Renewable Energy Country Profile
Version 0.6b

These profiles are a work in progress. They are presented to the international community for review and comment. The profiles are undergoing continual updating for technical content, formatting, grammar, and other issues. Each country profile will be modified on a continuous basis as new information is made available.

If you have any questions or comments please contact:

Ryan Pletka
Black & Veatch
Study Manager
pletkarj@bv.com
(913) 458-8222

Prepared by:

ARGES ENERJI SISTEMLERI SAN. VE TIC. A.S., Primary Country Consultant

Interwind, Wind Energy Issues
Black & Veatch, Project Coordinator

8.0 Czech Republic

8.1 Overview of Electricity Supply

The Czech Republic has followed an aggressive development plan since their independence from the Former Soviet Union in 1991. In December 1995, the Czech Republic was the fist post-communist country to become a member of the Organization for Economic Cooperation and Development (OECD). Additionally, in February of 1995, an Association Agreement with the European Union (EU) was achieved with full membership in 2003-05. The Czech Republic also maintains membership in the following international organizations: Central European Free Trade Agreement (CEFTA); NATO; The World Trade Organization (WTO); the International Monetary Fund (IMF); the World Bank (WB); and the European Bank for Reconstruction and Development (EBRD).

The GDP for 2000 is estimated at $132.4 billion (Purchasing Power Parity) which makes it one of the larger economies out of the Former Soviet Union.

Electricity is primarily generated with the lignite reserves of the Czech republic with the balance in nuclear and hydroelectric systems.

Table 8-1
Installed Generation Capacity

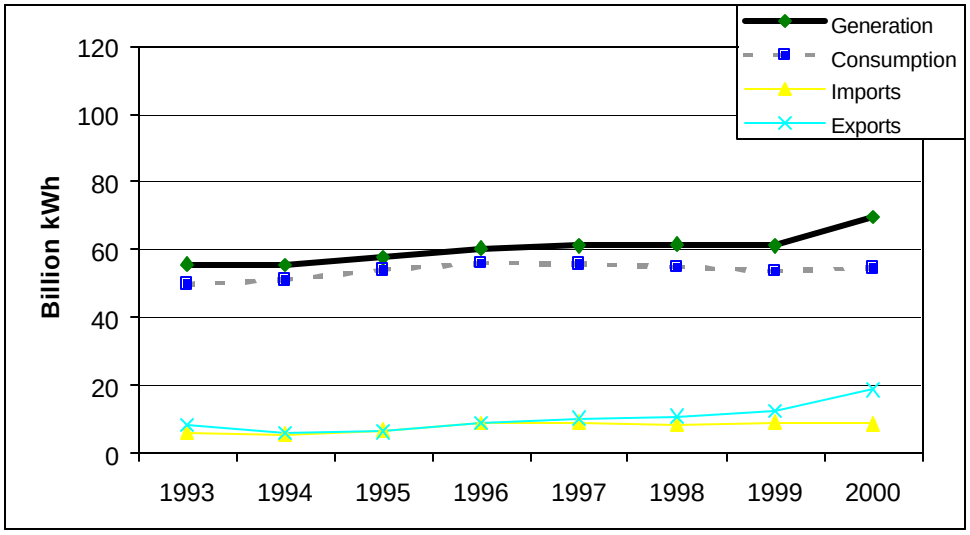
Fuel	Number of Units	Capacity (MWe)	Percent of Capacity
Nuclear	2	3,760	32.31%
Coal	17	6,307	54.12%
Natural Gas	--	--	--
Hydro	12	727	6.24%
Pumped Storage Hydro	3	852.5	7.32%
Other Renewables*	3	1.5	0.01%
Total	37	11,648	

*Includes 2 small wind projects and 1 solar project.

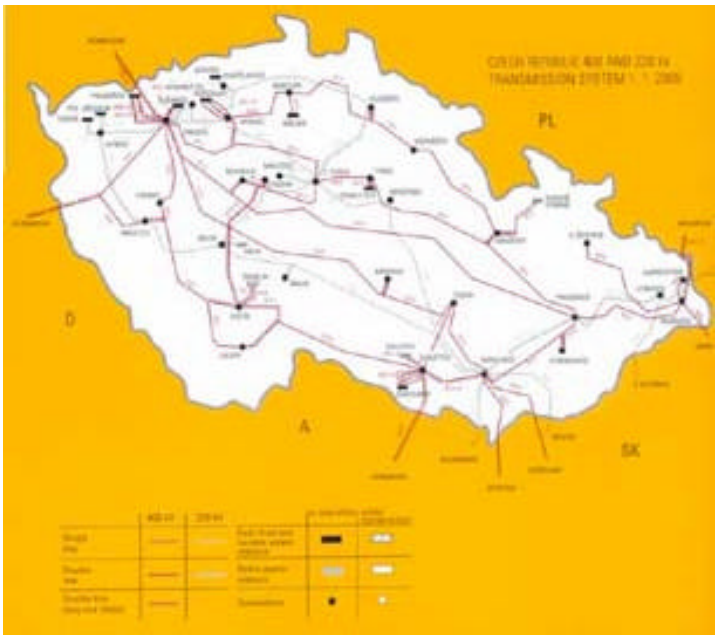
Throughout the 1990's efforts at improvement in the power sector were aimed at reducing emissions, specifically sulfur, from coal fired power plants. This has been accomplished by decommissioning obsolete plants, while adding desulfurization equipment to other existing plants. The loss in generation from decommissioning these plants has been made up for with new nuclear and hydroelectric generation coming online.

As evidenced by the historic chart of supply and demand, Figure 8-1, the decommissioning of obsolete plants has not hurt the Czech Republic's ability to continue to meet demand. Additionally, through the Czech Republic's grid structure, Figure 8-2, a

consistent electricity trade was maintained throughout the 1990's with imports approximately equaling exports until 2000 when new generation came online.



The electricity grid in the Czech Republic is one of the most developed in eastern Europe. The grid is significantly developed within the country and is highly connected with the surrounding countries, Figure 8-2.



The electricity sector in the Czech Republic has been under constant change throughout the 1990's. All major energy enterprises have been converted to joint stock companies, however, many are still state owned and are likely to maintain that status in the long term. The privatization of Ceske Energeticke Zavody (CEZ), the state owned electricity monopoly, is the focus of current negotiations. The government plans to privatize CEZ by selling the company, including generation and transmission facilities to one buyer.

Additionally, on January 1, 2001 a new energy regulatory authority began operating with the mission of determining customer rates in the sort term and opening up the grid to party access in the long term. To this end a schedule has been set to achieve third part access by 2006.

- By 2002, customers with electricity usage of greater than 40 GWh will be able to choose their supplier and negotiate electricity rates.
- By 2003 the minimum level of usage to gain competitive pricing is lowered to 31GWh.
- By 2006, All customers will be able to choose their electricity supplier.

1.1.1 Wind Resources

Current Status of Wind Energy [1), 2)]

During the first half of the last decade more than 8 MW of wind power, consisting of 23 turbines ranging from 75 - 500 kW were installed. Of these 9 were built by 3 different local manufacturers. Currently there are 5 - 7 MW of operational wind energy for electricity production in the Czech Republic. There were no new turbines installed since 1995.

A country wide wind-atlas is available, but it was not possible to secure a copy until now. However, a map showing

Wind energy has long tradition in the Czech Republic. Oldest records from 13th century mention a wind mill in the area of today's city of Prague. In the 18th and 19th century there were 900 wind mills in the area of Czech Republic, a clear sociological indicator of wind energy resources of the country.

The industry association of the country is the Czech Wind Power Society. Development engineers of the now bankrupt Vitkovice company, which built 75 and 315 kW units have established two new companies Ekov and Energovars. Ekov builds a true Czech turbine with 400 kW installed capacity. Energovars uses foreign components for their 315 and 630 kW units. A third company, Windtower, is planning to develop a 7 kW unit, a fourth, Chlupa, two units of 22 kW and 40 kW.

Two specific projects one for 100 MW and another dating back to 2000 with a total of 44 turbines of 600 kW unit capacity. This 26.4 MW project was awaiting approval of the Czech banks. Nothing was heard of it since then.

The main barrier seems to be the extremely low feed-in tariff. In 2000 the utility would pay 1.13 Zlotys / kWh, which is approximately 2.75 € Cents (2000), where as the average electricity price was 2.40 Zlotys or 5.9 € Cents/kWh. The government has introduced a tariff of 9.5 € Cents / kWh in November 2001, but the wind plant operators were given 3 days to lodge applications. It is may be because of this that the effect of this new tariff was not visible by September 2002. There is a grid obligation for renewables, but there are no consequences for non-compliance.

Czech Republic has a good technical potential for wind energy development and local manufacturing.

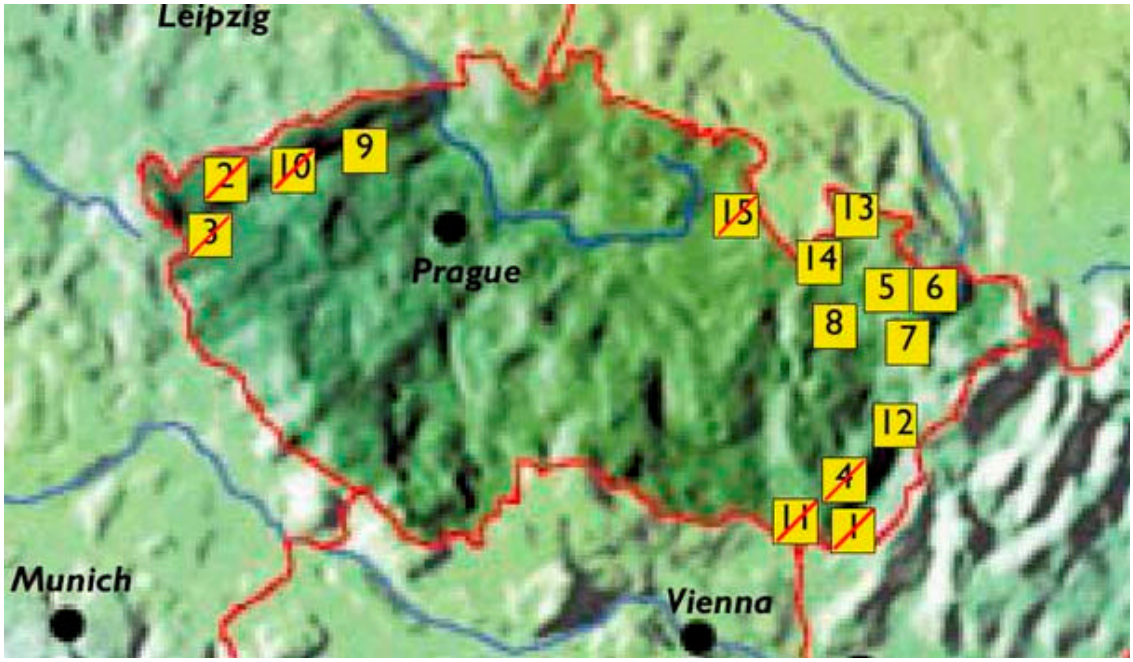
Wind Energy Resource Potential [1) 2) 3)]

The Czech Wind Power Society had estimated the resource potential of the country at 600 MW in 2000. Current estimates are in the order of 2'200 MW.

Although the wind atlas of the country was not available for this report, several areas with wind speeds of 9 m/s at 50 m above ground level were identified. It is recommended to do a country wide assessment, with state of the art wind measurements, at least at 50 m above ground. Based on available information today, we would rate the technical wind energy resource potential of Czech Republic as very good.

Identification of Areas/Projects with High Potential for Wind Energy

Judging by the past and currently operational projects the most promising sites seem to be the western and the eastern parts of the country.



Map of Czech Republic, showing the projects installed during 1990 - 1995. Projects dissembled, respectively no more operational are marked with a diagonal red line.

Table 1-2 Czech Republic Areas/Projects with High Potential for Wind Energy

No	Location	Turbine kW	Number	Mfg / Model	Start-Up	Status
1	Kuzelov, Hruba	150	1	DWT 150	1990	Ceased operation
2	Bozi Dar	75	1	VE 75 (*)	1992	Ceased operation
3	Hory u K. Varo	75	1	VE 75 (*)	1992	Ceased operation
4	Strabenice	315	1	VE 315 (*)	1993	Ceased operation
5	Mravenecnik 1	200	1	Wind World	1993	Operated by CEZ s.a.
6	Mravenecnik 2	315	1	EWT 315 (*)	1995	Operated by CEZ s.a.
7	Mravenecnik 3	630	1	EWT 630 (*)	1995	Operated by CEZ s.a.
8	Mladonov	315	1	VE 315 (*)	1993	Private
9	Dlouha Louka	315	1	EWT 315 (*)	1993	Research Plant
10	Nova Ves v Horach	320	1	West Medit	1994	Ceased operation
11	Borsice u Buchlovic	400	1	Ekov E-400 (*)	1994	Dissembled
12	Hostyn	225	1	Vestas V-27	1994	In Operation
13	Velka Kras	225	1	Vestas V-29	1994	In Operation
14	Ostruzna	500	6	Vestas V-39	1994	Partial Operation (?)
15	Novy Hradek	400	4	Ekov E-400 (*)	1995	In Operation
	Total	**8'160**	**23**	(*) Local Manufacture		
	Operational	**6'825**	**17**			

Barriers/Incentives for Wind Energy

Specific incentives for the implementation of wind projects in Czech Republic include:

- A grant for ECU 130,000 under the European Commission's Joint Opportunities (JOP) program has been granted to British company Borderwind for a feasibility study for establishing a wind energy development company in the Czech Republic with a local partner.
- The most promising development has been the legal grid obligation for renewables in the Czech Republic. Grid operators pay a price for the clean power that is usually linked to the power prices asked of household customers.
- In the Czech Republic, the typical rate paid for renewable energy is about CZK 1.20/kWh (EUR 0.033/kWh) -- somewhat less than the household power price of CZK 2.0/kWh. [1)]
- A policy paper from the Czech ministry of energy sets a target for renewables to cover 6% of the Czech electricity supply by 2010. Already, the industry ministry makes CZK 300 million available for renewable energy and energy saving projects.
- The government introduced a feed-in tariff of EUR 0.095/kWh in November 2001.
- The Czech Republic has placed a major emphasis on reducing harmful emissions from coal-fired power generation, and has established emission limits

Specific barriers to the implementation of wind projects in Czech Republic include:

- Extremely low feed-in tariff
- Poor reputation of wind energy caused by premature sales of prototypes to clients by the local manufacturer Vitkovice
- The present structure of the power production system in the Czech Republic is a result of the abundant and cheap supply of coal and especially of lignite. The lignite is burned mostly in power stations.

Table 1-3. Czech Republic Wind Energy Profile.

Current status of wind energy	
Installed capacity	5 MW (Operational)
Projects under construction	None
Supporting regulations?	None
Industry association?	Yes. The Czech Wind Energy Society.
Wind energy resource potential	
Level of information available	Good
Highest wind class	Class 6-7 (790 W/m^2 for 800m altitude, air density ~ 1.14 kg/m^3)
Country-level wind atlas available?	Yes
Estimated potential	104 TWh/year, gross (theoretical) potential 35 TWh/year, t echnical potential 2'200 MW, 6.2 TWh/year, economic potential
Target established?	Yes, 6% from renewables by 2010.
High wind speed locations	• Krusn Hory Mountains • Milesovka

	• Svratouch Locality
Identification of areas/projects with high potential for wind energy	
Recommended strategic assessments	Study 1 : an appraisal of legal and economical frame work Study 2 : Existing wind data should be supplemented with new measurements especially at sites that based on current knowledge may be suitable for establis hing wind parks. Study 3 : The specifications of the wind turbines manufactured in the Czech and Slovak Republics should be verified according to, e.g. by the Danish Test Station for Wind Turbines.
Identified areas/projects	• 26.4 MW Total (at Moldava and Novo Mewsto) Heliotec GmbH / Enwertec GmbH • 100 MW, Krusn Hory Mountains, Near German border • ? MW, Milesovka, Wind Speed is above 9 m/s at a height of 50m above the ground. 833mt a.s.l, located north of the country. • ? MW, Svratouch Locality, Wind Speed is between 8 and 9 m/s at a height of 50m above the ground. 737mt a.s.l, located center of the country. • ? MW, Luka, Wind Speed is between 8 and 9 m/s at a height of 50m above the ground. 510mt a.s.l, located south of the country. • ? MW, Praha, Wind Speed is between 8 and 9 m/s at a height of 50m above the ground. 376mt a.s.l, Located center of the country. • ? MW, Primda, Wind Speed is between 8 and 9 m/s at a height of 50m above the ground. 754mt a.s.l, located west Part of the country
Incentive s/barriers for wind energy	
Significant incentives	• New feed-in tariff of 9.5 € Cents / kWh • Legal grid access obligation for renewables • Announced target for renewables
Significant barriers	• Poor reputation of wind energy due to premature sales • Coal and nuclear lobby
Overall Prospects	**Good** Czech Republic has a long tradition in wind energy utilization, as evident from local manufacturing, and a large potential for wind energy development and the highest feed-in tariff in this study. With sufficient support this country could become one of the leaders in Central Europe.

[1] Wind Power Monthly, various issues
[2] Stillstand seit 1995, Windkraft-Nutzung in Teschechien braucht dringend neue Impulse, Kurin, Petr; Neue Energie, 8/2000
[3] Wind Power Potential in the Czech Republic, J. F. Rimal, Czech Technical University of Prague, Czech Republic. 14 October 1994

1.1.1 Solar Resources

1.1.1.1 Current Status of Solar Energy

At present in the Czech Republic a maximum area of 100,000 m^2 of solar collectors is in operation. For the total operated area of solar collectors of 100,000 m^2 and the average annual yield of 400 kWh from 1 m^2, an estimated annual production is 40,000 MWh (0.144 PJ) of thermal energy.

Solar energy cannot be assumed to be the only source for heating of houses and buildings in the Czech Republic due to the lack of solar energy in the periods with the highest requirements for heat output, i.e. roughly from November to February. The annual solar radiation on a horizontal surface in the Czech Republic varies between 1,050 and 1,259 kWh/m^2; the average solar radiation is about 1,150 kWh/m^2 per annum. 75% of this amount fall in the 6 summer months (from April to September). Given a surface inclination of 40°, which is the average inclination of a pitched roof, and a south or south-west facing orientation, the annual solar radiation amounts to 1,265 kWh/m^2/year. An angle of collector inclination of 30°-45° is ideal for solar applications with year-round usage.

The present utilization of solar photovoltaic systems in the Czech republic is very limited. The photovoltaic solar systems are used as decentralized sources of electric energy. The only exception is grid connected testing photovoltaic power plant of CEZ a.s. at Mravenecník with a power output of 5 kW.

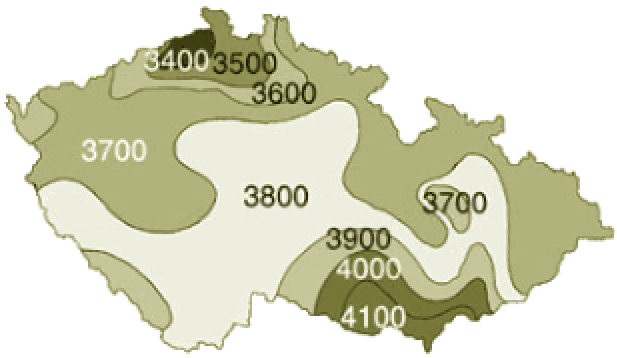


Figure..: The annual quantity of solar energy striking the Czech Republic.

Important data for Czech Republic	
Total time of sunshine in the Czech Republic (without cloudiness)	1,400 - 1,700 hrs/year
Total energy impinged on horizontal surface	950 - 1150 kWh/m2 /year
Profit from this energy in passive systems	20 - 50 % during heating season
Profit from this energy in active CH systems	30 - 40 % during heating

	season
Profit from this energy in active DHW systems	50 - 80 %/year
Profit from this energy in active systems, summer swimming pool	70 - 90 %/season
Profit from this energy in flat collector for DHW service	450 - 550 kWh/ m2/year
Optimum orientation of collectors	S - SW
Satisfactory orientation of collectors	SE - S
Less efficient orientation of collectors	E -SE, SW - W
Maximum collector output	Round 2.00 p.m.
Optimum inclination for summer operation	Approx. 30o from horizontal plane
Optimum inclination for round-the-year operation	Approx. 45o
Optimum inclination for winter operation	Approx. 60o or vertical plane
Maximum radiation impinging onto perpendicular surface in summer	Slightly over 1000 W/ m2
Maximum solar energy impinging in summer	8 kWh/ m2 /day
Efficiency of solar collectors (according to their location and exploitation)	50 - 80 %
Maximum critical temperature of unglazed absorber without energy demand	80 °C
Maximum critical temperature of glazed absorber without selective coating	120 °C
Maximum critical temperature of glazed absorber with selective coating	180 °C
Maximum critical temperature of glazed absorber with selective coating in vacuum	220 °C
Optimum glazing - flat hardened glass with minimum content of iron	Thickness 4 mm
Optimum temperature at outlet of flat collector for DHW	60 - 80 °C
Optimum temperature at outlet of flat collector for CH in winter	30 - 40 °C
Optimum temperature for swimming pool water heating, all the year round	About 30 °C
Pressure in primary circuit dependent on type of collector	0.1 - 0.6 Mpa
Antifreeze for winter temperature	Max. -30 °C
Service life of antifreeze as specified by manufacturers	4 - 6 years
Solar heater of hot service water for family of four	300 l
Solar heater of hot service water for family of six	500 l
Service life of plastic absorbers according to their type and application	5 - 10 years
Service life of metal collectors according to their type and application	20 - 30 years

Table… : Scientific data on the solar energy availability in Czech republic

1.1.1.2 Solar Energy Resource Potential

Solar photovoltaic systems use in near future is limited for demonstration applications and for off-grid applications like in holiday homes, caravans, telecommunication equipment,

traffic signs etc. and their potential and possible contribution compared with other renewable energy sources is assumed to be negligible.

The theoretical potential of the solar energy use is considerably high-given the usage of currently available solar heating systems with fluid collectors, more than 35,500 TWh (127,700 PJ) of thermal energy per annum can be received on the Czech Republic's overall area (78,802 km^2). The estimated available potential of solar energy includes active solar systems for domestic hot water heating and solar systems assisting to heating systems in family houses as well as in apartment blocks, solar systems for heating of swimming pools, solar-assisted district heating units and hot air solar systems. The available potential of solar energy amounts about 8-10 million m^2 of collector area with a yearly production of 11,500-14,400 TJ of thermal energy.

1.1.1.3 Identification of Areas/Projects with High Potential for Solar Energy

There are **poor** opportunities for solar development in the Czech Republic.

1.1.1.4 Barriers/Incentives for Solar Energy

Specific incentives for the implementation of solar projects in the Czech Republic include:

- In the framework of the State Program of Support for Savings and Use of Renewable Sources, greater use of renewable and secondary energy sources and potential savings are supported

Specific barriers to the implementation of solar projects in the Czech Republic include:

- At present conditions, level of technology development and unit prices, photovoltaic systems could not be compared with grid connected sources of electricity. The estimated costs of *solar photovoltaics* remain too high in the time horizon of year 2010. The use of photovoltaics in near future is limited for demonstration applications and for off-grid applications as is use in holiday homes, caravans, telecommunication equipment, traffic signs etc and their potential and possible contribution compared with other renewable energy sources is assumed to be negligible.
- Lack of solar energy in the periods with the highest requirements for heat output
- There is a general observation in the state that some of the solar active systems have already been implemented though most of the installations have been unprofitable.

Table -1. Czech Republic Solar Energy Profile.

Current status of solar energy	
Installed capacity	120 MW Total
Projects under construction	

Supporting regulations?	Yes. No specific regulation exists except that of the one on renewables.
Industry association?	No.
Solar energy resource potential	
Level of information available	Fair
High range of solar insolation	450-550 kWh/m2/day
Country-level solar atlas available?	Yes.
Target established?	Yes. For the year 2010 targets have been set by the State. For active solar systems the current utilization of energy will be increased from the current 0.14 PJ/yr to 0.50 PJ/yr. This will cause the share within the energy market an increase of 3.6 times. For photovoltaics there is no expected accomplishment.
High solar insolation locations	See Figure 1.
Identification of areas/projects with high potential for solar energy	
Recommended strategic assessments	Technical and economical feasibility of introducing highly advanced solar energy technologies where periods with lack of solar energy is not very significant.
Identified areas/projects	NA
Incentives/barriers for solar energy	
Significant incentives	State Program of Support for Savings and Use of Renewable Sources
Significant barriers	Expensive than fossil fuel energy. Insufficient amount of solar energy during winter months.
Overall Prospects	Poor. Solar energy does not seem to be on the leading renewable energy source for the State unless feasible technology is introduced. Likelihood of using solar energy for small scale heating systems is very high for the total of the country.

1.1.2 Geothermal Resources

1.1.2.1 Current Status of Geothermal Energy

The specification of installed thermal output only to thermal water - water heat pumps, which uses low-potential geothermal heat and the heat of the environment, their total number was about 240 at the beginning of 1998, with the total thermal output of about 3,000 kW. Their total energy yield, when considering the average annual use of 3,000 hours/year, is 9.3 GWh, or 33.5 TJ per year.

Geothermal heat is used for domestic and swimming- pool heating, and for some small industries. The most famous spa use is at Karlovy Vary (Karlsbad) and Marianske Lazne (Marienbad), along with five others (28-72°C water) in the western part of the country, with an estimated 4.5 MWt capacity and 90 TJ/year of utilization. About 390 geothermal heat

pumps have been installed, with a total capacity of 7.95 MWt and an estimated 38.2 TJ/year (350 vertical and 10 horizontal ground-coupled, and 30 water source installations).

The small-scale private installations are typically used for heating family houses (output less than 20 kW), hotels, accommodation facilities, swimming pools and small businesses (20-100 kW) as well as three water-treatment plants that use heat pumps with an output of more than 100 kW each.

A heat pump with 1 MW output has been installed at the Prokop Mine in the Pribram ore-mining district, where the water is then used to heat the mine facilities as well as the adjacent administrative buildings.

1.1.2.2 Geothermal Energy Resource Potential

The assessment of low temperature heat potential exploitable in heat pumps has been focused on low temperature geothermal heat only. The estimate of the total potential based on the assessment of areas defined by heat flow isolines is summarised in the table below.

Table: Estimate of geothermal potential in the Czech Republic

Area [km^2]	Heat flow [mWm^{-2}]	Total potential [MW]
2,400	> 80	204
9,500	70-80	713
25,400	60-70	1,651
15,000	50-60	825
27,230	40-50	1,248
Total		4,641

The total (theoretical) geothermal potential assessed for the entire territory of the Czech Republic on the basis of the heat flows is 4,641MW. The exploitable potential in the depths up to 100-120m below ground level ranges from 2,500 to 3,000 MW, resulting to an installed heat capacity of about 3,750-4,500 MW. The net contribution of heat pumps could range between 27 to 32,4 PJ.

The estimate of the available potential is based on an estimation of the possible development, according to which the current, rather progressive trend will continue and is about 26,000 installations of heat pumps (an average unit output of about 13 kW) utilizing low temperature geothermal heat with a total output of about 338 MW can be expected to take place by the year 2010.

Future project possibilities include a 15 MW heat pump in the town of Breclav for district heating, direct use in a soap factory and swimming pool in Trekov, two projects in Musov and Pisek for thermal spas, swimming-pool and greenhouse heating, and a power plant in the region close to the Czech-German border

Identification of Areas/Projects with High Potential for Geothermal Energy

There are **fair** opportunities for geothermal development in Czech Republic. The data of actual locations where geothermal energy is used could not be obtained at this time. Nevertheless, according to contacted organizations/agencies this type of a general data does not exist.

1.1.2.3 Barriers/Incentives for Geothermal Energy

Specific incentives for the implementation of geothermal projects in Czech Republic include:

- The 1998 National Support Program for Energy Savings and the Utilization of Renewable Energy Sources being implemented since1999, geothermal energy biomass is supported significantly among the renewable energy resources the utilization.
- Renewables in general are subject to several tax relieves. Legal persons operating these schemes do not pay income tax for 5 years of operation, or do not pay real estate tax. Biofuels and biogas as well as the selected renewable energy technology components are subject to a lower VAT rate (5%).

Specific barriers to the implementation of geothermal projects in Czech Republic include:

- Specific barriers to the penetration of geothermal energy in the Czech Republic are mainly economical, technical and legislative issues. In addition, lack of access to data and specific information is another hindering effect.

Table - 2. Czech Republic Geothermal Energy Profile.

Current status of geothermal energy	
Installed capacity (electric)	3 MWe Total (electric and thermal)
Installed capacity (thermal)	NA
Projects under construction (electric)	NA
Supporting regulations?	Yes. Supporting 'Energy Policy of the Czech Republic' and specific document for renewables is still in preparation, including targets for renewables.
Industry association?	Yes. Union of Refrigerating Engineering
Geothermal energy resource potential	
Level of information available	Fair
Country geothermal atlas available?	NA
Estimated potential (electric)	6.67 PJ/yr, economic potential
Target established?	Yes. According to targets set for 2010, 1PJ/yr of utilization is expected, causing more than 30 fold increase.

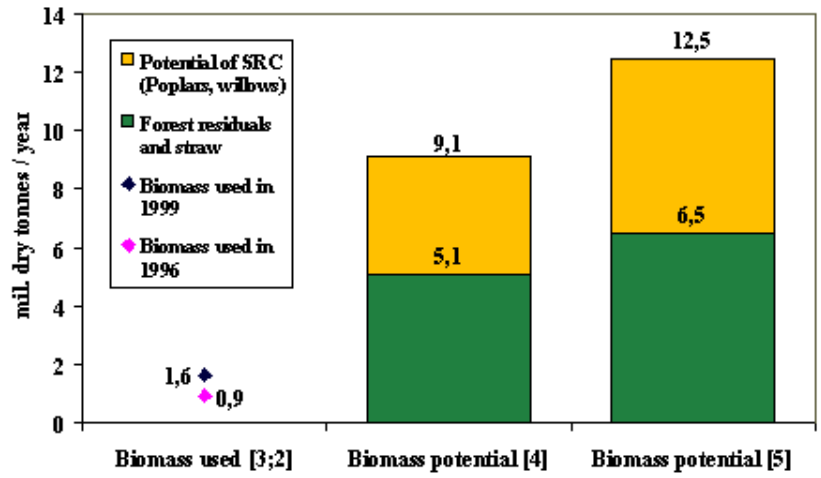
High enthalpy geothermal locations	NA
Identification of areas/projects with high potential for geothermal energy	
Recommended strategic assessments	A detailed geothermal atlas (could not be determined whether a country atlas exists) Countrywide economical feasibility study and planning .
Identified areas/projects (electric)	NA
Incentives/barriers for geothermal	
Significant incentives	Incentive 1 Incentive 2, etc.
Significant barriers	Economic reasons Technical reasons Financing barriers Lack of information Legal constraints
Overall Prospects	Fair Only 0.5% of the available potential is currently used. Upon the changes in the legislation, this may be increased drastically. Targets set by the State envisages a 30 fold increase giving a hint that special attention /incentives will be provided.

1.1.3 Biomass Resources

1.1.3.1 Current Status of Biomass Energy

The research work and studies of the real potential of renewable energy resources have shown that biomass is the best exploitable renewable resource in the Czech Republic. As shown in Figure 1, only one-tenth of the potential of biomass is currently being used. In 1999 in the Czech Republic, about 1,600 thousand tons of dry biomass, largely wood and waste byproducts from woodworking were used for energy purposes. Biogas from wastewater plants and dumps came in second place. Straw has to date been used minimally, but farmers in some areas are starting to use it more. The production of MERO, the base component for producing "biodiesel" - makes up a large portion of the biomass utilization. Gradually the production of briquettes and pellets for which in 1999 approximately 140,000 tons of biomass, mainly wood, were used is increasing. Over the past ten years the growth in the percentage of renewable resources in the energy balance has been caused mainly by the use of biomass, including the use of rape seed to produce MERO. The total production of energy from biomass which in 1995 was estimated at 3,200,000 MWh (11.5 million GJ) grew in 1999 to 5,600,000 MWh (20,160,000 GJ). Even though this shows a great shift in a five-year period, it is far from utilizing the real potential of biomass.

Figure 1: Present utilization and potential of biomass



Solid biofuels have a ratio in the balance of domestic primary energy sources at the level of minimally 16 PJ. After adding liquid biofuels (biodiesel) - in the volume of about 50,000 tons/year (1,900,000 GJ/year) and gaseous biofuels (biogas) in the volume of about 4.5 million m^3/year (about 1,000,000 GJ/year), the total share of biomass on primary energy resources in the Czech Republic is about 19 PJ.

Table…: Available potential and present utilization of biofuels in Czech Republic, 2000

Biofuel	Available potential $TJ.year^{-1}$	Present utilization $TJ.year^{-1}$	%
Fuel wood and wood waste	32 800	16 200	49,4
Cereal straw	6 050	39	0,6
Straw from oil plants	9 800	170	1,7
Energy plants (planted on marginal agricultural lands)	12 000	0	0
Biodiesel	9 200	2 300	25,0
Biogas	7 000	1 000	14,2
TOTAL	76 850	19 709	25,6

1.1.3.2 Biomass Energy Resource Potential

Biomass has the largest potential in the Czech Republic in comparison with other bioenergy sources. The potential to use biomass under the present economic and technical conditions is estimated to be yearly 6 million tons of dry mass. Only 1.6 million tons were used in 1999, which means that from the existing resources, three times more biomass could be used.

The total area of agricultural land unsuitable for producing food goods is estimated to be more than 1.3 million hectares by the Ministry of Agriculture. Of this land, about 800,000 hectares was not used at all or was maintained with state subsidies. Of this at least 500,000 hectares could be used for biomass production. Another 35,000 hectares is available in devastated areas. This increases the estimation of available dry mass production by 6 or 7 million tons. Theoretically, if all these 0.5 mil ha would be used for biomass, biomass would make 18 % of all energy sources. The more than 1 million tons of biomass available yearly from unused grasslands and unploughed arable soils is excellent material for producing biogas. Thus far, biogas is not utilized very much in the Czech Republic.

Although statistical data sometimes are insufficient and not complete, the low temperature heat market shows to be the most important market for biomass. About 2/3 of bioenergy are consumed by households for that purpose, the rest in industry. More than 1,2 million dwellings heated by coal, coke and briquettes presently (as compared to only 49.000 heated with biomass) offer a challenging possibility for introducing biomass into this market, especially if supported by fiscal measures. This would also be a good possibility to improve environmental quality.

Another chance for biomass are the already existing district heating plants (about 50% of all houses heated by district heat), mainly those fuelled with coal. Only about one third of them (based on the power installed) is equipped with cogeneration, leaving (theoretically) some 10.000 MW of district heat to be switched from coal to biomass.

Table **-3** shows agricultural and forestry statistics for Czech Republic.

Table - 3. Czech Republic Biomass Resource Data (FAO 2002a, FAO 2002b).

Biomass resource type	**Total production**	**Production density**
Primary crop production, tonne	(avg. 1999-2001, tonne)	(tonne /1000 Ha)
Total primary crops (rank among COO)	33,672,065 (7)	4,357 (1)
Top 10 primary crops		
Maize for Forage & Silage	7,463,343	966
Mixed Grasses, Legumes	5,344,000	692
Wheat	4,219,369	546
Clover for Forage & Silage	3,525,000	456
Alfalfa for Forage & Silage	3,428,400	444
Sugar Beets	3,005,786	389
Barley	1,928,259	250
Potatoes	1,490,958	193
Rapeseed	920,315	119
Maize	304,801	39
Animal units, number	(number)	(number / 1000 Ha)
Cattle	1,615,434	209

Poultry	13,018,000	1,685
Pigs	3,844,344	497
Equivalent animal units	3,283,352	425
Forest products, cubic meters	(avg 1999-2000, cu meters)	(cubic meters /1000 Ha)
Wood fuel and charcoal	890,000	115
Wood residues	739,500	96

1.1.3.3 Identification of Areas/Projects with High Potential for Biomass Energy

There are **fair** opportunities for biomass development in Czech Republic.

1.1.3.4 Barriers/Incentives for Biomass Energy

Specific incentives for the implementation of biomass projects in Czech Republic include:

- The 1998 National Support Program for Energy Savings and the Utilization of Renewable Energy Sources being implemented since1999, biomass is supported the most among the renewable energy resources the utilization.
- From the year 2000, the State program also supports the founding of long-term plantations
- According to the State's ecological and agricultural policies, the unacceptably high 74% of ploughed land must be reduced by 10%, approximately 300,000 hectares. This can best be achieved by planting permanent crops or by afforestation.

Specific barriers to the implementation of biomass projects in Czech Republic include:

- There is a lack of capital on the side of the investors in all spheres and the long-term loans with low interest rates that are needed to finance these type of investments are either unavailable or non-existent. Therefore very few prepared and approved projects are carried out. This is true especially in the community and agriculture spheres and it even pertains to projects prepared with foreign assistance.
- The financial costs of producing and burning biomass are relatively high - a wood waste boiler costs 50 % more than a gas boiler, whilst a straw boiler is 200 % more expensive than a gas boiler. Also all energy prices are subsidized by the government - except renewables. There are also problems with ensuring biomass in a good quality.
- The total capacity of financial resources that the state can provide yearly to support these investments is many times lower than the real need. In 1999 and 2000, the state provide only about 15% of that what was needed

? On the legislative side, to date effective measures to encourage the use of biomass are lacking.

Table Error! No text of specified style in document. **- 4. Czech Republic Biomass Energy Profile.**

Current status of biomass energy	
Installed capacity	NA (19290 TJ/year utilized)
Projects under construction	NA
Supporting regulations?	No. Although there is new legislation about renewables in general in accordance with EU accession, still specific legislation is missing.
Industry association?	NA
Biomass energy resource potential	
Level of information available	Fair
Relative biomass potential (total / density)	App. 28 % is used.
Country-level biomass investigations available?	Yes. There are organizations doing extensive research on the biomass capacity but most of these approach the topic from only one or two different types of biomass and not cover it through.
Estimated potential	68.502 PJ/yr, gross (theoretical) potential 50.96 PJ/yr, economic potential
Target established?	Yes. For the year 2010 target incremental production is set as 33.61 PJ/yr resulting in target-total production/ current utilization as 2.9.
High density biomass areas	NA
Identification of areas/projects with high potential for biomass energy	
Recommended strategic assessments	Specific feasibility studies for cereal straw, rape straw and energy crops should be carried out since the utilization of theses resources are almost none.
Identified areas/projects	NA
Incentives/barriers for biomass energy	
Significant incentives	National Support Program for Energy Savings and the Utilization of Renewable Energy Sources
Significant barriers	Lack of capital Expensive Machinery
Overall Prospects	Good. Almost 70 % of the resources have not been used and the State is in favor of this renewable source in particular. The market should me created for biomass by decreasing the unit cost.

Hydroelectric Resources

1.1.3.5 Current Status of Hydroelectric Energy

In the 1930s there were 12,000 small hydro stations generating power in the Czech Republic. Due to lack of investment, the number of operating plants declined to 259 (22MW) in 1986. As the country became familiar with dealing with small hydro applications, the number of plants have increased considerably over the years. Small hydroplants are once again significant for Czech Republic, with 1,230 small hydro stations producing 2,653 TJ/year. Installed capacity in small hydro plants, at the end of 1999 was 283 MW, equivalent to about 31% of the Czech Republic's hydro capacity. Actual generation from small-scale schemes in 1999 accounted for 37 to 40 % of hydro output.

The hydropower potential of rivers in the Czech Republic, utilizable from the technical point of view, amounts to 3,380 to 3980 GWh/year depending on different sources, in which the hydropower potential utilizable in the small hydroelectric power stations is around 1,570 GWh/year in each case.

1.1.3.6 Hydroelectric Energy Resource Potential

Total hydro-electricity output represents 48% of the technical potential. A relatively high proportion (nearly 40%) of the technically exploitable capability is classified as suitable for small-scale schemes. The potential for further small hydro projects is around 834 GWh and resulting that there is a need to build or reconstruct small hydro stations with installed capacity of approximately 220 MW. The hydropower potential currently utilizable in the existing small hydroelectric power stations amounts to approx. 30 %, i.e. about 500 GWh/year.

The policy overall goal for the year 2010 is set as to increase the share of renewable sources twice the current share. Policy has been developed to use this source as much as possible but lack of current statistical data on existing hydropower plants cause the inefficiency of the studies for future. As stated above, goals have been established as to the target share of hydro plants in the energy sector in compliance with the EU harmonization studies. A nationwide action plan is still being developed.

1.1.3.7 Identification of Areas/Projects with High Potential for Hydroelectric Energy

There are fair opportunities for further hydro development in Czech Republic.

1.1.3.8 Barriers/Incentives for Hydroelectric Energy

Specific incentives for the implementation of new hydroelectric projects in Czech Republic include:

- Renewables in general are subject to several tax relieves. Legal persons operating these schemes do not pay income tax for 5 years of operation, or do not pay real estate tax. Biofuels and biogas as well as the selected renewable energy technology components are subject to a lower VAT rate (5%).

- Small hydro schemes are covered by a state programme for the promotion of better utilization of renewable energy resources and cogeneration. Under this programme, projects seeking state support must have a payback period of less than 12 years, the efficiency of newly-installed turbines in small hydropower plants must be at least 80% and they should be used in through-flow plants under automatic operation. In addition to the state support programme, a free consulting service on small-scale hydro plants has been organized by the Czech Power Company (CEZ) and the Association of Entrepreneurs for Energy Fuels Utilization.

Specific barriers to the implementation of new hydroelectric projects in Czech Republic include:

Unit investment costs can be increasing as the utilization of the technical potential of renewable energy source continues. In the case of small hydro power plants, where mainly projects with low unit investment costs (retrofits, new small hydro plants where large constructions - dams, weirs, derivation channels are not needed) were already realized. As the utilization of hydro potential continues, the unit investment costs increase as the construction costs are higher. In addition following are some major barriers:

- Low creditworthiness of Czech investors
- Small size of investments
- Hard currency loans are connected with an exchange rate risk.
- Shortage of trained and skilled staff to develop a bankable project proposal
- Limited experience of local banks with renewable schemes
- Lack of co-ordination in state support
- Increasing prices for equipment and services
- High price of construction investments(high interest rates for commercial loans).
- Operation fees payable to the waterway administrators

Problems specific for the development of small hydro capacity in the Czech Republic are related to the ownership of the river flow and the installations (weirs) on which the small hydro power plant is installed. Possible barriers are the agreement to operate the power plant and the level of the required rent. In practice, the main problem is the high rent for the use of weirs or other installations required for the operation or installation of small hydro power plants.

Table Error! No text of specified style in document. **- 5. Czech Republic Hydro Energy Profile.**

Current status of small to medium hydro	
Installed capacity (small < 30 MW)	2.34 PJ/yr
Installed capacity (medium 30-100 MW)	
Projects under construction (small < 30 MW)	NA
Projects under construction (medium 30-100 MW)	NA
Supporting regulations?	Yes.

	Supporting 'Energy Policy of the Czech Republic' and specific document for renewables is still in preparation, including targets for renewables.
Industry association?	Yes. Association of Entrepreneurs for Energy Fuels Utilization
Hydro energy resource potential	
Level of information available	Poor
Country-level hydro atlas available?	NA
Estimated potential	5.65 PJ/year, economic potential
Target established?	Yes The particular policy targets for individual renewable energy sources in the year 2010 are target for the *small hydro power plants* was established at the level of the economic potential (4.1 PJ, 0.23%). There is twofold reason of not exceeding the economic potential, as it is quite close to the available potential and there can be substantial barriers of the environmental legislation requirements. It is supposed by the national energy efficiency study that no new *large hydro-plants* can be approved and implemented in the Czech Republic.
Identification of areas/projects with high potential for hydro energy	
Recommended strategic assessments	Current state of plants,
Identified areas/projects	
Incentives/barriers for hydro energy	
Significant incentives	Special state program Tax relieves
Significant barriers	High initial investment cost
Overall Prospects	Fair The country is already familiar with the technology and uses it nationwide up to 50 %. Although there is good potential for small hydro plants and incentives as well as supporting measures are being established, the unavailability of up to date statistics on the country is a major concern.

1.1.4 Contact Information

Contacts made in the preparation of this assessment are gratefully thanked for their contribution to this report. Contacts include:

Jaroslav Jakubes
Enviros s.r.o
Jaroslav.jakubes@enviros.cz

Eva Kudnova
Technologicke Centrum AVCR
kudrnova@tc.cas.cz

Petr Koran
Geo Group a.s.
koran@geo-praha.cz

Jana Szomolanyiova
Seven
Janas@svn.cz

Antonin Slejska
Biom
slejska@vurv.cz

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