



www.SETatWork.eu

Country Profile for CZECH REPUBLIC

Prepared by: *Energy Centre, Bratislava, Slovak Republic*

Prepared: *August 2009*

Published: *August 2009*

Contents

1.	Introduction	2
2.	General Country Overview	3
2.1	National energy system.....	3
2.2	Security of supply.....	13
2.3	Climate change	15
2.4	Overview of industries with highest energy demand	16
3.	Legislation.....	17
3.1	Energy Act.....	17
3.2	Act on Energy Management.....	17
3.3	Establishment of Czech Environmental Information Agency.....	18
4.	Financial market.....	19
4.1	National Allocation Plan	19
5.	National situation in the carbon markets	19
5.1	European Emission Trading Scheme and National Allocation Plan.....	20
5.2	Clean Development Mechanism (CDM) opportunities, requirements and SET transfer demand.....	20
5.3	Joint Implementation (JI) opportunities and requirements.....	20
6.	Companies in the Carbon Markets	22
6.1	General overview of ETS branches	22
6.2	Key Stakeholders	23
6.3	Identification of technology needs in targeted companies	25
7.	R&D priorities.....	26
7.1	General national aspects	26
7.2	RTD assessment of energy efficiency and savings technologies for the different types of industry on national level.....	27
7.3	Multiregional Operational Programme 2007-13: Research and Development for Innovations	29
8.	Links to relevant and related websites	31

© SETatWork Consortium Members 2009

Reproduction of this publication is authorised provided the source is acknowledged.



SETatWork is supported by the European Commission under the Seventh Framework Programme (FP7). This publication reflects the author's views. Although the author's best efforts have been made to ensure that the information contained herein is accurate, neither the European Commission, the SETatWork Project Members nor the author are liable for any use that may be made of the information contained herein.

1. Introduction

1.1 SETatWork Country Profiles

This report is one of a set of Country Profiles produced by **SETatWork**. The global society is faced with a huge challenge in order to meet the threat given by global warming. The project **SETatWork - Sustainable Energy Technologies at Work** aims to meet this challenge through the collaboration and partnerships between organisations in EU, Asia and South America, supported by the EU's Seventh Framework Programme (FP7). The activities take place over two years from 1 September 2008 to 31 August 2010.

The aim of this country profile, is to provide an overview of the carbon market in the Czech Republic with a focus on RTD needs, implementation options and perspectives associated with energy efficiency and savings in the carbon market (short term and medium-long term).

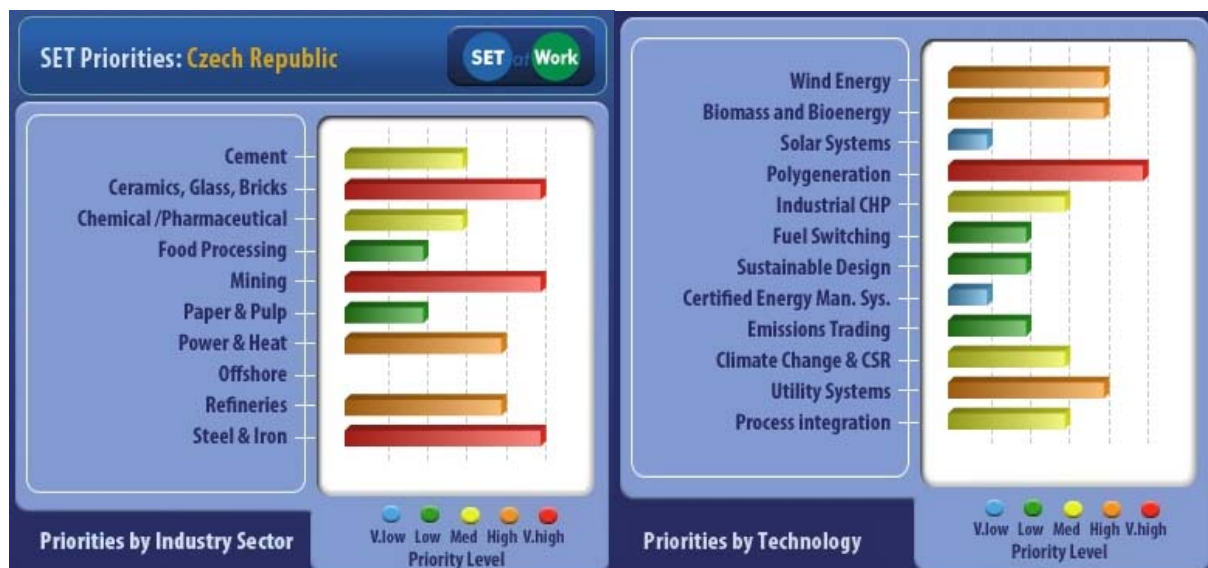
The main target groups for this country profile are companies (financial investors, project developers, technology providers, ESCOs, consultants, etc.), organisations and administrations that are interested in a short overview of relevant information in the development of carbon projects and markets in the Czech Republic. This information may also be of relevance to readers from other countries that are interested in an overview of the Czech Republic as well as for national readers that need to have information on their national developments.

SETatWork Country Profiles can be found online at: <http://www.setatwork.eu/countries.htm>

1.2 SETatWork Sustainable Energy Technology (SET) Priorities

In each country, companies and organisations were interviewed by SETatWork in order to identify indicative priority rankings for various Sustainable Energy Technologies (SET) and Industrial Sectors. The results of these interviews for each sector can be viewed on the following page: <http://www.setatwork.eu/maps/index.html>

The SETatWork Priorities for the Czech Republic are shown below. Where data is not yet available, the bar chart columns are left empty.



Note: Levels of priority recommended for SETatWork activities are given by the fact that the drive towards energy efficiency via biomass and polygeneration has strong policy support in Czech Republic.

2. General Country Overview

In January 1993, Czechoslovakia split into two separate states: Czech Republic and Slovakia. Czech Republic has population of 10.3 million (in 2008) and total area 78,865 km².

Before the financial and economical crisis 2008/2009 Czech economy was rising high above the average growth in the EU. Favourable and secure conditions for business were put in place and made the country attractive for foreign investments even despite the gradual rise of wages. The reasons why the Czech Republic was persisting on the top of investors' attention include the convincingly growing economy, stable and fair business environment, skilled labour force and low level of prices.

The *European Economic Recovery Plan*, agreed by the European Council in December 2008, is a joint framework for the coordinated effort of the European Union and its Member States.

According to the Czech Republic's State Energy Policy, **coal** will remain the country's primary energy source in the coming decades, despite the increased use of natural gas and nuclear energy. Coal accounted for 55% of electricity production in 2005, and it is supposed to share 37% in 2030.

The Czech government also aims to increase the contribution of **renewable energy** sources to electricity generation to 16.9% in 2030.

The share of **nuclear power** will increase to 39% in 2030. The Minister of Trade and Industry announced in May 2005 that the building of new nuclear units was being considered. The construction of the Temelin NPP (Nuclear Power Plant) took a long time because it had to overcome a variety of technical and political challenges.

2.1 National energy system

Dominant energy producer in Czech Republic is company CEZ a.s. (Czech Energy Facilities). This company owns 12 GW of installed power generation capacity what represents 71% from total installed capacity in Czech Republic. Electric power generation capacities and consumption figures are shown in Table 2.1.

Table 2.1.a Characteristics	2003	2004	2005	2006	2007
Gross consumption (GWh)	67,0	68,6	69,9	71,6	72,0
Gross power generation (GWh)	83,2	84,3	82,5	84,2	88,3
Imports total (GWh)	3,6	2,7	8,3	6,9	10,2
Exports total (GWh)	19,9	18,5	20,9	19,5	26,3
Installed capacity (MW)	17,3	17,4	17,4	17,5	17,6

Table 2.1.b Energy Production and Consumption expressed in (1000 t oil equivalent)	Czech Rep.	Europe	World
Total Energy Production	29869	2253336	10077984
Energy Imports	19105	1341347	9521506
Energy Exports	9347	961926	3419104
Total Energy Consumption	38584	2559701	9702786
Electricity consumption	4138	291148	1040770
Energy consumption per capita	4	4	2
Energy Consumption per GDP	300	243	244

One metric ton of oil equivalent (toe) is defined as 10 Exp. 7 kilocalories or 41.868 gigajoules, equal to the amount of energy contained in 1 metric ton of crude oil.

Table 2.1.c Energy Consumption by Sector (1000 t oil equivalent)	Czech Republic	Europe	World
Industry	10352	569813	2140474
Transportation	4121	451881	1755505
Agriculture	468	51724	166287
Commercial & public services	3028	154692	511555
Residential	5504	477196	1845475
Non-energy Uses	1351	76515	333981
Total Final Energy Consumption	24823	1781820	6753276
<i>One metric ton of oil equivalent (toe) is defined as 10 Exp. 7 kilocalories or 41.868 gigajoules, equal to the amount of energy contained in 1 metric ton of crude oil.</i>			

2.1.1 Thermal power

Fossil power plants account for under 70% of the installed capacity of the CEZ Power Company. Brown coal is fired at most fossil power plants. The North Bohemian fossil power plants are situated in direct neighbourhood of brown coal mines.

CEZ have installed the total of 28 desulphurisation plants and 7 fluidised-bed boilers. Ash precipitators have been reconstructed and power plant control systems have been modernised. The overall investment in modernisation and desulphurisation of fossil power plants amounted to EUR 2 billion. Thanks to the effort, the SO₂ and ash emissions have been cut by 90% and those of NO_X by 50%. Power plants are thus currently fully comparable to similar sources anywhere in Europe.

Desulphurisation units have been used for the total of 5,930 MW of installed capacity as follows:

Power Plant	Capacity	Date installed
Prunerov I	4 x 110 MW	December 1995
Prunerov II	5 x 210 MW	August 1996
Pocerady	2 x 200 MW	November 1994
Pocerady	3 x 200 MW	November 1996
Ledvice	2 x 110 MW	December 1996
Tusimice 2	4 x 200 MW	May 1997
Tisova	100 MW	December 1997
Chvaletice	2 x 200 MW	December 1997
Chvaletice	2 x 200 MW	November 1998
Detmarovice	4 x 200 MW	June 1998
Melnik	720 MW	November 1998

Note: MVV - wet lime washing PSV - semi-wet lime method

Programme of construction of fluidised-bed boilers in CEZ a.s. was realised with following schedule:

Power Plant	Capacity	Date installed
Tisova	86 MW	December 1995
Hodonin	60 MW	September 1997
Porici	50 MW	October 1996
Hodonin	45 MW	October 1997
Tisova	86 MW	November 1997
Ledvice	110 MW	October 1998
Porici	55 MW	September 1998

Total of 2020 MW of installed capacity in obsolete coal-fired plants have been phased out as follows:

Power Plant	Capacity	Date installed
Prunerov 1	110 MW	January 1991
Tisova 2	100 MW	January 1991
Tusimice 1	110 MW	June 1991
Prunerov 1	110 MW	January 1992
Tisova 2	100 MW	January 1992
Tusimice 1	110 MW	March 1992
Hodonin	55 MW	January 1993
Pocerady	200 MW	January 1994
Ledvice	110 MW	February 1994
Hodonin	50 MW	January 1995
Hodonin *	50 MW	August 1996
Tusimice 1	110 MW	September 1996
Hodonin	50 MW	April 1998
Tusimice 1 **	110 MW	April 1998
Ledvice	200 MW	June 1998
Porici	55 MW	December 1998
Tusimice 1 **	110 MW	December 1998
Tusimice 1 **	110 MW	December 1998
Tisova	50 MW	December 1998
Melnik 2	110 MW	December 1998
Melnik 2	110 MW	December 1998
Total	2,020 MW	

Formerly waste, now recycled materials

Roadbed material for roads and railways, refill material replacing coal in exhausted coal seams, landscaping material in recultivation projects, use in dry mortar mixes - these all are the possible ways how to utilise power plant gypsum or the mix of power plant gypsum and ash in some applications.

The production of gypsum plasterboard for the construction of interior walls in residential and other projects and the manufacturing of structural sections are perhaps the best known and most efficient methods of utilisation of desulphurisation products.

2.1.2 Nuclear Power System

Nuclear power accounts for 31% of total electricity production and the share of nuclear is expected to increase, according to the government. The Minister of Trade and Industry announced in May 2005 that the building of new nuclear units was being considered. The country has two nuclear power plants (NPPs), at Dukovany and Temelin.

Nuclear Fact Sheet

Number of nuclear units:	6
Net generating capacity (MWe):	3548
National Generation (TWh):	84.3
Nuclear generation (TWh):	26.3
Power generation nuclear share:	31%

The country primarily exports electricity to Germany, Austria and Slovakia. Electricity exports have increased since the completion of the Temelin NPP, According to Czech legislation - the Atomic Act - CEZ is responsible for decommissioning and must prepare both the financial and technical means required to do the job. It should provide payments to the Czech National Bank to accumulate the necessary funds to cover the cost of decommissioning.

Temelin's units 1 and 2 became fully operational on 11 October 2004. Both NPPs comply with Western safety standards. The design of the Temelin NPP was modified to meet safety requirements.

Czech Republic has signed the Convention on Nuclear Safety. The National Reports assess favourably the safety level of the Czech Republic's NPPs.

Existing two plants have following capacities:

Nuclear power plant	Installed power output	Operation started
Dukovany	4 x 440 MW	1985 – 1988
Temelin	2 x 1 000 MW	Unit 1 – 2002 Unit 2 – 2003

Nuclear Power Plant Dukovany

Four 440 MW units were installed and introduced into operation in the period of 1985 - 1988. In 1995, the installed power output of the power plant represented nearly 20 % of the total capacity installed within the power utility. Its share at the total electricity production of CEZ, a. s., equals 30 % within the same period.

Nuclear Power Plant Temelin

There is a pair of production units constructed, each having 1000 MW of power output capacity. Skoda Praha Company assumes the role of the chief supplier.

The power plant's share at the total electricity production of the CEZ joint-stock company is 50 %, approximately. The automated I & C system for this particular power plant was delivered by Westinghouse Electric Corporation.

For the summary information concerning nuclear safety of Czech nuclear facilities please see the detailed report, successfully negotiated within IAEA, available on the SUJB pages.

2.1.3 The fuel cycle

When both units of Nuclear Power Plant Temelin are introduced into operation, the nuclear energy industry shall cover more than 40 % of electrical power consumption in Czech Republic.

The fuel of both Czech nuclear power plants is uranium dioxide UO₂, where uranium is slightly enriched with 235 fissile isotope (for 2-4 % of the uranium total amount; there is only 0.7 % of 235 isotope in the natural uranium). For NPP Temelin, fuel is supplied by A.O.Technobexport, a Russian company, whereas for NPP Dukovany is the fuel supplied by the Westinghouse company from the USA.

The atomic act requires from all radioactive waste originators, and therefore from the CEZ, a.s. company as well, to bear all the costs associated with radioactive waste depositing since its origination, with safety and security measures concerning the deposits included. The guarantees for a safety depositing of all the radioactive waste, including spent nuclear fuel, are provided by the state, which established Radioactive Waste Deposit Management Office (SURA), in order to comply with the requirements stipulated in the law.

Each year, Nuclear Power Plant Dukovany produces less than 44 tons of spent nuclear fuel. Both nuclear power plants, then, produce 3 000 tons of spent nuclear fuel during their entire operation periods. The spent nuclear fuel produced by NPP Dukovany, initially, was transported into an intermediate storage facility situated in NPP Jaslovské Bohunice area, in Slovakia, from which it was expected to be gradually removed on a basis of an international treaty concluded with the (former) Soviet Union. The Russian Federation, however, as one of the successor states of the Soviet Union withdrew from the obligations. Following the split of Czechoslovakia, the spent nuclear fuel from NPP Dukovany suddenly appeared on the territory of a foreign state and therefore the Czech Republic accepted a return transport of the fuel assemblies into its own intermediate storage facility built in the NPP Dukovany area. The dry intermediate storage facility, with its 600 tons of spent nuclear fuel capacity, comprises 60 dual-purpose (transport and storage) Castor 440/84 delivered by GNS Nukem, a German supplier.

In 2005, the existing storage capacity of the Dukovany spent nuclear fuel intermediary storage capacity shall be used up. Therefore, design works has started, on an extension of the storage capacity. The spent nuclear fuel from NPP Temelin shall be stored in a storage facility situated within its area and its construction is envisaged in the near future.

Nuclear Safety and Nuclear Waste Management

The Dukovany NPP was built in the 1980s. It has 4 VVER-440 units, pressurized water reactors designed in the former Soviet Union. However, the NPP does comply with Western safety standards and no incident classified above level 1 on the IAEA's International Nuclear Event Scale (INES) has been reported since it came into operation. The design of the Temelin NPP has been modified to comply with accepted safety standards, as explained above. The Czech Republic has signed the Convention on Nuclear Safety and the National Reports prepared for the review process favourably assessed the safety level of the Czech NPPs. The State Office for Nuclear Safety, created in 1993, is the governmental body responsible for the supervision of safety at nuclear facilities.

The Radioactive Waste Repository Authority (RAWRA) was established by the Ministry of Industry and Trade in May 1997. The radioactive waste repositories currently in operation in the country are: the LLW (low-level waste) and ILW (intermediate-level waste) repository in

Dukovany, the Richard repository near Litomerice and the Bratrstvi facilities, in Jachymov. They were put under state ownership in January 2000. The Environment Minister agreed, in November 2005, to the building of an intermediate storage facility for spent fuel near the Temalin NPP by 2014. There is already an intermediate spent fuel storage facility near Dukovany.

The construction of a deep geological repository for high-level waste and spent nuclear fuel is also being planned and prepared by RAWRA. A study is still being conducted into finding a suitable location for the repository site. It should become operational by 2065.

2.1.4 Hydro power

ČEZ, a. s. - Hydroelectric Power Stations

All of the large hydroelectric power stations, except the Dalešice, Mohelno and Dlouhé Stráně hydroelectric power stations, are situated at the Vltava River where they form a cascade system called the Vltava Cascade.

Capacity of these power stations represent more than 17 % of the total installed capacity of ČEZ, a. s. as follows:

Power Stations	Capacity (MW)	Year of commissioning
Lipno I	120	1959
Orlík	364	1961–1962
Kamýk	40	1961
Slapy	144	1954–1955
Štěchovice I	22,5	1943–1944
Vrané	13,88	1936
Střekov	19,5	1936
Lipno II	1,5	1957
Hněvkovice	9,6	1992
Kořensko I	3,8	1992
Kořensko II	0,98	2000
Želina	0,64	1994
Mohelno	1,2; 0,56	1997; 1999
Dlouhé Stráně II	0,16	1996
Přelouč	2,34	1927
Spálov	2,4	1926
Hradec Králové I	0,75	1926
Práčov	9,75	1953
Pastviny	3	1938
Obříství	3,36	1995
LesKrálovství	2,12	1923
Předměřice nad Labem	2,1	1953
Pardubice	1,96	1978
Spytihněv	2,6	1951
Brno Kníničky	3,1	1941
Brno Komín	0,21	1923
Veselí nad Moravou	0,27	1914, 1927

Power Stations	Capacity (MW)	Year of commissioning
Vydra (ZČE)	6,4	1939
Hracholusky	2,55	1964
Čeňkova Pila	0,1	1912
Černé jezero I	1,5	1930
Černé jezero II	0,04	2004
Černé jezero III	0,37	2005
Bukovec	0,63	2007
Štěchovice II	45	1948, 1996
Dalešice	450	1978
Dlouhé Stráně I	650	1996

2.1.5 Renewable energy sources

Table 2.2: Survey of Renewable Energy Sources (RES).

	Gross Power (GWh)	Power to grid (GWh)	Share on RES Power Prod. (%)	Share on gross power Prod. (%)
Hydro power plants	2019	1 615	72,879	2,4
Biomass total	592,7	223	21,391	0,70
Biogas total	138,7	82	5,009	0,16
Municipal solid waste	10,0	3,4	0,362	0,01
Wind power plants	9,9	9,7	0,356	0,01
Photovoltaic systems	0,08	0,009	0,003	0,00
Total	2771	1933	100,0	3,3

The largest RES electricity production was created by hydro power plants (2019 GWh) followed by biomass (593 GWh) of which however significant share (219 GWh) is from the production of cellulose (the electricity produced is in fact used in the production factories). As a quite important source of electricity we can consider biogas (139 GWh). The role of wind power plants and refuse incineration plants is negligible and photovoltaic systems have only demo character.

The RES electricity production share on the total domestic consumption was app. 4 % in 2004. National indicative objective is 8 % in 2010.

Solar energy

The surface of the Czech Republic absorbs 80 000 TWh of energy in sunshine during cca 1500 hours of sunshine every year. The annual consumption of energy is app. 320 TWh (electrical energy 50 TWh, heat energy 270 TWh) which represent 0,4 % of the amount of sunshine caught by the area of the Czech Republic. 1 m² catches app. 1000 kWh of energy per year.

Water and air heating The share of solar collectors was estimated at app. 57 300 GJ in 2004 (0,14% of RES).

Hydropower

Hydropower plants' share on total energy output in the Czech Republic is about 17 % and on electricity generation app. 3,5 % (including large hydropower plants). The share of hydro power on RES is app. 13 %.

The total technical potential of Czech rivers is about 3 380 GWh/year in which the hydropower potential utilizable in the small hydroelectric power stations (up to 10 MW) is 1,570 GWh/year. Usage in 2004 of small hydropower plants was about 900 GWh/year (40 % of possible potential) and about 1 115 GWh/year in large hydro power stations.

Wind Energy

The wind power plant is efficient on such a place where the wind velocity exceeds 5,2 m/s together with the minimum 1500 hours of the annual usage of the power plant. Only app. 5 areas in the CR meet such requirements. Some of these localities are situated at higher altitudes above the sea level (obviously beyond 500 to 600 m ASL), where the construction of the wind power plants is often being hindered by the nature protection regulations. For this reason, the wind power engineering does not play in the energy balance of the Czech Republic too significant role.

However in the beginning of April 2006 CEZ (www.cez.cz) - the largest state owned electricity producer in the CR – announced a plan to invest about 20 billions Czech Crowns (6,6 billions SEK) for a construction of wind power plants in coming 15 years.

Biomass energy

In the Czech Republic, biomass is still traditional solid fuel in households heating systems mainly in rural areas, mostly as a chopped timber wood. But also furnaces equipped with automatic dosing machine for pellets (in single households) and woodchips or saw dust (in central district heating systems) are in use.

The biomass energy should play ever more important role in the energy system of the Czech Republic. The source of energy biomass in the Czech Republic can be most of all the wood waste produced by the wood-processing industries and the forest exploitation.

In total it will be available for use 111,8 PJ energy from **solid biomass**. We can assume that 50% will be used for generation of electricity together with heat and another 50% will be used only for heat production.

Potential for electricity production 55,9 PJ.

In 2010 will be used 30 % 16,8 PJ Heating capacity from biomass according EU 20% 3,4 PJ (932 GWh) Heating capacity from biomass 30 % 5,0 PJ (1399 GWh).

Using solid biomass we can gain between 932 and 1399 GWh in 2010.

Besides solid biomass, **biogas** is also important source for generation of electricity. According to studies it is estimated that total production of electricity can be 500 GWh in 2010. We have to add already existing biomass and biogas production of 182 GWh, production of power plants owned by CEZ (150 GWh). From the information above we can

expect minimum objective for production of electricity from biomass in 2010 of 1764 GWh (6,3 PJ).

Geothermal energy

Heat pumps are installed mainly in small family houses and estimated production was 580 000 GJ in 2004.

Potential for the future

Czech Republic is the country with relative high area of agricultural land, (54,2 % of total area) and forests (38,5 %). Large area of country has specific restriction due to the environmental protection (8,4 % agricultural land and 16,0 % of total area of Czech Republic), which makes some limitation in intensive farming and forestry and provides chance for energetic crops plantation and wood utilization which is usually less intensive than convention management of farm and forest land.

At present there is about 0,5 mil ha of agricultural land as a set-a-site. To reach the aim for renewable electricity production in 2010 it would be sufficient to grow energy crops on half of set-a-side area (approx. 250 000 ha). Long term proposal estimates that 1,5 mil. ha (approx. 35 % of agricultural land) could be use for energy crops with respect to crop rotation and good agronomic practice.

The potential for using RES in the CR approaches 500 PJ. This is about 30 % of present primary energy consumption, which, moreover, still contains high potential for energy efficiency measures. If we make the assumption that sustainable long-term energy consumption should not go beyond 20 % of the current consumption of primary energy in industrialised countries, we can conclude that the CR has sufficient potential in RES in order to achieve sustainable development.

2.1.6 Power transmission & distribution network

CEPS s.o. (Czech Transmission company state organization) is company responsible for power transmission in Czech Republic.

Majority of cross-border exchanges are carried out across this system. The CEPS transmission system comprises 38 substations of 420 kV and 245 kV located at 30 transformer stations, along with 2,900 km of 400 kV lines and 1 440 km of 220 kV lines. Two 123 kV substations and 105 route kilometers of 110 kV lines are also included in the transmission system. The CEPS is responsible for electricity transfer, transmission system operation, maintenance and supply system. As a system service it further develops and tests a Defense Plan (to prevent failure spreading) and a Restoration Plan (to restore the power supply after major system failures). It provides technical management of system services such as power-frequency control and voltage and reactive power control, and is responsible for availability and efficient use of power reserves.

CEZ distribution Inc., holds a license for distribution electricity and operator distributive system for nine territories. CEZ Distribution Inc. repairs fiduciary assets (technology and related arrangement distributive system) and achievement proprietary law above those assets, including reservation care of consumer from look distribution on all suspense levels of ad drive system in real time.

E.ON Distribution Inc., is another company involved in distribution networks. This company is located in the southern part of the Czech Republic.

PRE Distribution Inc. is the final company that handles distribution networks.

2.1.7 Natural gas transmission and distribution network

The Czech natural gas industry began its **liberalization**, starting on January 1, 2005, with a second stage on January 1, 2006, and reaching its final stage on January 1, 2007. Starting on the first date, large natural gas consumers (more than 15 million m³ per year) and producers using CHP were able to choose or switch their gas supplier. On the second date, all gas end-use customers other than households were able to choose; and on the third date, all customers could choose (EC, 2007). Vertical unbundling was also accomplished during this period. Producers and distributors were separated and regulations entered into force to prevent possible conflicts of interests of regulated utilities; to prevent utilities from shifting costs between regulated and unregulated activities; to enable companies to better understand the true costs of their activities; and to promote separated calculation of service costs, transparency, and competition (Mejstrik, 2004).

70 % of imported natural gas comes from Russia and 30 % is imported from Norway.

TECHNICAL DATA of the Czech Gas Industry

- number of customers in the Czech Republic – about 3 millions
- natural gas consumption – 10 billions m³ per year
- Length of Transmission pipelines – about 3600 km
- Length of Distribution pipelines – nearly 70 000 km
- 8 Gas Underground storages
- 3 cross border points
- no LNG terminal
- mid 1990s privatization of the majority interest in the Czech Gas Industry
- new strategical partners – mainly RWE Energy Group and now E.ON energy company (RWE holds its interests of 100 % in Transmission company TRANSGAS and majority in 6 Gas Distribution companies)
- liberalization and market opening process - according to the Directive 2003/55/EC - started by the passing of a new Energy Act
- process was divided into three stages:
 - 1st stage – market opening for big industry customers
 - 2nd stage – all customers except households
 - 3rd stage – all customers and finalized by the 1st January 2007 for all customers

2.1.8 Role of coal

Czech Republic domestically provided for 1.2 EJ (1 EJ = 10⁹ GJ) of its total energy consumption. Producing 62 million t of coal in 2005, Czech Republic ranks twelfth globally in coal production, while its total recoverable coal reserves are estimated at approximately 5.6 billion t.

Further, in an effort to align itself with the European Union market standards, the country reduced its reliance on coal by about 22 percent from 1993 to 2001. This decreasing trend is

expected to continue until 2010 as the country moves from coal-fired to natural gas-generated electricity.

CMM emissions from operating mines. Czech Republic has been utilizing CMM (**Coal-mine-methane**) for over a century from both active and abandoned black coal mines from Ostrava region, the country's largest coalfield and the most important site for mine gas production. It is estimated that the country uses about 100 million m³ of CMM per year for domestic purposes and for sale to European markets. Czech energy company, Green Gas DPB is a major player in the market, using 75 million million m³ of CMM per year.

Czech Republic faces a number of barriers to achieving greater CMM recovery. First, the continuing trend of declining coal production in the Republic is detrimental to the growth of CMM development. Second, unusual topography in the coalfields hinders CBM recovery projects. Still, because of its large coal deposits, the Czech Republic ranks high globally in its potential for CMM development.

There has been increased use of new technologies; however, no significant R&D projects are in place to enhance the current CMM recovery technologies. Implementation of new developments is not widespread.

Infrastructure in OKR consisted of 21 drainage plants operating 115 vacuum pumps as of 1997. Gas is typically lower quality and diluted with air, but the local gas utility has modified its equipment to accommodate this. In 1994, 32 km of new pipeline was installed by Green Gas DPB to supply a coke plant at Ostrava (Schwochow, 1997), and Green Gas now has more than 200+ km of gas pipeline. End-use options include onsite heating plants and heating water, as well as CHP plants.

Czech Republic imports substantial amounts of gas. This makes domestic generation of CMM and CBM (coal bed methane) an attractive proposition. The Czech government has therefore been encouraging its development through direct finance as well as lenient leasing policies. Holders of CBM production licenses pay a fixed annual fee per unit area and a variable royalty (about 5 percent) based on a percentage of production. However, the gas prices are set centrally by the Energy Regulatory Office, which is hindering the development of the CMM market (Pilcher, 2003).

2.2 Security of supply

Czech Republic imports most of its crude oil and natural gas from Russia.

Coal remains the main energy source for electricity production, followed by nuclear, and hydro.

Around 70% of the electricity production is assured by CEZ (the Czech Power Company), a jointly-owned stock company: its operations include ten coal power plants, the Dukovany and Temelin NPPs, eleven large hydro plants, three wind power plants and one solar power station. The country operates the Dukovany and Temelin NPPs. After years of delay, the Czech Nuclear Safety Authority finally cleared the Temelin NPP (South Bohemia) for operation. The first reactor was connected to the grid in December 2000. The second reactor at the Temelin NPP was put into trial operation in April 2003. Both reactors began operating fully in October 2004.

Czech Republic exports electricity primarily to Germany, Austria and Slovakia. Electricity exports are becoming increasingly important to Czech Republic, especially since the completion of the Temelin NPP.

Czech Republic has signed the Convention on Nuclear Safety. The National Reports assess favourably the safety level of the Czech Republic's NPPs. The use of nuclear energy is playing a very significant role in electricity production and, therefore, in the reduction of greenhouse gases emissions (GHG) in Czech Republic. Public opinion is in favour of nuclear, with 54 % of Czechs supporting its use and development, according to a recent survey by the statistical agency STEM.

Czech Republic is a member of CENTREL, the electricity system linking it with Slovakia, Poland and Hungary.

In 1995, the CENTREL system was connected to the Western Europe's grid. Currently, both North-South and East-West connections are being expanded, as part of the EU's Trans-European Energy Network project, including a new link to Lithuania. The four countries in the region are also members of the electricity transmission system, Union for the Coordination of Transmission of Electricity (UCTE), which coordinates the interests of transmission system operators in 20 countries.

The CENTREL electricity system links Slovakia, with Czech Republic, Poland and Hungary. In 1995, CENTREL system was connected with Western Europe's grid. Currently, both north-south and east-west connections are being expanded, as part of the EU's Trans-European Energy Network Project, including a new link to Lithuania. The four countries in the region are also members of the electricity transmission system - Union for the Coordination of Transmission of Electricity (UCTE).

Position of Czech Republic in UCTE. UCTE is an association of 35 transmission system operators from 21 countries of the continental Europe, which provides a reliable market basis through effective and safe "electrical highways". The synchronously interconnected system meets technical conditions for a reliable operation and is useful for all market participants, since the system guarantees access to the market. More than 50 UCTE has been co-ordinating through various technical rules and recommendations - an international operation of extra-high and ultra-high voltage grids, which work at so-called one "heart rhythm" at the frequency of 50 Hz. UCTE is in charge of the development of the system so as to meet all new market requirements with no loss in relation to reliability and safety of the existing system. UCTE grid allows for safe electricity supplies for population of more than 400 million. It means that UCTE co-ordinates one of the largest synchronously interconnected systems on the globe.

Czech republic is represented in UCTE via **CEPS a.s.**, CEPS provides a complex service of pipeline systems for transport and distribution of gas, oil, oil products and other chemicals to its clients. CEPS is also involved in service works on piping of oil refineries and nuclear power stations.

UCTE responsibilities are as follows:

- Safety of the whole UCTE system, i.e. system ability to withstand major or sudden failures such as trip of generation units, grid elements, as well as accidents due to calamities
- UCTE system adequacy, that is a structural ability of the system to ensure an even balance between the electricity generation and consumption

- each UCTE member is responsible for his own transmission system quality, and jointly with the others maintains a high technical level that is the basic presumption for market development
- quality assurance of international transmission services and early warning in case of reduced generation or transmission capacities that might lead to sudden limitations or adverse effects on competitive electricity markets

2.3 Climate change

In 1998, the Czech Republic has signed the Kyoto Protocol. During the 2008-2012 commitment period, the country is committed to reducing total CO₂ emissions by 8% compared to the 1990 level. Currently total GHG are 20% below the 1990 baseline. The country's State Energy Policy rightly makes energy efficiency the primary focus of its energy strategy. Even though progress has been made in this area, the Czech Republic still lags behind its neighbours. Although energy intensity fell by 17% in the Czech Republic from 1990 to 2002, it fell by 23% in Hungary, by 27% in Slovakia and by 39% in Poland. This suggests that there is still substantial room for improvement. Energy efficiency increases national competitiveness, reduces emissions and enhances energy security. The government has been encouraged to follow up its work in the SEP with concrete policies and measures aimed at improving energy efficiency, especially in the transport and building sectors. The reduction in government funding for energy efficiency that has occurred in recent years is not consistent with the ambitious targets that it has set for improving energy efficiency. The budget allocation for energy efficiency and renewable energy should be reviewed based on cost-effectiveness criteria.

Public Opinion. 54 % of Czechs support the use and development of nuclear energy, according to a recent survey by the statistical agency STEM. Two thirds of Czechs support the construction and operation of the Temelin NPP. Support for the future development of nuclear energy remains stable at around 54 %. Two thirds of Czechs also believe that technologies used at the Temelin NPP are comparable to any modern nuclear NPPs in the world. 58 % of Czechs living in the South Bohemian region, where the Temelin NPP is located, believe that its security measures are adequate, according to STEM. The power utility CEZ, which runs Temelin, plans to operate the facility until 2045 and Dukovany, another nuclear power plant, until 2025.

CO₂ emissions. Owing to its coal-intensive energy sector structure Czech Republic has higher CO₂ emissions than European average, as indicated in **Table 2.3**.

Table 2.3: CO₂ emissions of EU countries expressed in *kg CO₂ per capita*.

Country	kg CO ₂ /cap	Country	kg CO ₂ /cap
Netherlands	14,600	Slovenia	8,300
Belgium	14,400	EU average	9,600
Czech Rep.	12,400	Slovakia	7,200
Finland	11,500	Belgium	7,200
Germany	10,900	France	7,000
UK	10,000	Sweden	6,800
Austria	9,900	Hungary	6,300
Estonia	9,500	Romania	5,300
Italy	8,700	Lituania	4,400
Poland	8,700		

Environmental Policy

In 2004 the Government of the Czech Republic approved the State Environmental Policy of the Czech Republic 2004 – 2010 (SEP) which defines the basic framework of a long and middle-term environmental sustainable development of the Czech Republic. It is a document covering all other conceptual environmental materials (e.g. policies concerning particular environmental components).

The main purpose of the SEP is to provide a guideline for decision-making and activities at the international, national, regional and local levels aimed at:

- improved quality of the environment as a whole and of its components,
- implementation of sustainable development principles in compliance with the European and Czech Sustainable Development Strategy and continuing the integration of environmental aspects into the policies of the ministries,
- increased economic efficiency and social acceptability of environmental programmes, projects and activities.

Pursuant to the 6th Environment Action Plan of the EU, the SEP priorities focus mainly at solving continuous and newly emerged environmental issues in the areas of:

- protection of nature, landscape and biological diversity,
- sustainable use of natural resources, water protection and anti-flood measures, material flow optimisation and waste management,
- decrease of environmental load originating from human activities, improvement of environmental standards for a better quality of human life,
- protection of the climatic system of the Earth and elimination of long-term pollution transfer.

The SEP provides a whole range of tools to accomplish the above-named objectives. Normative, economic, institutional, organisation, information, voluntary and other instruments are meant to be combined in such a way as to achieve the objectives with the least finances, personnel, technical and other resources. A number of indicators was proposed to monitor the effectiveness and efficiency of the SEP's fulfilment; these indicators correspond to the indicators monitored within the EU and the OECD.

2.4 Overview of industries with highest energy demand

Industries of with highest carbon emissions are as follows:

Industry	Mt CO ₂ /a	Share
energy	7,8	71 %
steel	8,1	11,4 %
chemistry	0,6	2,5 %
cement	0,8	1,4 %
glass	0,3	0,5 %

Five companies with highest carbon emissions as follows:

ETS Company	Locality	industry	Share (%)	Allocation CO ₂ (Mt/a)
ArcelorMittal Ostrava a.s.	Ostrava	Ferrous	8,1	6,9
CEZ, a. s. - Elektrárna Pocerady	Pocerady	Energy	7,8	6,7
CEZ, a. s. - Elektrárna Prunérov 2	Prunerov	Energy	7,4	6,3
CEZ, a. s. - Elektrárna Tušimice 2	Tusimice	Energy	6,2	5,3
Sokolovská uhelná - a PPC Vresová	Vresova	Coal	5,2	4,5

3. Legislation

3.1 Energy Act

On December 30, 2004, the Energy Act including its latest amendment to the Energy Act of 2001 (Act No. 458/2000 Coll. on Business Conditions and Public Administration in the Energy Sectors) entered into force. The Energy Act of 2001 was based on EU principles and brought the electricity- and gas sectors closely in line with the EU directives. According to this law, electricity generation, transmission, distribution and trading are defined as business activities. Licenses are issued by the Energy Regulatory Office.

Principles of the new energy policy are:

- improvement of energy efficiency;
- reduction of negative impacts of energy production on the environment;
- reorganisation of the energy sector with the targets: deregulation of prices, privatisation, liberalisation.

The privatisation of energy companies aimed at the improvement of the competitiveness of Czech companies as prerequisite for the future liberalisation of the energy markets (electricity- and gas sectors). Liberalisation of the electricity market is applied in a stepwise approach: since 2002 for consumers with annual demands exceeding 40 GWh, representing about 30 % of the market. In 2003 for consumers with annual demands exceeding 9 GWh. Since 2006, the market is planned to be completely open.

3.2 Act on Energy Management

(Act No. 177/2006 Coll, in force since July 2006 replaced Act No. 406/2000 Coll. on Energy Management.)

The Energy Management act makes standards in energy efficiency of heat and electricity production, transmission, distribution and use, energy planning requirements and energy auditing obligatory.

The Energy Management Act also sets out the obligation to formulate "National Energy Policy", a strategic document with an outlook of 20 years expressing the goals of the state in energy management in accordance with the needs of economic and social development, including the protection of the environment. Draft of the National Energy Policy is prepared by the Ministry of Industry and Trade and is submitted to the Government for approval.

The Act stipulates mandatory Regional Energy Plans for all 14 regions and for 14 towns. The Act also stipulates the necessity to prepare "National Programme for Energy Efficiency and Use of Renewable and Waste Energy Sources".

Through the new version of the Energy Management act, the Directive of the European Parliament and of the Council on the energy performance of buildings (2002/91/EC) was transposed into Czech national legislation.

3.3 Establishment of Czech Environmental Information Agency

The Czech Environmental Information Agency (**CENIA**) is a state allowance organization reporting to the Czech Ministry of the Environment. CENIA was established in 2005. The key objectives of the Agency are to create, collect, validate, assess and report the cross-media environmental information supporting better sustainability and environmental policies. To support these goals, CENIA concentrates, inter alia, on

- developing and managing an integrated environmental information system including primary data validation and information syntheses;
- assessment of state of the environment in the socioeconomic context and assessment of efficiency of environment policy instruments;
- developing and operating the Integrated Pollution Register (IPR), competence centres on IPPC, waste management, REACH, BAT, EIA/SEA, eco-damages and environmental economics;
- voluntary instruments - ecolabeling, cleaner production, EMAS, awareness raising;
- leading the horizontal data related processes currently represented by INSPIRE, GMES and SEIS including coordination of the national and international reporting;
- management of the entire information and data flows in the environmental sector.

As a typical example, the Agency builds the Integrated Polluters Register (IPR) which integrates all mandatory environmental reporting from polluters to government and connects databases on IPPC facilities, water discharges, air pollution sources, waste management, ePRTR and contaminated sites. Secondly the project decomposes the whole environmental legislation extracting the duties, responsibilities and procedures, that will be made available through helpdesk, portal and also as a sort of pre-due diligence through geoportal. Thus no polluter or local administrative body will be left ignorant of the correct terms and procedures when dealing with the environmental sector.

CENIA became major governmental data broker as it develops and operates cross cutting national metadata and map portals (geoportal.cenia.cz, mis.cenia.cz), information system on statistics and reporting (issar.cenia.cz), environmental portal (portal.cenia.cz) and portal for environmental education (vitejtenazemi.cenia.cz) as well as thematic portals for Water Framework Directive (voda.cenia.cz), military atlas (izgard.cenia.cz) and many others.

Furthermore CENIA is in charge of an interdisciplinary and intersectoral assessment and interpretations of information on the environment in the context of social and on the economic data and sustainable development. The Agency publishes primarily yearly State of the Environment Report, Environmental Statistics Yearbook, complex reviews (The environment in the Czech Republic 1989-2005, The economy and the environment 1989-2008), public awareness raising publications (The environment - environment for life?) and methodology guidebooks (Assessor's handbook, Guide to cleaner production).

At international level CENIA acts as National Focal Point and National Reference Centre for different thematic areas towards European Environment Agency. CENIA has been leading European Topic Centre on Water Consortium since 2007 as the first new EU Member State.

CENIA acts as a standard Environment Protection Agency with an emphasis on knowledge and its management. The Agency has 110 permanent employees, of which 80% hold a university degree and has been certified according to ISO 9001:2000, ISO14001:2004, OHSAS 18001:1999 and EMAS.

By adopting Decision No. 2002/358/EC of the European Parliament, of the Kyoto Protocol on Climate Change, the EU and its member states undertook to reduce greenhouse gas emissions.

As a consequence, Directive No. 2003/87/EC of the European Parliament establishing a scheme for greenhouse gas emission allowance trading was approved on 13 October 2003.

4. Financial market

In the Czech Republic, the Ministry of Environment (MoE) is the national entity with overall responsibility for the National Inventory System (NIS). The Czech Hydrometeorological Institute (CHMI) has been commissioned by the Ministry of the Environment (MoE) to manage the National Inventory System in accordance with Article 5 of the Kyoto Protocol and decision 19/CMP.1. CHMI is designated as the coordinating and managing body responsible for the compilation of the national greenhouse gas inventory and reporting its results.

In Annex B of the Kyoto Protocol, the Czech Republic is required to reduce its emissions to a level of 92% of those in the base year. 1990 was selected as the base year for CO₂, CH₄ and N₂O and 1995 was selected as the base year for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride, in accordance with Article 3(8) of the Kyoto Protocol.

4.1 National Allocation Plan

Czech Republic developed the National Allocation Plan allocating carbon dioxide (CO₂) emission allowances for the 2008-2012 trading period of the EU Emission Trading Scheme (ETS). The cleared annual allocation for Czech Republic for year 2009 allocates 85 445 875 t CO₂.

A reduction commitment for Czech Republic for the 2008-2012 period is defined in the Annex B to the Kyoto Protocol as a five-multiple of 92% of total national greenhouse gas emissions in 1990 (reduction commitment -8%).

5. National situation in the carbon markets

To meet its obligations to reduce greenhouse gas concentrations under the Kyoto Protocol, the European Union established an Emissions Trading System (ETS) started in January 2005. The scheme is based on Directive 2003/87/EC, which came into force on 25 October 2003.

The EU ETS is a 'cap and trade' system, which means that it caps the overall level of emissions allowed but, within that limit, allows participants in the system to buy and sell

allowances - European Union Allowances (EUA) - as they require. These allowances are the common trading 'currency' at the heart of the system. One allowance gives the holder the right to emit one tonne of CO₂. The cap on the total number of allowances is what creates scarcity in the market.

However countries will have a certain degree of flexibility in how they make and measure their emissions reductions. Three flexible mechanisms have been identified:

- A.** an international "emissions trading" regime will be established allowing industrialised countries to buy and sell emission credits amongst themselves,
- B.** they will also be able to acquire "emission reduction units" by financing certain kinds of projects in other developed countries through a mechanism known as **Joint Implementation (JI)**,
- C.** the Clean Development Mechanism (CDM) enables industrialised countries to finance emissions-reduction projects in developing countries and receive credit for doing so (see articles 6, 12 and 17 of Kyoto protocol).

5.1 European Emission Trading Scheme and National Allocation Plan

Emissions trading covers both the energy and industrial sectors. Within the European Emission Trading Scheme (EU ETS) two Emissions Trading Periods were established. The first one lasted three years from 2005 to 2007. The second emissions trading period covers five years from 2008 to 2012. The first period was seen as a largely experimental phase, and resulted in a sharp fluctuation in the price of certificates during the three years.

The member states have had to develop a National Allocation Plan (NAP) for each trading period, termed NAP I (2005-2007) and NAP II (2008-2012). These plans define the installations included in the EU ETS as well as the overall cap of the CO₂ emissions.

5.2 Clean Development Mechanism (CDM) opportunities, requirements and SET transfer demand

Every EU Member State that has a commitment to the EU ETS to reduce its CO₂-emissions has to define in its NAP - the maximum amount of JI/CDM-project certificates, which installations included in the EU ETS covering its territory, may use in order to fulfill their obligation.

5.3 Joint Implementation (JI) opportunities and requirements

Joint Implementation and Clean Development Mechanism (CDM) projects are both part of the project-based flexible Kyoto mechanisms. JI is based on Article 6 of the Kyoto Protocol and offer industrial countries the opportunity to reduce greenhouse gases in the host industrial country, as pledged in the Kyoto Protocol. Companies can also participate in JI projects and utilize the certificates issued to them. JI climate projects are only open to countries named in Annex B of the Kyoto Protocol and companies based in those countries.

5.3.1 Criteria for the Participation in JI projects

It is important for the states involved in JI projects to fulfil the Kyoto mechanism participation criteria, as laid out in the Marrakech Accords.

These include:

1. Ratification of the Kyoto Protocol
2. Calculation of Assigned Amount Units (AAUs) in accordance with the Kyoto
3. Protocol Annex B
4. An established national system for the evaluation of greenhouse gas emissions and carbon sinks.
5. An established computer-based national registry
6. Timely submission of annual emissions inventories
7. Submission of additional information on the Assigned Amount

An investor country must fulfill criteria 1 to 6. To participate in the JI mechanism, a host country must fulfill criteria 1, 2 and 4. A host country that fulfills criteria 1 to 6 will be authorized to verify the reduction in the output of greenhouse gases or their storage in sinks and to issue the relevant Emission Reduction Units (ERU)s. The host country can, to a large extent, make its own decisions on how to implement the JI climate project requirements and decide on the stages of the project cycle. This procedure is easier for the states involved and known as JI Track 1.

Where the host country fulfills only criteria 1, 2 and 4, the JI project will be supervised by the JI Supervisory Committee (JISC). This internationally valid procedure is similar to the CDM procedure and known as JI Track 2. Host countries that fulfill the criteria for track 1 still have the option of choosing track 2.

The **Joint Implementation (JI)** mechanism gives industrialised countries (those listed in Annex I of the Kyoto protocol), and companies in them, the possibility to finance emission-saving projects in other developed countries, in the Czech Republic for example. In return they will receive Emission Reduction Units that count towards their emission targets. These will be deducted from the assigned amount of the country in which the project is located.

JI and CDM mechanisms are concrete projects based while emission trading functions at a macro-level. The reason to develop such mechanism is that investments should be made where they will have the greatest cost effectiveness and thus the greatest impact on the climate system. It will allow the industrialised countries to make a part of their climate protection investment abroad, in countries where marginal abatement cost are lower.

5.3.2 Joint Implementation in Czech Republic

In Czech Republic the Ministry of Environment is responsible for JI project and a National Reference Centre (NRC) has been established within the Department of Integrated Financing of the Ministry. On 7 January 2002 a framework for JI projects has been officially approved with the following key points[4] :

- Approximately 2 Mt CO₂ eq. annually have been allocated for JI, or about 10 Mt for the period 2008-2012.
- Projects must comply with legislation and must not lead to transfer of pollution (from air to soil or water)
- Renewables have a priority
- Transparent calculation of baseline
- Compliance with the priorities of the State Environmental Policy and the State programme of Support for Energy Savings and use of Renewable Sources of Energy.
- Use best available technology
- Compliance with macro-economical policies (employment...)

Jl projects needed for bioenergy in the Czech Republic. Czech Republic has to adapt its energy structure and industries to Community standards and renewables have the potential to be helpful to achieve this goal. The current biomass use amounts to 24 PJ/year or 1,3% of the total consumption of primary energy sources. A target of 96,5 PJ/year in 2010 has been defined in a National Programme. At present bioenergy takes the form of about 40 000 domestic boilers, 100 municipal boilers, 450 boilers in industries and 35 biogas plants.

Manufacturing of these technologies takes often place in Czech companies that are able to propose reliable boilers, much cheaper in comparison with foreign technologies.

However, if bioenergy is to represent a major energy sector in the Czech Republic larger scale developments have to be undertaken, and these represent opportunities for export for EU countries/companies that have such expertise.

Bioenergy has an enormous potential development in the Czech Republic that has to adapt its energy structure to EU standards. It represents socio-economic development in the Czech Republic but also export opportunities for EU companies for specific technologies and know-how.

6. Companies in the Carbon Markets

Through the Kyoto Protocol, the Czech Republic agreed that its Greenhouse Gas (GHG) emissions for the years 2008-12 would not exceed 92% of the 1990 level (multiplied by five).

In 2003, the EU adopted an Emissions Trading Directive to create a new, unified emission quota market for trading of carbon allowances. As a result, the vast majority of installations producing carbon dioxide and engaged in energy activities, cannot operate at all unless they hold a GHG emissions permit.

6.1 General overview of ETS branches

During individual negotiations, enterprises submitted development of emissions since 1990, calculated preferentially according to the draft Commission Decision on a Directive on monitoring GHG emissions and on reporting these emissions in accordance with the [Directive 2003/87/EC](#). Allowances were allocated for the installations after assessing these backgrounds and possible specifications.

As stated in Chapter 5 two Emissions Trading Periods were established, each supported by National Allocation Plan (NAP). The first, called NAP 1 lasted three years from 2005 to 2007. The second emissions trading period supported with NAP 2 lasts five years from 2008 to 2012. These plans define the installations included in the EU ETS as well as the overall cap of the CO₂ emissions.

The first period being as a largely experimental phase, resulted in sharp fluctuations in the price of certificates during the three years.

Seven industrial processes have been covered in the Czech Republic and corresponding allocations are listed in Table 6-1.

Table 6-1. Allocated allowances through industrial branches based on NAP 1.

Industry process		Installation count	Allocated allowances (kt CO ₂)/a 2005-2007	Verified emissions (kt CO ₂)		
#	Name			2005	2006	2007
1	Refining	4	1370	997	1105	1095
2	Paper	10	425	265	261	167
3	Iron & Steel	8	5770	4681	4931	5247
4	Glass	21	801	769	770	764
5	Combustion	297	83334	71457	72041	75484
6	Cement & Lime	11	4388	3561	3826	4335
7	Bricks & Ceramics	66	830	724	689	742
	All	417	96920	82455	83625	87835

The same seven industrial processes have been covered in NAP 2 and corresponding allocations are listed in Table 6-2.

Table 6-2. Allocated allowances through industrial processes based on NAP 2.

	Industry process	Installation count	Allocated allowances 2008-2012 (kt/a)	Verified emissions 2008 (kt/a)
1	Refining	4	1088	1087
2	Paper	10	210	134
3	Iron & Steel	8	3052	3203
4	Glass	21	971	823
5	Combustion	297	75,578	70442
6	Cement & Lime	11	3836	4057
7	Bricks & Ceramics	66	823	652
	All	417	85559	80399

6.2 Key Stakeholders

Almost 70% of allowances allocated for year 2009 are in hands of 21 biggest emitters shown in Table 6-3:

Table 6-3: CO₂ allocations (in mega-tons per 5 years) of 21 biggest shareholders responsible for almost 68,4% of CO₂ emissions in the Czech Republic.

ETS Company	Locality (city)	Industrial Process	Share (%)	Allocation CO ₂ (Mt/a)
Arcelor Mittal Energ.	Ostrava	Iron & Steel	8,1	7,0
CEZ, Elektr. Pocerady	Pocerady	Combustion	7,8	6,7
CEZ, Elektr. Prunérov	Prunerov	Combustion	7,4	6,3
CEZ, Elektr. Tušimice	Tusimice	Combustion	6,2	5,3
Sokol.uhelná PPC	Vresova	Combustion	5,2	4,5
CEZ, Elektr. Chvaletice	Chvaletice	Combustion	3,2	2,7
Unipetrol, Energetika	Litvin.-Zal.	Combustion	3,3	2,8
International Power	Opatovice	Combustion	3,0	2,6
CEZ, Elek. Detmarovice	Detmrvc.	Combustion	2,9	2,5
CEZ, Elektr. Melník 3	Melnik	Combustion	2,3	2,0
ENERGOTRANS-Elektř. Melník 1	Melnik	Combustion	2,6	2,2
CEZ, a. s. - Elektrárna Ledvice	Ledvice	Combustion	2,4	2,1
CEZ, a. s. - Elektrárna Tisová	Tisova	Combustion	2,2	1,9
ENERGETIKA TRINEC	Trinec	Combustion	2,1	1,8
ECK - Elektrárna Kladno	Kladno	Combustion	1,9	1,6
Teplárna Komorany	Komorany	Combustion	1,7	1,4
Dalkia - Elektrárna Trebovice	Trebovice	Combustion	1,6	1,4
CEZ, a. s. - Elektrárna Melník 2	Melnik	Combustion	1,3	1,1
Dalkia - Teplárna Trmice	Trnice	Combustion	1,3	1,1
Plzenská teplárenská -	Plzen	Combustion	1	0,8
CEZ, a. s. - Elektrárna Porčí	Porici	Combustion	0,9	0,8
“Top 21”			68,4	58,6
Czech Republic total			100	85,5

Some of the plants indicated in Table 6-3 as “Combustion process” spread across industries in which energy production is not final product (e.g. Sokolovska uhelna in Vresova, Unipetrol in Litvinov, or Trinec), while emissions are generated by their own energy producing divisions.

Table 6-4. Allowances allocated from NAP1 for biggest ten emitters in the Czech Republic.

Company		Locality (city)	Allocated allowances (kt CO ₂)/a	Verified emissions (kt CO ₂)		
				2005	2006	2007
	Name		2005-2007			
1	CEZ, Elektr. Pocerady	Pocerady	7177	6668	6557	6896
2	Arcelor Mittal Energ.	Ostrava	6418	4858	5271	5324
3	CEZ, Elektr. Prunérov	Prunerov	6117	5924	6587	7105
4	CEZ, Elektr. Tušimice	Tusimice	5135	5121	5364	4107
5	Sokol.uhelná PPC	Vresova	4602	4500	4345	4435
6	CEZ, Elektr. Chvaletice	Chvaletice	3416	2678	2692	4116
7	Unipetrol, Energetika	Litvinov-Zal.	3126	2790	2779	2617
8	International Power	Opatovice	2800	2575	2501	2640
9	CEZ, Elek. Detmarovice	Detmarvce.	2701	2258	2593	3607
10	CEZ, Elektr. Melnik 3	Melnik	2689	2141	1778	2870
“Top 10” total			44181	39513	40467	43717

Table 6-5. Allowances allocated from NAP2 for biggest ten emitters in the Czech Republic.

	Company	Locality (city)	Allocated allowances 2008-2012 (kt/a)	Verified emissions 2008 (kt/a)
1	CEZ, Elektr. Pocerady	Pocerady	6697	6401
2	Arcelor Mittal Energ.	Ostrava	6959	6422
3	CEZ, Elektr. Prunérov	Prunerov	6335	6433
4	CEZ, Elektr. Tušimice	Tusimice	5310	2746
5	Sokol.uhelná PPC	Vresova	4479	4258
6	CEZ, Elektr. Chvaletice	Chvaletice	2719	3362
7	Unipetrol, Energetika	Litvin.-Zal.	2820	2462
8	International Power	Opatovice	2571	2467
9	CEZ, Elek. Detmarovice	Detmrvc.	2456	2067
10	CEZ, Elektr. Melnik 3	Melnik	1985	2705
“Top 10” total			42331	39323

6.3 Identification of technology needs in targeted companies

6.3.1 SET priorities by industry sector

Priorities in technology needs by industry sector are focused to Power Generation industries.

Power & heat production: This category is the dominant emitter among all industry in the Czech Republic, mainly company CEZ a.s. who is the main power generation utility producing 90% of national power.

CEZ management prepares program for intensive biomass co-combustion in several coal-burning plants with aim to substitute 1500 kt/a of coal with biomass.

At the same time degree of cogeneration in thermal plants is one of the highest priorities. For example, in June, 2009 ČEZ concluded a contract with ŠKODA PRAHA Invest. for the

design, supply, procurement, erection and commissioning of a Gas Turbine Combined Cycle (GTCC) powerplant capacity 841 MW. to be built in Pocerady. It's construction will start early 2010. Development of this GTCC plant will be in progress in the period from October 2010 to April 2013. Project costs are of the investment amounts approx 800 Mill. EUR.

The new plant will not produce any sulphur oxides emissions or dust, emission of nitrogen oxides will be ten times less than the rest of Pocerady coal-fired blocks. Electric power efficiency of more than 57% is unprecedented in the Czech Republic.

6.3.2 SET priorities by technology

Biomass / bioenergy are identified as highest SET priorities among all technologies in the Czech Republic.

In years 2006 – 2008 biomass as secondary fuel has been introduced in power plant EHO CEZ (Elektrarna Hodonin, ČEZ, hereafter “EHO”) in city of Hodonin, East of the country. For this purpose two lignite-fired Circulating Fluid Bed (CFB) boilers K01 and K02, were subsequently retrofitted with new cofiring systems adopted to simultaneous burning of mix of coal with wood chips. EHO has become the biggest producer of electric power from biomass in the Czech Republic. The new system can even operate on pure biomass which is rarity in this range of boiler capacity per unit. Compliance with stringent emission standards was fulfilled. Process economy and reliability were improved dramatically as well.

7. R&D priorities

7.1 General national aspects

The Research and Technical Development (RTD) activities in the Czech Republic are coordinated by Government. Ministry of Education is the executive subject responsible for their supervision. Legislation framework for this sector is codified by the RTD Act [Code number 130/2002 Coll.]. The Research and Development Council is the successor of the Research and Development Council of the Government of the Czech Republic, which was established according to the previous RTD Act [Code number 300/1992 Coll.]. The members of the Research and Development Council assemble at the meetings taking place once a month where they discuss and approve the materials related to the fulfilment of the tasks of the Council. Between the meetings, the Presidium of the Council meets at least once a week.

Important initiative called “Sustainable Energy of the Czech Republic Technology Platform” aims at effective promotion of communication and cooperation among the manufacturers, operators and research centres planning to get involved in the implementation of structural and technological changes in the energy sector in the Czech Republic. It's aim is to actively participate in the Strategic Energy Technology Plan (SET Plan) of the European Commission encouraging the introduction of innovative energy technologies, which will contribute to a system solution of a possible imbalance between production and consumption, strengthen energy safety and ensure that the ambitious goals in environmental protection be fulfilled.

The platform is open to other entrepreneurial and research entities planning to take an active part in solving the use of new energy technologies. The platform is ready to assist the Czech party in its involvement in energy research and development and in other key EU initiatives in the field of clean technologies.

The founding members of the platform are ČEZ a.s., Škoda Power a.s., EGÚ Brno a.s., ČVUT Prague, VUT Brno, The Ministry of Industry and Trade, Ministry of Education, and Research and Development Council of the Government of the Czech Republic et al.

Practical implementation of RTD activities through promotion of pilot projects are supported e.g. by Czech Energy Agency (CEA).

The CEA is a subsidised organisation established by the Decision of the Minister of Industry and Trade from 1.9.1995. Its mission is to initiate, support and realize activities leading to energy savings and reductions of the negative environmental impacts of the consumption and transformation in all types of energy.

One of the main tasks of CEA is preparation, realization and consistent evaluation of the State Programs for financial subsidies for implementation of the energy savings equipments and reduction of the negative environmental impacts which are generated during energy processes.

As a part of the State Programme for Promotion of Rational Use of Energy, the Czech Energy Agency supports pilot projects on fuel cells use in the Czech Republic through its programme in the following 2 sub-programmes, namely:

- II.2. Combined heat and power production including employment of fuel cells
- II.5. Pilot projects for demonstration of advanced technologies for production and transport of energy.

The Czech Government approved the new Energy Strategy document which sets RTD priorities and the outlook till the year 2030.

Among the general long-term priorities the Strategy lists:

- security of energy supply,
- higher utilisation of local energy sources (both non-renewable and renewable ones),
- energy efficiency,
- affordability of energy for everybody, and
- minimal impact on the environment.

To meet the priorities a system of tools has been proposed among which promotion of new technologies, know-how transfer and RTD in the field of new energy technologies is among the prioritised ones.

Hydrogen and fuel cells will play an important role meeting the general goals of the Strategy as they can highly contribute to all of them.

Programme POKROK (Progress) defines development of new technologies for use of coal including fuel cells as one of the priority fields of RTD.

7.2 RTD assessment of energy efficiency and savings technologies for the different types of industry on national level

RTD Strategy for Sustainable Development was created by the Government Council for Sustainable Development. The timeframe for 24 strategic goals has been set up to the year 2014.

Key responsible bodies are:

- Government Council for Sustainable Development (<http://wtd.vlada.cz>)
- Ministry of Environment of the Czech Republic (<http://www.env.cz>)
- Local government authorities
- Social partners
- Non-governmental organizations
- Academics

There is the indicative aim for the year 2010 stated by the Czech government with compliance of the EU regulation that 8 % of the total electricity consumption should be produced from renewable energy sources (RES). Currently this figure is about 4,3 %.

RTD strategy priorities are focused to following main branches:

- **Solar energy** (exploited by solar collectors for production of heat or by photovoltaic panels for generation of electric power).
- **Hydropower** (hydroelectric power stations, and previously, wind mills and hammer mills)
- **Wind energy** (wind power plants, wind-driven pumps, sailing ships).
- **Biomass energy** (combustion of wood waste, of straw and of wood chips, reprocessing of excrements into biogas, production of biofuels, etc.).
- **Geothermal energy** (exploitation of earth heat by heat pumps).

The largest RES electricity production was created by hydro power plants (2019 GWh) followed by biomass (593 GWh) of which however significant share (219 GWh) is from the production of cellulose (the electricity produced is in fact used in the production factories).

As a quite important source of electricity we can consider biogas (139 GWh). The role of wind power plants and refuse incineration plants is negligible and photovoltaic systems have only demo character.

In comparison with 2003 there is a 46 % output growth in hydro power plants and 58,9 % output growth from biomass.

The RES electricity production share on the total domestic consumption was approximately 4 % in 2004.

The most important role in heat generation has a heat production from biomass (90,88 %). The total share of RES energy on primary energy resources of the CR was 2,9 % in 2004. National indicative objective is 6,7 % share on the consumption of primary energy sources in 2010.

RTD priorities for Renewable Energy Technologies in the Czech Republic are as follows:

- Electricity generation from RES
- Heating and Cooling from RES
- Renewable Energy in Transport Applications
- Technologies for renewable electricity production are at a different stage of development, but all require some RTD with a view to reducing their cost, and facilitating their integration into the grid to increase their consumption
- RTD to increase the adoption of RETs into the heating and cooling sector should include the improvement of building technologies and energy efficiency measures

- RTD for transport applications should focus both on improving the fuel production processes, and to create the requested infrastructure for the uptake of renewable-based fuels

Position of hydrogen-based technologies:

- Hydrogen can be produced using local energy sources (coal, hydro, wind, nuclear) and thus reduce demand for energy import,
- Hydrogen can be stored and thus improve reliability of energy supply,
- Hydrogen can be used in combined heat and power and production and thus would improve energy efficiency and reduce production costs and provide energy at affordable price,
- Hydrogen use has minimal impact on the environment in all types of use.
- A special attention will be given to the use of hydrogen in transport to meet the common EU policy in diversification of fuels.
- Hydrogen and fuel cells technologies will play an important role and should be promoted in all sectors.
- Support to hydrogen and fuel cell technologies is mostly provided by the Ministry of Industry within its programmes for RTD and implementation of advanced technologies, either through its own programmes or through activities of the Czech Energy Agency.
- The Czech Government approved the new Energy Strategy document in March 2004.

7.3 Multiregional Operational Programme 2007-13: Research and Development for Innovations

This program is co-funded by the European Regional Development Fund (ERDF) It was approved on 25 September 2007 by the European Commission for all Czech regions (except for Prague) for the period 2007-13. Its managing authority is Ministry of Education, Youth and Sports.

It falls within the framework laid out for the Convergence Objective and has a total budget of around €2.4 billion. Community assistance through the European Regional Development Fund (ERDF) amounts to some €2.1 billion, which represents approximately 7.9% of the total EU investment earmarked for the Czech Republic under the Cohesion Policy 2007-13.

7.3.1 Aim and purpose of the programme

Upon joining the EU, Czech Republic was included in the integration process for the national policies on research, development and innovation and related areas. Like other Member States of the EU, Czech Republic can see the key to growth of its competitiveness in research and development, the innovation abilities of its enterprises, the increasing quality of its human resources and the use of Information and Communication Technologies (ICT). As a result, for the period 2007-13, one of the priorities of the Czech Republic is to strengthen the growth of the country's competitiveness and the orientation towards a knowledge economy. The creation of highly qualified workplaces should also help make the Czech regions important locations for concentration of the aforementioned activities within Europe.

7.3.2 Expected impact of investments

The Programme should create around 2,500 new jobs in Research and Development (R&D). Total expenditure on R&D as a share of Gross Domestic Product (GDP) should increase from 1.42% to 2.2%. The Summary Innovation Index (SII) is expected to increase from 0.26 to 0.36, while support should be provided to five centres of excellence.

7.3.3 Priorities

The Operational Programme 'Research and Development for Innovations' is structured according to the following priorities:

Priority 1: European Centres of Excellence [approximately 33.1% of total funding] The main objective of this priority is to create a number of Centres of Excellence, which should be well equipped R&D centres with modern research infrastructures, able to contribute to the networking and closer integration between leading Czech R&D teams and the leading international research organisations and European research infrastructures. This effort will create internationally attractive partners in the Czech Convergence regions, research bodies with a clear research programme and prominent profile.

Priority 2: Regional R&D Centres [approximately 33.1% of total funding] This priority will support the establishment and development of R&D workplaces with quality equipment focused on applied research and reinforcement of co-operation with the application area (enterprises, hospitals, etc.) according to the needs of the region. The objective of regional R&D centres is to be a relevant research partner for collaboration with those application areas (enterprises, hospitals, etc.), including partnerships with innovative Small and Medium-sized Enterprises (SMEs) and other clusters. Through the advancement of knowledge, and the adaptation and transfer of technology and know-how, these centres will be able to contribute in an important way to the competitiveness of the economy in Czech regions.

Priority 3: Commercialisation and Popularisation of R&D [approximately 10.3% of total funding] This priority focuses on several horizontal, cross-cutting themes which are crucial for successful implementation of projects under the priority axes 1 and 2. It is open to other potential beneficiaries with a view to putting commercialisation and popularisation of research on the agenda of as many Czech R&D institutions as possible.

Priority 4: Infrastructure for University Education related to Research [approximately 20% of total funding] The main objective of this priority is to support development of a quality infrastructure of universities, the aim being to increase the capacity of tertiary education and create conditions for improving the quality of education. This type of investment represents a prerequisite for the quantitative and qualitative increase in supply of human resources which is needed for research and innovation. These efforts complement the work supported by the European Social Fund (ESF) Operational Programme 'Education for Competitiveness' which aims at improving the quality and relevance of tertiary education and strengthening the role of universities.

Priority 5: Technical Assistance [approximately 3.5% of total funding] The objective of this priority axis is to support activities carried out by the Managing Authority to ensure efficient implementation of the Operational Programme: preparation, monitoring, administrative assistance, evaluations, audit and controls.

8. Links to relevant and related websites

1. Introduction

<http://www.setatwork.eu/countries.htm>

2. General country overview

http://www.europarl.europa.eu/news/expert/infopress_page/051-52897-089-03-14_909-20090330IPR52895-30-03-2009-2009-false/default_en.htm

3. Legislation

http://www.cr-sei.cz/prehl_en.htm

4. Financial market

http://wapedia.mobi/en/Czech_Hydrometeorological_Institute

5. National situation in the carbon markets

<http://italy.usembassy.gov/pdf/other/RL33581.pdf>

6. ETS companies

<http://www.epractice.eu/en/news/283010>

7. RTD priorities

<http://www.lfhk.cuni.cz/Data/files/Veda/GrantProgramy/pr%C5%AFvodce2006a.pdf>

<http://www.mpo.cz/zprava60024.html>