.

Section II

Requirements to Quality, Control and Market Distribution of Pure and Blended Biofuels

Art. 24. (to enter into force from 1.01.2008 - SG 49/2007) Producers and importers of liquid fuels for the transport sector are obliged to sell to the market petroleum-based fuels mixed with biofuels in proportion specified in the ordinance referred to in Art. 8, para. 1 of the Clean Air Act.

Art. 25. Blending biofuels into petroleum-based fuels and their sale to the market may only be performed in tax warehouses licensed in accordance with the provisions of the Excise Duties and Tax Warehouses Act.

Art. 26. The technical and quality standards for the pure or blended biofuels as well as the procedures, terms and conditions for their control shall be determined in an ordinance under Art. 8, para. 1 of Clean Air Act.

Art. 27. The President of the National Agency for Metrology and Technical Control through its Chief Directorate for Quality Supervision on Liquid Fuels in accordance with the Clean Air Act.

Chapter Five

REPORTING REQUIREMENTS WITH REGARD TO THE QUANTITIES OF ENERGY GENERATED FROM RENEWABLE AND ALTERNATIVE ENERGY SOURCES AND BIOFUELS

Art. 28. (1) The public utility company and respectively the end suppliers shall provide data on the sold and purchased quantities of electricity generated from renewable and alternative energy sources by various types of sources.

(2) The content, rules and procedures for submission of data under para. 1 shall be determined by ordinance of the Minister of Economy and Energy.

Art. 29. (1) Each producer of energy from renewable energy sources using combined generation technologies, including energy generated for its own needs,

shall submit data on the produced quantities of electric and heating power according to the ordinance referred to in Art. 28, para. 2 .

(2) Reporting of quantities of energy generated from renewable energy sources using combined generation technologies shall be done in accordance with the ordinance referred to in Art. 162, para. 3 of the Energy Act.

Art. 30. Each producer of energy using combined generation from biomass and non-renewable energy sources, including energy generated for its own needs, shall submit data on the quantities of eelectricity generated from biomass and the actual quantity and quality of input biomass according to the ordinance referred to in Art. 28, para. 2 .

Art. 31. Each producer of heating and/or cooling energy from renewable energy sources, including energy generated for its own needs, shall submit data on the produced quantities of energy according to the ordinance referred to in Art. 28, para. 2.

Art. 32. Each producer of biofuels, including for its own needs, shall submit data on the produced and sold biofuels on the market regardless of their form according to the ordinance referred to in Art. 28, para. 2 .

Chapter Six

ADMINISTRATIVE AND PENALTY PROVISIONS

Art. 33. A fine in the amount of 1,000 BGN shall be imposed on any regional governor or municipality mayor, who fails to organize the maintenance of a public information system as stipulated by Art. 6, item 4, and Art. 7, item 5, respectively.

Art. 34. A fine in the amount of 1,000 BGN shall be imposed on any regional governor or municipality mayor who fails to submit to the Minister of Economy and Energy the information on the implementation of the programs specified in Art. 7, item 1 .

Art. 35. (1) A penalty payment in the amount of 50,000 BGN shall be imposed on any energy company, which fails to connect with priority a producer of electric power according to Art. 13, para. 2.

(2) A penalty payment in the amount of 30,000 BGN shall be imposed on any energy company, which fails to connect a producer of electric power within the terms specified under Art. 13, para. 7.

(3) In case of repeated violation under para. 1 and 2, the penalty payment shall be three times the maximum amount of the sanction specified under para. 1.

Art. 36. (1) A penalty payment from 7,000 to 20,000 BGN shall be imposed on any public utility company and end supplier, respectively, who fails to observe its obligations under Art. 16 , 17 and 18.

(2) In case of repeated violation under para. 1 the penalty payment shall be three times the maximum amount of the sanction specified under para. 1.

Art. 37. (1) A penalty payment in the amount of 2,000 BGN shall be imposed on any producer, who fails to present the data specified under Chapter Five.

(2) In case of repeated violation under para. 1 the penalty payment shall be three times the maximum amount of the sanction specified under para. 1.

Art. 38. (1) A penalty payment from 7,000 to 20,000 BGN shall be imposed on any producer, importer or supplier of petroleum-based liquid fuel, who fails to observe its obligations for mandatory blending under Art. 24.

(2) In case of repeated violation under para. 1 the penalty payment shall be three times the maximum amount of the sanction specified under para. 1.

Art. 39. (1) A penalty payment in the amount of 2,000 BGN shall be imposed on any public utility company and end supplier, respectively, which fails to present the data specified under Chapter Five.

(2) In case of repeated violation under para. 1 the penalty payment shall be three times the maximum amount of the sanction specified under para. 1.

Art. 40. (1) Violations under this Act shall be established by statements issued by state officials authorized by the Minister of Economy and Energy.

(2) Penalty enactments shall be issued by the Minister of Energy and Energy or by a person authorized by the latter.

(3) Establishment of the violations, issuance, appeal and execution of penalty enactments shall be carried out under the terms and conditions as provided in the Administrative Violations and Sanctions Act.

COMPLEMENTARY PROVISIONS

§ 1. For the purposes of this Act:

1. "Renewable energy sources" shall include non-fossil sources such as solar, wind, geothermal, hydroelectric, water wave or tidal energy, which are capable of renewing without visible depletion during their use, as well as waste heat, biomass energy, industrial and household waste energy.

2. "Alternative energy sources" include hydrogen, waste products of technological processing and others.

3. "Biofuels" include gas or liquid fuels for transport vehicles, derived from biomass. Biofuels include the following products:

a) "Bioethanol": ethanol derived from biomass and/or biodegradable fractions of waste, which can be used as biofuel;

b) "Biodiesel": methyl esters derived from vegetable oils or animal fats, having the properties of petroleum-derived diesel, which can be used as biofuel;

c) "Biogas": gas derived from biomass and/or biodegradable fractions of waste, which can be refined to the quality of the natural gas and be used as biofuel ;

d) "Biomethanol": methyl alcohol derived from biomass, which can be used as biofuel;

e) "Biodimethylether": dimethylether derived from biomass, which can be used as biofuel;

f) "Bio-ethyl-tertiary-butyl-ether": ethyl-tertiary-butyl-ether derived from bioethanol with 47 percent volume content of of bio-ethyl-tertiary-butyl-ether, which can be used as biofuel;

g) "Bio-methyl-tert-butyl-ether": fuel derived from biomethanol with 36 percent volume content of bio-methyl-tertiary-butyl-ether, which can be used as biofuel;

h) "Synthetic biofuels": synthetic hydrocarbons or mixtures of such hydrocarbons derived from biomass;

i) "Biohydrogen": hydrogen derived from biomass and/or biodegradable fractions of waste, which can be used as biofuel;

j) "Pure vegetable oil": oil derived from oil-bearing plants through pressing, extraction or comparable proceses, crude or refined but chemically unmodified, can also be used as biofuel in specific cases where its use is compatible with the type of engines involved and relevant emissions requirements.

4. The forms of selling the biofuels listed in item 3 on the market are:

a) "pure" - pure biofuels or liquid fuels with high biofuel content and specific properties for use in the transport sector;

b) "blended" - biofuels blended into liquid fuels, which meet the quality standards for oil-derived fuels such as gasoline (BDS EN 228) and diesel fuels (BDS EN 590), containing the maximum possible percentage of biofuel;

c) "biofuel derivatives" - liquid fuels derived from biofuels, such as bio-ethyl-tert-butyl-ether with 47 percent content of biofuel.

5. "Biomass" is the biologically decomposing part of agricultural products, waste and residues, including vegetable and animal wastes, forestry residues, as well as biologically decomposing fractions of industrial and household waste, which can be used as fuel, as well as the following waste products:

a) vegetal waste from agriculture and forestry;

b) vegetal waste from the food processing industry, if the generated heat is utilized;

c) vegetal waste from the production of wood pulp and production of paper from the pulp, if they are incinerated at the production site and the generated heat is utilized;

d) cork waste

e) wood waste, except such containing hologenic organic compounds or heavy metals;

f) sediments from waste water treatment facilities;

g) animal substances.

6. "Other renewable fuels" include renewable fuels different from biofuels, generated from renewable energy sources and used in the transport sector.

7. "Energy content" is the minimum operative heat emitted during combustion of a fuel.

8. "Electric power generated from renewable energy sources" is the electricity generated by facilities using only renewable energy sources as well as the portion of electricity generated from renewable energy sources in hybrid systems using also conventional energy sources and including the renewable electricity for charging storage systems and cut-off electricity generated by storage systems.

9. "Green certificate" is a document with a limited term of validity certifying the production of a certain volume of electricity from renewable energy sources or by a combined generation method, indicating the date and place of generation, the generation facility and its owner; transferable separately from the physical electric or heat energy the generation of which it certifies.

10. "Combined combustion" is combustion of renewable and non-renewable energy sources in a single process where at least 20 percent of the fuels for heat/power generation come from renewable energy sources.

11. "Minimum connection scheme" is the most economically viable combination of electric facilities and power transmission lines for connecting an energy plant to the grid, defined in conformity with the applicable regulations governing the territorial infrastructure, management, safety and operations of the electric power grids, the technical specifications, facilities and technology used by the transmission, respectively, the distribution company in the construction and maintenance of the grid infrastructure.

12. "Point of connection to the electric power grid" is any point along the route of the transmission and/or distribution grids at which the connecting facilities of one or more producers and/or consumers of electricity are connected.

13. " Household user of electricity and/or heating power" is a physical person who owns or rents a property and uses electricity and/or heating power for its household.

14. "Electricity consumption (gross domestic electricity consumption)" is the sum of national electricity generation for domestic consumption and imported electricity, less exported electricity.

15. "Certificate of origin" is an official nontransferable document verifying the producer, the quantity of electricity and heating power generated from renewable energy sources, the power plant, its capacity and other data and indicators set forth in the ordinance stipulated by Article 19, para. 3.

16. "Heating and/or cooling power generated from renewable energy sources" is the energy generated through the use of solar, geothermal and biomass resources, alternative sources and waste heat from industrial and energy production processes.

§ 2. This Act implements the provisions of Directive 2001/77/EC of the European Parliament and the European Council aiming to promote production and use of energy generated from renewable energy sources on the domestic market and Directive 2003/30/EC of the European Parliament and the European Council aiming to promote the production and use of biofuels and other renewable fuels in the transport sector.

TRANSITIONAL AND FINAL PROVISIONS

§ 3. (1) The mandatory purchase of energy stipulated by Art. 15 shall be effected through sale and purchase contracts. The term of validity of these contracts shall be 12 years:

1. from enactment of the Act for Amendments and Supplements to the Energy Act (SG. 74/2006) - for all existing producers of energy generated from renewable energy sources except for hydroelectric power plants with installed capacity which exceeds 10 MW;

2. As from the start of generation of electric power, but no later than 31 December 2010 - for all new producers of energy generated from renewable energy sources except for hydroelectric power plants with installed capacity which exceeds 10 MW.

(2) Not later than 31 December 2011, the Minister of Economy and Energy shall prepare and submit for approval by the Council of Ministers a bill on the market mechanisms for encouraging production of electricity and heating power from renewable energy sources, which may not necessarily be applicable to producers of energy from renewable energy sources specified under para. 1.

§ 4. Until enactment of the licensing regime for end suppliers of electricity, the obligations of end suppliers arising out of or in connection with this Act shall be performed by the existing public utility companies.

§ 5. The Energy Act (promulgated, SG No. 107 / 2003; as amended and supplemented, No. 18 /2004, No. 18 and 95 / 2005 and No. 30, 65 and 74 / 2006) shall be amended as follows:

1. The words "and the use of renewable energy sources" in Art. 1 shall be deleted.

2. Art. 2, para. 1, item 5 shall be repealed.

3. Art. 4, para. 2, items 9 and 10 shall be repealed.

4. Art. 33 shall be amended as follows:

a) the words "from renewable energy sources under Art. 159, para. 2 and" in para. 1 shall be deleted;

b) para. 2 shall be repealed.

5. The words "Art. 159 and 162" in Art. 35, para. 2, item 3 shall be replaced with "Art. 162 and under Art. 15 of the Renewable and Alternative Energy Sources and Biofuels Act ".

6. The words in the title of Chapter Eleven "from renewable energy sources and" shall be deleted.

7. Chapter Eleven, Section I "Production of electricity from renewable energy sources" containing Art. 157 - 160 shall be revoked.

8. The words "7,000 to 20,000" in Art. 206, para. 1 shall be replaced with "20,000 to 1,000,000".

9. The words "7,000 to 20,000" in Art. 207, para. 1 shall be replaced with "20,000 to 1,000,000".

10. The words "5,000 to 15,000" in Art. 208, para. 1 shall be replaced with "10,000 to 100,000".

11. The words "7,000 to 20,000" in Art. 210, para. 1 shall be replaced with "20,000 to 1,000000".

12. The words "10,000 to 25,000" in Art. 211, para. 1 shall be replaced with "20,000 to 1,000,000".

13. Art. 212 shall be repealed.

14. The words "500 to 1,000" in Art. 216 shall be replaced with "1,000 to 5,000".

15. Art. 219, para. 1 shall be amended as follows:

a) the words "and 212" shall be obliterated;

b) the words "500 to 5,000" shall be replaced with "from 1,000 to 8,000".

16. The number "212" in Art. 225, para. 2 shall be obliterated.

17. Items 3, 6, 18 и 52 in § 1 of the Additional Provisions shall be repealed.

18. Para. 127 of the Transitional and Final Provisions of the Act for Amendments and Supplements to the Energy Act (SG No. 74 / 2006) shall be repealed.

§ 6. (1) By-laws for application of this Act shall be adopted within six months of its enforcement.

(2) By-laws for application of the Energy Act shall be amended in line with the provisions of this Act within the period specified under para. 1.

§ 7. The Council of Ministers shall adopt:

1. the indicative targets under Art. 4, para. 1, item 3 - within three months of the enforcement of this Act;

2. the programs under Art. 4, para. 2 and 3 - within six months of the enforcement of this Act.

§ 8. The provisions of Art. 24 shall enter into force on 1 January 2008.

This Act was passed by the 40th National Assembly on 7 June 2007 and the Great Seal of the National Assembly was attached to it.

No. 180/2005 Coll.

ACT

of 31 March 2005

on the promotion of electricity production from renewable energy sources and amending certain acts
(Act on Promotion of Use of Renewable Sources)

The Parliament has adopted this Act of the Czech Republic:

PART ONE
PROMOTION OF ELECTRICITY PRODUCTION FROM RENEWABLE ENERGY SOURCES

TITLE I
GENERAL PROVISIONS

Article 1
Object of regulation

(1) This Act regulates, in accordance with the legislation of the European Communities[1]), the method of promoting the production of electricity from renewable energy sources and from mining gas from closed mines, the performance of state administration, and the rights and obligations of natural and legal persons connected therewith.

(2) The purpose of this Act is, in the interest of protection of the climate and protection of the environment, to

(a) promote the use of renewable energy sources (hereinafter referred to as "renewable sources");

(b) ensure constant increase of the share of renewable sources in consumption of primary energy sources;

(c) contribute to economical use of natural resources and sustainable development of society;

(d) create conditions for fulfilment of the indicative target for the share of electricity from renewable sources in the gross consumption of electricity in the Czech Republic amounting to 8 % in 2010, and for further increase of this share after 2010.

Article 2
Definitions

(1) „Renewable sources" shall mean renewable non-fossil natural energy sources, i.e. wind energy, solar energy, geothermal energy, water energy, soil energy, energy of the air, biomass energy, landfill gas energy, energy of sewage treatment plant gas and energy of biogases.

(2) For the purposes of this Act:

(a) "biomass" shall mean the biodegradable fraction of products, waste and residues from operation of agriculture and forestry and related industries, agricultural products grown for energy-production purposes, as well as the biodegradable fraction of separated industrial and municipal waste;

(b) "electricity from renewable sources" shall mean electricity produced by plants using only renewable sources, as well as the proportion of electricity produced from renewable sources in plants using also non-renewable energy sources;

(c) "gross consumption of electricity" shall mean national electricity production, plus imports and minus exports of electricity;

(d) “green bonus” shall mean the financial amount increasing the market price of electricity that is paid by the operator of the regional grid system or the operator of the transmission system to the producer of electricity from renewable sources, taking account of reduced damage to the environment resulting from use of a renewable source compared to combustion of fossil fuels, of the type and size of the production plant and of the quality of electricity supplied;

(e) “operator of the regional grid system” shall mean the holder of a license for distribution of electricity, whose grid system is directly connected to the transmission system.

Article 3

Subject of promotion

(1) Promotion pursuant to this Act (hereinafter referred to as “promotion”) shall apply to production of electricity from renewable sources produced in plants in the Czech Republic using renewable sources, excluding wind power plants located over an area of 1 km^2 with a total installed capacity exceeding 20 MWe. In case of production of electricity from the biomass, promotion shall apply to the types and methods of use of the biomass laid down in an implementing regulation from the viewpoint of environmental protection.

(2) Promotion of electricity production from renewable sources is stipulated differently regarding the type of the renewable sources and the magnitude of the installed capacity of the production plant and, in case of electricity produced from biomass, also according to the parameters of the biomass laid down in an implementing regulation.

(3) When determining promotion pursuant to Article 2 above, the Energy Regulatory Office (Energetický regulační úřad; hereinafter referred to as the “Office”) shall provide economic advantage, for the purposes of exclusive combustion of solid biomass, for the use of waste biomass from production of timber and industrial processing of timber and, in case of combined combustion of solid biomass and a non-renewable energy source, for purpose-grown energy biomass.

(4) The promotion shall also apply to production of electricity from mining gas from closed mines. The provisions of Titles II and III shall apply to this promotion *mutatis mutandis*; the provisions of Article 4(13), (14) and (18) shall not apply.

Title II

PROMOTION OF ELECTRICITY PRODUCTION FROM RENEWABLE SOURCES

Article 4

Rights and obligations of the entities on the market in electricity from renewable sources

(1) The operator of the transmission system or the operators of the grid systems shall be obliged, within the area delimited in their license[2]), to preferentially connect to the transmission system or to the grid systems plants according to Article 3 (hereinafter referred to as the “plants”) for the purpose of transmitting or distributing electricity from renewable sources, provided that the producer of electricity from renewable sources (hereinafter referred to as the “producer”) so requests and that the producer meets the conditions for connection and electricity transport laid down in a special regulation[2]).

(2) The obligation to connect the plant of a producer of electricity from renewable sources shall arise to the operator of the grid system where the connection costs are the lowest, excluding cases of demonstrable lack of capacity of the distribution plant or in case of jeopardising reliable operation of the grid system.

(3) Producers of electricity from renewable sources eligible for promotion shall have the right to choose whether to offer their electricity for purchase pursuant to Article 4 of this Act or whether to request a green bonus for this electricity. This choice must not be changed before expiry of one year after the producer has made a binding choice from these two options and started using the option chosen. Change in the choice shall always be performed as of 1 January of the subsequent calendar

year. The dates and details of choosing the method of promotion shall be stipulated in an implementing regulation.

(4) Operators of the regional grid systems and the operator of the transmission system shall be obliged to purchase all electricity from renewable sources eligible for promotion and to conclude a supply contract, if a producer has offered electricity from renewable sources, under the terms and conditions stipulated in Article 5 and for the prices stipulated in Article 6. This obligation includes also assumption of responsibility for deviation pursuant to special regulation[3]).

(5) Operators of the regional grid systems and the operator of the transmission system shall use electricity purchased pursuant to paragraph (4) above to cover losses. If the momentary output of obligatorily purchased electricity from renewable sources pursuant to paragraph (4) hereof exceeds the volume of electricity for coverage of losses, this excess shall be evaluated as a deviation of the relevant operator of the regional grid system or the operator of the transmission system.

(6) In case of combined production of electricity from a renewable source and a non-renewable source, the promotion shall be provided only by means of green bonuses.

(7) If a producer of electricity from renewable sources eligible for promotion has failed to offer this electricity for mandatory purchase pursuant to paragraph (4) above and has sold it on the electricity market, the operator of the relevant regional grid system or the operator of the transmission system shall be obliged to pay to the producer for this electricity a green bonus expressed in CZK/MWh.

(8) Any deviations in the output of the plant caused by the natural character of the renewable sources shall not be grounds for non-fulfilment of the obligations under paragraph (4) above.

(9) Pursuant to special regulation[3]), operators of the grid systems and the operator of the transmission system shall bear the responsibility for a deviation connected with covering losses in their systems, which they can transfer to a different accounting entity.

(10) The costs connected with a deviation of the producer of electricity from renewable sources purchased pursuant to paragraph (4) above shall constitute deductible costs of the operators of the grid systems and the operator of the transmission system for the purposes of calculation of regulated prices for distribution and transmission, and the accounting entity shall have the right to charge these costs to the operators of the grid systems or to the operator of the transmission system. The details shall be stipulated in an implementing regulation.

(11) A producer producing electricity from renewable sources together with electricity from non-renewable energy sources shall be obliged to provide for separate metering or calculation of the amount of electricity produced from renewable sources in a way stipulated in special regulation[4]).

(12) A producer producing electricity by means of combined combustion of biomass and a non-renewable energy source shall report the amount of electricity from renewable sources, the actually acquired amount of biomass and its quality, and the actual use of all the acquired biomass for the purposes of production of electricity in a way laid down in an implementing regulation.

(13) On the basis of a written request from a producer producing electricity from renewable sources, the electricity market operator shall issue a certificate of origin of electricity from renewable sources (hereinafter referred to as the “guarantee of origin”). The electricity market operator shall issue a guarantee of origin within 30 calendar days after having received the request. The form for a request for issuing a guarantee of origin and the form for a guarantee of origin shall be stipulated in an implementing regulation.

(14) The Ministry of Industry and Trade shall perform recognition of guarantees of origin issued in another Member States of the European Communities.

(15) A producer producing electricity from renewable sources and exercising the right to payment of green bonus in accordance with paragraph (7) above shall be obliged to conclude a contract for supply of electricity with another participant in the electricity market in accordance with

special regulation[3]). This obligation shall not apply to a producer who consumes all energy produced by him from renewable sources.

(16) The right to payment of green bonus shall also apply to producers producing electricity from renewable sources for their own consumption. The duty to pay green bonus to such producer shall arise to the operator of the regional grid system within whose delimited area the electricity production plant of the producer is located.

(17) A producer who has offered electricity for mandatory purchase must conclude a contract with the operator of the relevant regional grid system or the transmission system.

(18) Import of electricity from renewable sources from other Member States of the European Communities may be included in the share of electricity from renewable sources in the gross consumption of electricity in the Czech Republic only if the exporting country has a similar provision permitting inclusion of imports. The Member States of the European Communities can include electricity from renewable sources in the indicative targets for the share of electricity from renewable sources in the gross consumption of electricity only once. The details of records of import and export of electricity from renewable sources in the Czech Republic shall be stipulated in an implementing regulation.

Article 5

Conditions for promotion, purchase and recording of electricity production from renewable sources

(1) The basic time period for the purchase of electricity from renewable sources shall be 1 hour. For plants that are not equipped with continual metering, the operator of the regional grid system or the operator of the transmission system and the producer may agree on a different time period.

(2) The basic time period for evaluation of and accounting for purchase of electricity from renewable sources shall be 1 month, unless the operator of the regional grid system or the operator of the transmission system and the producer agree otherwise.

(3) If the producer of electricity from renewable sources intends to offer this electricity for purchase pursuant to Article 4(4), he shall notify the relevant operator of the regional grid system or the operator of the transmission system of this fact. The deadlines for notification of this fact shall be stipulated in an implementing regulation.

(4) Upon submission of data on the amount of electricity produced from renewable sources according to paragraph (6) hereof to the operator of the regional grid system or to the operator of the transmission system, the producer shall acquire the right to payment of green bonus determined according to Article 6.

(5) A producer producing electricity from renewable sources for his own needs shall be obliged to submit the measured or calculated data on the amount of electricity produced by him from renewable sources to the operator of the regional grid system or to the operator of the transmission system. Upon fulfilment of this duty, the producer shall acquire the right to payment of green bonus and issuance of the guarantee of origin according to Article 4(13).

(6) The producer shall submit the measured or calculated data on production and sale of electricity from renewable sources according to the individual types of renewable sources to the relevant operator of the regional grid system or to the operator of the transmission system pursuant to special regulation[3])[4]).

Article 6

Amount of prices for electricity from renewable sources and green bonuses

(1) The Office shall always determine the purchase prices for electricity from renewable sources (hereinafter referred to as the “purchase prices”) for the subsequent calendar year in advance, separately for the individual types of renewable sources and green bonuses, so as to

a) create conditions for fulfilment of the indicative target for the share of electricity production from renewable sources in the gross consumption of electricity, which equals to 8 % in 2010, and so that,

b) for plants being put into operation

1. after the date of entry into force of this Act, fifteen-year period of recovery of investment is achieved with promotion by purchase prices, under the condition of compliance with the technical and economic parameters, including in particular the costs of an installed unit of capacity, efficiency of use of the primary energy contents in the renewable source and the period of use of the plant, which are stipulated in an implementing regulation;
2. after the date of entry into force of this Act, the level of revenues per unit of electricity from renewable sources is maintained, as a minimum, with promotion by purchase prices, for a period of 15 years from the year of putting the plant into operation, taking into account the price index of industrial products; completion of reconstruction of the technological part of an existing plant, a change of fuel or completion of modernisation, resulting in an increase in the technical and environmental level of the existing plant is also regarded as "putting a plant into operation";
3. prior the date of entry into force of this Act, the minimum level of purchase prices stipulated for 2005 pursuant to the hitherto regulations is maintained for a period of 15 years, taking into account the price index of industrial products.

(2) When determining the level of green bonuses, the Office shall also take account of the increased rate of risk of placing electricity from renewable sources on the electricity market.

(3) When determining the purchase prices and green bonuses, the Office shall base its decision on the different costs of acquisition, connection and operation of the individual types of plants, including their development in time.

(4) The purchase prices set by the Office for the subsequent calendar year may not be lower than 95 % of the value of the purchase prices valid in the year during which a decision is made on the their new values. This provision shall apply for the first time to the prices stipulated in 2007.

Article 7
Regular evaluation

(1) As of June 30 of each year, the Office shall always publish in the Energy Regulatory Bulletin (Energetický regulační věstník)[2]) evaluation of the share of electricity produced from renewable sources in the gross consumption of electricity for the previous calendar year and the calculation of the projected effects of promotion on the overall price of electricity for end consumers in the coming calendar year.

(2) In co-operation with the Ministry of the Environment and the Office, the Ministry of Industry and Trade shall submit to the Government annually by September 30, for the first time in 2005, a report including analysis of the progress achieved in fulfilment of Article 1(2)(d).

Title III
JOINT PROVISIONS

Article 8
Control

The State Energy Inspection (Státní energetická inspekce, hereinafter referred to as the "Inspection")[2]) shall perform control of compliance with this Act.

Article 9
Administrative torts

(1) A fine of up to CZK 5,000,000 shall be imposed on the operator of the regional grid system or the operator of the transmission system who fails to purchase electricity from renewable sources pursuant to Article 4(4) or fails to pay a green bonus pursuant to Article 4(7).

(2) A fine of up to CZK 5,000,000 shall be imposed on a producer who submits to the operator of the regional grid system or to the operator of the transmission system false measured or calculated data on the amount of electricity produced by him from renewable sources pursuant to Article 5(5) and (6).

(3) A fine of up to CZK 1,000,000 shall be imposed on a producer who fails to provide for separate metering of electricity from renewable sources pursuant to Article 4(11).

(4) A fine of up to CZK 1,000,000 shall be imposed on a producer who fails to report accurately the correct amount of electricity produced from renewable sources, the actual amount of acquired biomass and its quality, and the actual use of all the acquired biomass for the purposes of electricity production pursuant to Article 4(12).

(5) A fine of up to CZK 100,000 shall be imposed on a producer who fails to submit the measured or calculated data pursuant to Article 5(6).

(6) The Inspection may decide to suspend the right of a producer who repeatedly submits false measured or calculated data on the amount of electricity produced from renewable sources pursuant to Article 5(5) and (6) to the payment of the purchase prices or the green bonus for up to 2 years.

Article 10

(1) Fines shall be imposed, collected and exacted by the Inspection. The Code of Administrative Procedure (správní řád) shall apply to the proceedings on imposing a fine pursuant to this Article. The procedure of collecting and exacting the imposed fines shall be governed by a special regulation.

(2) The gravity of an administrative tort, and in particular the way in which it was committed, its consequences, and the circumstances under which it was committed, shall be taken into account in determining the amount of the fine.

(3) The liability of a legal person for an administrative tort shall expire if the territorial inspectorate fails to commence proceedings thereon within 1 year of the date when the inspectorate learnt of the tort and, at the latest, 3 years after the date when it was committed.

(4) The competent territorial inspectorate shall hear administrative torts pursuant to this Act in the first instance. The central inspectorate shall decide on an appeal against imposition of a fine.

(5) The provisions of Article 9 shall apply to the liability for any conduct occurred within business activities of a natural person or in direct relation thereto.

(6) Fines shall be an income of the state budget.

Article 11
Transitional provision

The right to choose green bonus pursuant to Article 4(3) and Article 4 (7) can be exercised from 1 January 2006.

Article 12
Authorisation to issue implementing regulations

(1) The Ministry of the Environment shall issue an implementing regulation to implement Articles 3(1) and 3(2).

(2) The Ministry of Industry and Trade shall issue an implementing regulation to implement Articles 4 (13) and 4 (18).

(3) The Office shall issue an implementing regulation to implement Articles 4(3), 4(10), 4(12), 5(3), and 6(1)(b)(1).

PART TWO
AMENDMENT TO THE ACT ON ENERGY MANAGEMENT

Article 13

The Act No. 406/2000 Coll. on energy management, as amended by the Act No. 359/2003 Coll. and the Act No. 694/2004 Coll., shall be amended as follows:

1. In Article 2, point (b) shall be repealed.
Former points (c) to (f) shall be designated as points (b) to (e).

2. In Article 4(5)(c), a reference to footnote No. 1 shall be inserted after the word “energy” and footnote No. 1 shall read as follows:

„[1)] Act No. 180/2005 Coll., on the promotion of electricity production from renewable energy sources and amending certain acts (Act on Promotion of Use of Renewable Sources)”

Former footnote No. 1 shall be designated as footnote No. 1a, including the reference to the footnote.

PART THREE
AMENDMENT TO THE ACT ON PROTECTION OF THE AIR

Article 14

The Act No. 86/2002 Coll., on protection of the air and amending certain acts, as amended by the Act No. 521/2002 Coll., Act No. 92/2004 Coll., Act No. 186/2004 Coll., and Act No. 695/2004 Coll., shall be amended as follows:

1. In Article 2(1), the full stop after point (u) shall be replaced by a comma and points (v), (w) and (x) shall be added, which shall read, including footnotes Nos. 3c and 3d, as follows:

“(v) “set volume of biofuels” shall mean the minimum quantity of biofuels or other fuels from renewable sources according to their type, for which financial support for biofuels is provided for the relevant period to authorised producers of biofuels;

(w) “authorised producer of biofuels” shall mean a person who produces biofuels under the conditions stipulated in a special regulation[3c)]) and to whom a share in the set amount for the relevant period has been granted in a binding manner according to the principles approved by the Government;

(x) relevant period shall mean the period for which financial support for biofuels is provided[3d)]).

[3c)] The Act No. 61/1997 Coll., on spirits and amending and supplementing the Act No. 455/1991 Coll., on business in trade (the Trade Act), as amended, and the Act of the Czech National Council No. 587/1992 Coll., on excise duties, as amended - (the Act on Spirits), as amended.

[3d)] 3d) Article 16(5) of the Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity.”.

2. Article 3(10) shall read as follows:

“(10) A person introducing petrol and diesel fuels to free tax circulation within the tax territory of the Czech Republic shall be obliged to ensure that the assortment of fuels introduced by him contains the set volume of biofuels, according to the type, stipulated in an implementing regulation. This implementing regulation shall also stipulate the period, to which the set volume applies.”.

3. In Article 3, new paragraphs (11) to (13) shall be inserted following paragraph (10) and shall read, including footnotes Nos. 7a and 7b, as follows:

“(11) A person pursuant to paragraph (10) above shall be obliged, annually by January 31, to inform the General Directorate for Customs (Generální ředitelství cel) of the total amount of fuels for transport purposes introduced by the given person during the previous calendar year to free tax circulation within the tax territory of the Czech Republic and of the share of biofuels in this amount.

(12) A person pursuant to paragraph (10) above shall be obliged to purchase, within the set amount, from the authorised producers of biofuels, biofuels produced by these producers in an amount corresponding to its share in the market in these fuels for transport purposes in the territory of the Czech Republic, calculated according to their energy content, for the minimum purchase prices stipulated pursuant to special regulation[7a]) (hereinafter referred to as the "minimum purchase prices"), except for bioethanol for transport purposes (hereinafter referred to as "bioethanol"), directly, and bioethanol from the Administration of State Material Reserves (Správa státních hmotných rezerv)[7b]). The Administration of State Material Reserves shall purchase bioethanol in the set volume from authorised producers, according to their share in the set volume, for the minimum purchase prices stipulated pursuant to special regulation[7a]).

(13) If a person pursuant to paragraph (10) above fails to purchase the amount of bioethanol pursuant to paragraph (12) above from the Administration of State Material Reserves, it shall be obliged to pay to the Administration of State Material Reserves the price for which the Administration of State Material Reserves purchased the non-purchased amount, the costs related to the purchase and a penalty in an amount equal to the price pursuant to Article 45a for the non-purchased amount. The price level shall be stipulated as the average price in the calendar year, during which the obligation was violated.

[7a]) Act No. 526/1990 Coll., on prices, as amended.

[7b]) Article 3 of the Act No. 97/1993 Coll., on the competence of the Administration of State Material Reserves, as amended.".

Former paragraph (11) shall be designated as paragraph (14).

4. In Article 37, paragraphs (3) and (4) shall be added, which shall read as follows:

"(3) In co-operation with the General Directorate for Customs (Generální ředitelství cel), the Ministry of Industry and Trade, the Ministry and the Office, the Ministry of Agriculture shall annually, by 1 July, submit to the European Commission and to the Government information on

a) the measures adopted to promote the use of biofuels or other fuels from renewable sources for transport purposes instead of diesel fuel or petrol;

b) the national resources intended for production of biomass for other use than in transport; and

c) the overall sales of fuels and the share of biofuels, both pure and mixed, and other fuels from renewable sources in the market during the previous year, possibly information on all exceptional situations in supplies of crude oil or oil products that affected the sales of biofuels and other fuels from renewable sources.

(4) The Ministry of Agriculture shall specify, in co-operation with the Ministry of Industry and Trade and the Ministry, in the first information for 2005, the national indicative target as of 31 December 2005 set by the Government, and in the information for 2006, the national indicative target as of 31 December 2010 set by the Government. Within this information, the Ministry of Agriculture shall justify, in co-operation with the Ministry of Industry and Trade and the Ministry, the difference between the set national target and the actual state. The national indicative targets shall be stipulated in an implementing regulation.".

5. In Article 40, new paragraphs (13) to (15) shall be inserted following paragraph (12) and shall read as follows:

"(13) The Czech Trade Inspection (Česká obchodní inspekce) shall impose a fine of up to CZK 100,000 on a person pursuant to Article 3(10) who fails to fulfil the information duty pursuant to Article 3(11).

(14) The Czech Trade Inspection shall impose a fine of up to CZK 5,000,000 for the non-purchased amount of biofuels on a person pursuant to Article 3(10) who fails to purchase the amount of biofuels within the scope of his share in the market in fuels.

(15) The Czech Trade Inspection shall impose a fine of up to CZK 5,000,000 on a person pursuant to Article 3(10) who fails to ensure that the assortment of fuels introduced by the given person on the market contains the minimum amount of biofuels.”.

Former paragraphs (13) to (17) shall be designated as paragraphs (16) to (20).

6. New Article 45a shall be inserted after Article 45 and shall read, including footnote No. 21b, as follows:

“Article 45a

The prices pursuant to Article 3(12) shall be stipulated separately for the individual types for the maximum of 6 calendar months in advance in such amount, so that economic recovery of the usual costs for construction of plants for production of biofuels and plants for processing of biofuels into fuels and appropriate profit were guaranteed to the production plants put into operation after the date of entry into force of the Act on Promotion of Use of Renewable Sources[21b]), and so as to create conditions for fulfilment of the indicative targets; completion of reconstruction of the technological part of an existing plant, a change of fuel or completion of modernisation, resulting in an increase in the technical and environmental level of the existing plant shall also be regarded as “putting into operation”. The technical and economic parameters of the plant, according to which the prices are set, shall be stipulated in an implementing regulation.

[21b]) Article 2(2) of the Decree No. 580/1990 Coll., implementing the Act on Prices, as amended.”.

7. In Article 55(1), the words “Article 3(10),“ shall be inserted after the words “implementation”, the words “and Article 7(11)” shall be replaced by the words “, Articles 7(11), 37(4) and 45a” and, in paragraph (3), the words “Article 3(11)” shall be replaced by the words “Article 3(14)”.

PART FOUR
LEGAL FORCE

Article 15

This Act shall enter into force on the first day of the third calendar month following the date of its publication.

Zaorálek o. h.
Paroubek o. h.

[1)] Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market

[2)] The Act No. 458/2000 Coll. on the conditions for operating business and on performance of state administration in the energy sectors and amending certain acts (the Energy Act), as amended

[3)] The Decree No. 373/2001 Coll. stipulating the rules for organisation of the electricity market and the principles of determining the prices for activities of the market operator, as amended

[4)] The Decree No. 218/2001 Coll. stipulating the details of measurement of electricity and submission of technical data, as amended

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