

Country Profile for SLOVAKIA

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Prepared: August 2009

Published: August 2009

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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 Slovak 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 Slovakia. This information may also be of relevance to readers from other countries that are interested in an overview of Slovakia 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 Slovak Republic are shown below. Where data is not yet available, the bar chart columns are left empty.



Notes: Levels of priority recommended for SETatWork activities are given by the fact that Power Generation and Steel industries are the highest producers of GHG (green house gases).

Levels of opportunities for SETatWork providers in Slovakia are based on the fact that biomass resources are one of the highest in Europe and this potential is currently not fully exploited.

2. General Country Overview

2.1 National energy system

Slovakia is a country with a shortage of indigenous energy sources and, therefore, over 90% of primary energy sources have to be imported.

Table 1 shows the energy mix found in Slovakia. This is relatively favourable in terms of carbon produced per unit of energy produced due to the high proportion based on nuclear power as well as the considerable share produced as hydro-electricity. Electricity consumption in Slovakia has been fairly steady since 1990. It is rising by 3% a year. Generating capacity in 2005 was 7.7 GWe, 34% of this came from nuclear. In 2006, 31.4 TWh gross was produced, with 57% of this derived from nuclear power. Up to the end of 2006 the Slovak Republic was a net exporter of electricity - some 2 TWh/a. *Per capita* consumption is about 4300 kWh/a. 60% of electric power is generated by SE a.s., a subsidiary of EnEI.

Table 1: Electricity & heat supply breakdown 2005 (source: IEA).

Primary source	Electricity (GWh)	Heat (TJ)
coal	6000	10937
oil	741	257
gas	2184	36585
biomass	9	1808
waste	47	528
nuclear	17727	2233
hydro	4741	
geothermal	0	140
solar PV	0	
solar thermal	0	1
wind	6	0
tide	0	0
other sources	0	56
Total Production	31455	52545
Imports	8005	0
Exports	-11270	0
Domestic Supply	28190	52545
Statistical Differences	0	0
Total Transformation*	3	0
Electricity Plants	0	0
Heat Plants	3	
Energy Sector**	3650	6794
Distribution Losses	1687	5925
Total Final Consumption	22850	39826
Industry	11034	3433
Transport	572	0
Residential	4701	26187
Commercial and Public Services	6151	10027
Agriculture / Forestry	392	179

2.1.1 The Nuclear Power Industry

The Nuclear Power Industry of Slovakia involves five nuclear reactors with two more at the planning stage. The first commercial nuclear power reactor began operating in 1972. Government commitment to the future of nuclear energy is strong. An overview of nuclear capacity is shown in table 2.

Table 2: Nuclear Plants in Slovakia.

Reactors	Model (V=PWR)	Status	Net MWe	First power	Closure year
Bohunice 1 (V1)	V-230	Closed	408	1980	2006/12
Bohunice 2 (V1)	V-230	Closed	408	1980	2008/12
Bohunice 3 (V2)	V-213	Operating	408	1984	2025
Bohunice 4 (V2)	V-213	Operating	408	1985	2025
Mochovce 1	V-213	Operating	435	1998	
Mochovce 2	V-213	Operating	435	1999	
Mochovce 3	V-213	Planning	435	2012	
Mochovce 4	V-213	Planning	435	2013	

The government has raised the possibility of building a fifth unit at Mochovce as well as new capacity at Bohunice or at a new site in the east of the country at Kecerovce. In March 2007 the German utility E-ON indicated its interest in building new reactors at Bohunice, and in October the Czech utility CEZ indicated a similar interest. A nuclear cooperation agreement with France was signed in September 2008. This brought EdF and Areva in to the picture as possible companies to be involved in a seventh reactor (following B-2 closure).

Plans for Bohunice 5 (V3) were announced in April 2008 and are for a 1000-1600 MWe facility involving a partner other than ENEL and probably western technology. A public-private partnership is envisaged that will build and own the reactor, with the government holding 51%, financed out of SE revenue.

The government's list of priority power projects beyond Bohunice V3 include another 1200 MWe nuclear plant at Kecerovce after the closure of Bohunice V2 units around year 2025 with estimated cost of EUR 3.5 billion.

Nuclear Fuel Cycle All fuel supply is contracted from TVEL in Russia.

Radioactive Waste Management Originally the policy was for used fuel to be disposed of without reprocessing, but in 2008 this changed to recycling it. In 1996 the decommissioning and radioactive waste management organisation (SE-VYZ) was set up as a subsidiary of SE, based at Bohunice. Then a separate subsidiary of SE - Decom - was set up as a consultancy and to focus on decommissioning. An interim wet storage facility for spent fuel at Bohunice supplements reactor storage ponds, and has a capacity of 1680 tonnes (14,000 fuel assemblies). Some spent fuel has been exported to Russia. Site selection for an underground high-level waste repository has commenced. A treatment and conditioning plant for low- and intermediate-level wastes exists at Bohunice, with a repository at Mochovce.

A state fund for radioactive waste management and decommissioning was set up in 1995, with a levy of 10% of the wholesale price of electricity being paid into it by SE. This is expected to amount to EUR 775 million by 2010. A long-term spent fuel storage facility is

expected to cost about SK 4 billion (EUR 100 million). Decom, with the Association for Regional & International Underground Storage (ARIUS - based in Switzerland), is running an EC-funded project to undertake a pilot study on the technical and legal requirements for a regional waste repository. This SAPIERR project is related to the needs of countries with smaller nuclear programs, and it involves 21 organisations from 14 countries.

The first phase of decommissioning of the A1 reactor was due to be completed in 2007. Preparation for decommissioning the two Bohunice V1 reactors will begin in 2012, with the work taking 13 years at an estimated cost of about EUR 500 million.

2.1.2 Thermal power

The dominant power producer (SE) also operates two thermal power plants (Nováky and Vojany), with an installed capacity of 1,843 MW.

In March 2004, the Slovak government put out to tender its 90 percent stake in the country's only other significant power producer, Paroplynovy Cyklus (PPC). Atel, a Swiss energy group, and the Penta Group, a Slovak financial group, acquired the 220-MW steam-gas cycle power plant. SE owns the remaining 10 percent stake in PE.

The Hungarian company, MOL, as the main shareholder in the Slovnaft oil company is planning to install a 800 MW natural-gas CHP unit (steam-gas cycle). Meanwhile in Levice a 80 MW CHP unit (steam-gas cycle) started operation in October 2007. In addition the German company E.ON plans to construct new steam-gas cycle CHP unit with the capacity 2x210 MW in Malženice.

The Coal power plants play a significant role in the Slovak power system. The total installed capacity of thermal power plants at SE, a.s., is 1398 MWe.

Power Plant Nováky is located close to city of Novaky nearby brown-coal mine and. In addition to electricity generation and supply, Elektrárne Nováky provides for hot heat for public sector and for industry.

It operates under basic and semi-peak modes. It's installed capacity is 518 MWe.

Technical parameters:

	ENO A	ENO B
Installed capacity	78,00 MW	440,00 MW
Number of units		4
Fuel	brown coal	brown coal, HFO
Commissioning	1953 - 1957	

Power Plant Vojany is situated in Eastern Slovakia, district Michalovce. It consists of two energy production plants, namely:

Power plant Vojany 1 (EVO 1 with capacity of 4 x 110 MW) and Power plant Vojany 2 (EVO 2 with capacity of 4 x 110 MW).

PP Vojany supplies base power and thus ensures reliability of the transmission network in the Eastern Slovakia necessary to sustain stability of the system qualitative indicators. With installed capacity of 880 MWe, it represents approximately 40% of installed capacity of the company Slovenské elektrárne.

EVO 2 consists of a regulating power plant the generating blocks of which are put into operation in case of scheduled or unscheduled outages on other sources. At the moment, EVO 2 units do not operate due to high costs of power generation.

The requirements for compliance with the air protection legislation, the need for upgrading, and improving the cost-effectiveness of operation of existing generating equipment had led over the period between 1997 and 2001 to the implementation of an extensive programme of SE - EVO Renewal and Reconstruction. The crucial investment projects - EVO I Units 1 and 2 Desulphurisation and Denitrification, EVO 1 Units 5 and 6 Restoration and the Replacement of EVO 2 Burners with Low-Emission ones made it possible to bring down the production of nitrogen oxides (NOx) by over 35%, that of sulphur oxides (SOx) by 60% and that of fly ashes by nearly 30%. By 2007, units EVO 1 3 and 4 and units EVO 2 5 and 6 are not in operation due to the non-compliance with relevant emission limits set forth by regulation No.: 706/2002 Ministry of Environment of the SR

Technical parameters:

	EVO 1	EVO 2
Installed capacity	4x110 MW	4x110 MW
Number of units	4	4
Fuel	black coal	gas, HFO
Commissioned:	units 1-4 / 1966	1973 - 1974

2.1.3 Hydro power

The dominant power producer (SE) also operates numerous hydropower plants, with a combined installed capacity of 2,399 MW.

Till 2013 construction of several small hydro power plants is being considered by ENEL including investment project of large pump storage on Ipeľ River.

Hydro Power Plants are capable to satisfy the swiftly changing demands in the daily-load diagram. They are suitable to cover the short time load variation in the power system. The hydro power plants located at large water reservoirs (e.g. Orava, Liptovská Mara, Nosice, Kráľová) and the pumped storage hydro-plants (e.g. Čierny Váh, Liptovská Mara, Ružín, Dobšiná) help to satisfy the non-uniform electricity consumption during the day.

Hydro Power Plants secure

- satisfaction of abrupt variations in load
- frequency control
- stand-by power in case of failure
- reactive power production

The Hydro Power Plants are suitable for frequency control and to create power reserve in the Slovakia power system.

Additional benefits for national economy are:

- water reservoir for the industry and agriculture
- protection against flood
- ship transportation
- holiday and sport resorts

Today's technology enables to utilise at hydroelectric power plants a generation process that is specific only for the hydroelectric power plants:

- high flexibility and manoeuvrability enabling to provide qualitative services for the power system
- environment friendly technology
- highly reliable operation and safety
- full automation of the whole process, possible operation with no operating staff and with remote control
- long life period of equipment and whole plant at inexhaustible primary energy resource
- low energy consumption
- compensation is possible in addition to the turbine and pumping mode.

The actually utilised potential of hydropower in the Slovak Republic is about 57.5%.

2.1.4 Power transmission & distribution network

After restructuring of Slovenske elektrarne, a.s. (SE), new company Slovak Electricity Transmission System (Slovenska elektrizacna prenosova sustava, a.s.), (thereinafter SEPS) has been established.

Position of SEPS after separation from the mother company SE

SEPS has been registered on January 21, 2002 by a recording in the Commercial Register of the Slovak Republic. SEPS acts as the transmission system operator and ensures electricity transmission through 400 and 220 kV lines on the territory of Slovakia, as well as electricity import, export, and transit. The company mission is to ensure a reliable electricity supplies to customers, maintenance, renewal, and development of the transmission system equipment, dispatching control on the territory of Slovakia, and co-ordination of the system control within internationally connected system. SEPS provides transmission and system services to its customers, i.e. electricity generation and distribution companies, customers connected to the transmission system, as well as importers, exporters, and transit companies on a contractual basis, while applying tariffs agreed by the Regulatory Office for Network Industries. SEPS has been appointed by the Ministry of Economy as the temporary market operator.

On June 2, 2004, the Slovak government agreed to privatize its 51 percent stake in the country's largest distributor Západoslovenská energetika (ZSE), with the stake split between a direct sale of 41 percent to E.ON and the remaining 10 percent floated on the Bratislava stock exchange. E.ON has declined to comment on whether it would take up the offer. E.ON originally bought a 49 percent stake in ZSE in September 2002, but sold a 9 percent stake of the distributor to the European Bank for Reconstruction and Development (EBRD) in November 2003.

RWE and Electricité de France (EDF), owners of 49 percent in the country's other two regional distributors Stredoslovenská energetika (SSE) and Východoslovenská energetika (VSE), respectively, will eventually be given the opportunity to increase their stakes. EBRD has also expressed interest in acquiring stakes in VSE and SSE.

2.1.5 Natural gas transmission and distribution network

Gas transmission as well as most of distribution in Slovakia was until recently operated by Slovenský plynarenský priemysel, a.s. (SPP). The Slovak state is the majority shareholder,

with 51% share in the company. The remaining 49% share is owned by Slovak Gas Holding B.V., whose shareholders are Gaz de France, and E.ON Ruhrgas.

SPP has legally unbundled the transmission activities and distribution activities from July 1st 2006. In addition to the parent company SPP, a. s.: 100% subsidiaries SPP Transmission (SPP Preprava, a.s) and SPP Distribution (SPP Distribucia a.s.) have also started operating on the market.

Legal unbundling of SPP has been done pursuant to Act 656/2004 on energy, which is based on EU Directive 2003/55. The General Meeting of SPP on May 16th 2006 took the decisions implementing these changes. The purpose of this step was to create independent network operators for transmission and distribution that would contribute to strengthening the transparent and indiscriminate access to the gas network for third parties, i.e. other traders with natural gas. All energy companies in the European Union have to fulfil obligation under the 2003 Directive.

The gas market has been liberalized which means that all consumers may choose their gas supplier. In 2007 the Regulatory Office for Network Industries has issued 103 licenses for natural gas supply. The majority of the recipients are the biggest industrial market players in Slovakia.

Sales of Natural Gas in 2005 have experienced a slight decline (table 3a and 3b). In the medium-term the shrinking natural gas sales have resulted from a newly adopted path of rationalization and energy-saving measures intended to improve energy efficiency. It covers mainly thermal insulation of the buildings connected to district heating or supplied by heat from individual natural-gas boiler rooms. More economic users' behaviour has also contributed to this decline. Decrease of natural gas consumption in rural regions has been caused by a general return to use of cheaper solid fuels (fire wood, coal).

Table 3a: *Natural gas sales in 2005.*

	Volume (mil.m³)	Number of consumers
Large	4 070	4 713
Small	516	51 786
Households	1 732	1 385 238
Total	6 318	1 441 737

Table 3b: Natural gas sales in 2005 – breakdown, expressed in TJ on a gross calorific value basis

	TJ
Production	5876
From Other Sources	0
Imports	281273
Exports	-14461
International Marine Bunkers	0
Stock Changes	1019
Domestic Supply	273707
Transfers	0
Statistical Differences	888
Total Transformation	65814
Electricity Plants	0
CHP Plants	29657
Heat Plants	29451
Petroleum Refineries	6706
Other Transformation	0
Energy Sector	8065
Distribution Losses	80
Total Final Consumption	200636
Industry	45084
Transport	27929
Residential	65943
Commercial and Public Services	41894
Agriculture / Forestry	1856
Fishing	0
Other Non-Specified	0
Non-Energy Use	17930
<i>of which Petrochemical Feedstocks</i>	<i>17930</i>

2.1.6 Fossil fuel sources

Slovakia is a country with a shortage of indigenous energy sources and , therefore, over 90% of primary energy sources have to be imported from abroad, especially from the Ukraine (coal), the Czech Republic (coal), to a lesser extent from Poland (coal) and the Russian federation (gas, oil and coal). The only indigenous energy sources are low-grade brown coal, small amounts of gas and crude oil. Fuel for nuclear power is also imported from abroad. Net fuel imports in 2005 in Mtoe (mega ton of oil equivalent) were as shown in table 4.

About 98% of domestic natural gas consumption is being imported from the Russian Federation. Supply is ensured based on a contract between SPP, a.s. and the Russian company Gazexport. Annual natural gas consumption makes up some 7 bn. m³, out of which national gas production represents some 3%. The remaining gas volume is imported from

the Russian Federation. About 88 billions m³ of natural gas is being transmitted through Slovakia to the Western Europe. Domestic natural gas resources represent only about 5% of domestic consumption.

Table 4: Net fuel imports:

Fuel Type	Energy value (Mtoe)	Percent
Solid fuels	3.70	30
Oil	3.31	26
Natural gas	5,76	46

2.2 Security of supply

The CENTREL electricity system links Slovakia, with Czech Republic, Poland and Hungary. In 1995, CENTREL system was connected with the Western European grid. Currently, both north-south and east-west connections are being expanded, as part of the EU's Trans-European Energy Network Project. This includes 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 represents the interests of transmission operators in 20 countries.

Total energy consumption is decreasing steadily in Slovakia year by year as shown in Figure 1. The reason is the gradual implementation of saving measures on the demand site (consumption). Changes in the years 1993 – 2003 were as follows:

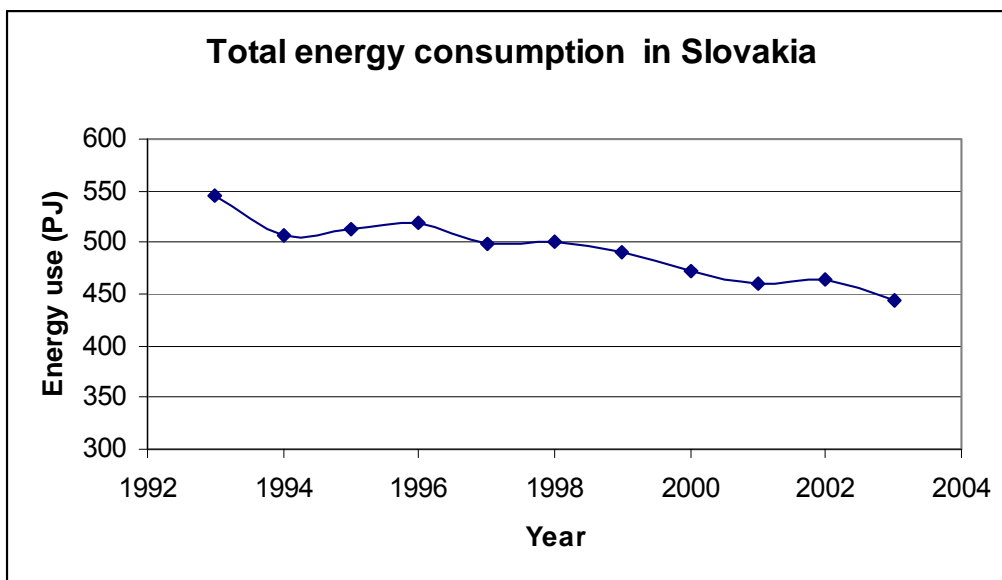


Figure 1: Annual energy consumption (PJ) in Slovakia between 1993 and 2003.
 Source: Ministry of Economy

Position of Slovakia 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.

Slovakia is represented in UCTE through SEPS, which has been a fully-fledged member since May 17, 2001 with all rights and duties arising from the membership. The duties are the following:

- responsibility for 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

Owing to its climate-friendly energy sector structure Slovakia has lower CO₂ emissions than the European average, as indicated in table 5.

Table 5: 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 Republic	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		

Since 1990 CO₂ emissions have been decreasing as shown in table 6.

Table 6: Total carbon emissions in Slovakia showing decline over a 25 year period

	CO₂ kg/cap
1990	11,500
1995	8,000
2000	7,300
2005	7,300

2.4 Overview of industries with highest energy demand

Industries with the highest energy demand and hence producing the most carbon dioxide are listed in table 7.

Table 7: Distribution of energy use by sector

Industry	mil.t/5 yrs	%
energy generation	60	32
steel production	59	31.3
oil production	15	8
cement production	12	6.5
lime production	5.7	3
pulp & paper	5.3	2.8
textiles	2	1
sugar production	1	0.5
car industry	0.3	0.15

At the same time, these industries also have the greatest potential to reduce emissions as there are around 50 individual companies that create more than 90% of the CO₂ emissions within these Slovakian industrial sectors.

2.5 Investments planned in the Power Production Industries

According to the energy policy schedule of the Ministry of Economy, about 18 bn EUR is to be invested in the Slovak power production industries by 2030. The investment will be distributed as follows:

- 44% – renewable sources,
- 35% – nuclear power,
- 15% – thermal power plants and about
- 5% at the Ipeľ hydroelectric power plant.

Three general issues are defined in the plan:

- efficient and reliable supplies by all energy sources
- reduction of energy consumption and,
- creating capacities to cover the whole economy energy demand.

Increased nuclear power capacities were announced as the most important priority. First, the ministry intends to finish the third and the fourth block of Mochovce nuclear power plant; as

well as two of the new blocks of the Jaslovské Bohunice nuclear power plant. In addition a completely new nuclear power plant in Eastern Slovakia is under consideration. The total capacity of the new energy sources to be built is planned to be 6,6 GWe for an annual electricity production of 29 TWh. The ministry also announced a tender for a partner to co-invest in a large hydroelectric power plant at the Devín village close to Capital City of Bratislava. With its capacity of 800 to 1,000 MWe the new power plant should be the largest hydropower facility in Slovakia.

3. Legislation

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 that was approved on 13 October 2003. The Slovak Republic transposed this Directive by introducing the Act on Emissions Trading No. 572/2004 Coll. as amended (hereinafter the "**Act**"). Subsequently, the Slovak National Emission Registry was established (hereinafter the "**Registry**").

Being a member of EU and in order to increase competitiveness, Slovakia committed itself to prepare its energy sector for market liberalization as required by several legislative regulations.

Overview of the EC steps toward liberalisation:

- July 2004: Industrial market opens up to competition;
- 10 Jan 2007: Commission issues progress report on the internal energy market and final results of a competition enquiry which confirmed "serious problems" in the liberalised gas and electricity markets;
- 8-9 March 2007: EU Summit adopts conclusions on energy liberalisation, calling for:
 - full implementation "in letter and spirit" of existing EU directives, and;
 - "effective separation of supply and distribution activities from network operations (unbundling)".
- July 2007: household market opens up to competition;
- 19 Sept 2007: Commission presents its 'third liberalisation package' (EurActiv 20/09/07);
- 3 Dec 2007: Discussion of third package expected at Energy Council;
- Second half 2008: French Presidency hopes to reach political agreement on the third package (EurActiv 6)

In accord with the common EU legislative framework the following timetable for liberalization has been set in Slovak Republic:

- Since 1 October 2002 electricity purchasers over 100 GWh and purchasers of natural gas over 25 mil. m³ have been allowed to choose supplier;
- Since 1 January 2003 electricity purchasers over 40 GWh and purchasers of natural gas over 15 mil. m³ have been allowed to choose supplier;
- Since 1 January 2004 electricity purchasers over 20 GWh are allowed to choose supplier;
- Since January 2005 all purchasers apart from households are allowed to choose supplier;
- Since 1 July 2007 the market is liberalized also for households.

The Directive 2003/54 (the “Electricity Directive”) was implemented in Slovakia in 2004, via Act No. 656/2004 Coll., the Energy Act, which has for the first time introduced the concepts of unbundling of the activities of vertically integrated undertakings. The Act became effective on 1 January 2005.

The Energy Act, together with the Ordinance of the Government of the Slovak Republic, no. 124/2005 Coll., lay down rules for the operation of the electricity market. The licensing regime set out in the above-mentioned legislation is fully in accordance with the requirements of the Electricity Directive;

Regarding gas market liberalisation - from 2005 all natural gas purchasers apart from households are eligible to choose their supplier. Households have been able to do this since 1 July 2007.

Price regulation Operators of distribution grids that distribute at least 1,500 GWh are statutorily obliged to purchase renewable-energy-sourced electricity at special prices to compensate for power losses.

Subsidies System operators may be subsidised for the promotion of renewable electricity by the European Structural Fund. The detailed conditions for a subsidy are specified by the respective call for applications.

Fiscal regulation mechanisms Electricity generated from renewable energy is exempt from consumption tax. In general, all technologies used in the generation of renewable-energy-sourced electricity are eligible for promotion. All instruments of promotion of renewable energy apply to the Slovak Republic only. The cost of promotion through the price-regulation is borne by those market participants (e.g. distribution grid operators) that purchase electricity to compensate for power losses. The cost of promotion through subsidies is borne by both the European Union's funds and national public funds. The cost of promotion through consumption tax exemption is borne by the state.

Connection to the grid System operators are contractually entitled against the *grid operator* to the connection of their systems to the grid according to the principle of non-discrimination. The *grid operator* is obliged to enter into the respective contract (§ 22 Par. 2 Letter o Energy Act Nr. 656/2004 Z.z. in connection with § 3 Par. 1 Government Decree Nr. 317/2007 Z.z. and § 24 Par. 2 Letter h Energy Act Nr. 656/2004 Z.z. in connection with § 3 Par. 1 Government Decree Nr. 317/2007 Z.z.)

Usage of the grid The grid users (e.g. system operators) are contractually entitled to the transmission and distribution of electricity by the *grid operator* (§ 5 Par. 1 in connection with § 7 Par. 1 Government Decree Nr. 317/2007 Z.z.). The *grid operator* is obligated to enter into this contract. The transmission and distribution of renewable-energy-sourced electricity shall be given priority.

Grid expansion Expansions of the grid shall not be carried out unless the *grid operator* in charge or a company he commissions and the system operator or another grid user have reached an agreement (§ 3 Par. 2 Government Decree Nr. 317/2007 Z.z.).

The Gas market has been fully liberalized and unbundled. The new legislation in Slovakia that shapes the open gas market, applicable as of the beginning of 2005, introduced new rules under which the Gas Trade Division became one of several players operating on the gas market with rights equal to those of other potential natural gas suppliers establishing their businesses in the Slovak Republic. According to this legislation, as of the beginning of

2005, legal unbundling of the gas supply and distribution system (SPP) has been done pursuant to Act 656/2004 on energy, which is based on EU Directive 2003/55.

4. Financial markets

In accordance with the Agreement concluded between the Slovak Ministry of Environment and Dexia banka Slovensko, a.s., incorporating the establishment and operation of the Slovak National Emission Registry, Dexia banka Slovensko, a.s. (hereinafter “**Dexia banka**” or the “**Registry administrator**”) was authorized to establish and operate the Registry, the objective of which is to provide for accurate recording of allowances issuance, allocation, holding, transfer and cancellation.

4.1 JI and voluntary markets

The Ministry of Environment’s stated preference for selling AAUs rather than JI-based ERUs represents an effort to circumvent the bureaucracy of JI. Officials in the Ministry of Environment have consistently stated their frustration with the bureaucracy of JI.

The Government has set a 10 Mt upper limit for international transfers of ERUs and AAUs during the first commitment period. With a “first come, first served” policy rather than an organized tender, this ceiling may be reached sooner rather than later.

Slovak enterprises can make applications to the MoE to receive AAUs for emissions offset projects they have carried out since 1998, or for projects they are planning to do. The government assesses these projects based on a simplified baseline methodology. There is no additionality requirement. The government issues a commitment to transfer to a buyer AAUs equivalent to these measured offsets. Reductions due to production decreases or shutdown are excluded. Greenfield renewable energy projects are sometimes ineligible because the government wants to measure actual reductions, not grid mix-derived offsets.

Slovakia calls this system “international trades backed up with projects” and makes no claim that its projects meet/track to JI criteria. The aim is apparently to make available to Slovak society surplus AAUs it “earned” through the economic downturn of the early 1990s. Although the system differs significantly from JI, it is intended to make it easier for buyers to acquire Kyoto compliance instruments linked to project offsets.

Four AIJ (Activities Implemented Jointly) projects have taken place in Slovakia. These include a large energy efficiency project sponsored by the Swiss government and a small coal-to-biomass fuel switch sponsored by the Dutch government. These projects did not generate great enthusiasm for JI in Slovakia, as the government began its emissions trading oriented strategy just as the AIJ phase was ending.

In 2002, Slovakia approved its first JI project, a bundle of landfill gas recovery measures assembled by Dutch company BKB Waste Management that was contracted under ERUPT 2.

5. National situation in carbon markets

5.1 National Allocation Plan

National Allocation Plan The Slovak Republic has developed a National Allocation Plan 1 (NAP 1) stating the total quantity of allowances that were intended to be allocated for the three-year period 2005-2007 and the allocation of the allowances between operators.

Subsequently, National Allocation Plan 2 (NAP 2) was adopted on 7 December 2007 allocating carbon dioxide (CO₂) emission allowances for the 2008-2012 trading period of the EU Emission Trading Scheme (ETS). The cleared annual allocation for Slovakia for 2008-2012 is now fixed at 32.6 million tonnes CO₂ allowances per year.

A reduction commitment for Slovakia 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%). Initially, Slovakia was not satisfied with the allocation for the Kyoto period allocated by the EU. Therefore the Ministry of Environment opposed the allocation, as it believed that drastic a decrease in the allocation could harm the Slovak economy and industry in particular.

MoE roposed to allocate nearly an additional 4 million allowances, arguing that some new nuclear capacity would not be operational before the end of 2012. After assessing the claim, the Commission has found that a partial increase of some 1.7 million allowances is justified. This assessment was carried out in line with the assessment methodology applied to all previous decisions.

However, NAP2 was agreed in early 2008 and allocations distributed among NAP2 participants for comments and discussion. Increasing CO₂ emissions and GDP growth is not linear, with GDP growing faster than emissions. It is in the interest of Slovakia to maintain and further increase this trend. One of the reasons for non-linear relationship between growth in GDP and that of emissions is the decreasing carbon intensity of the Slovak economy, mostly due to an increasing share of services on GDP generation, partial reconstruction of industry, increasing energy efficiency and modernisation of technologies, as shown in Figure 2.

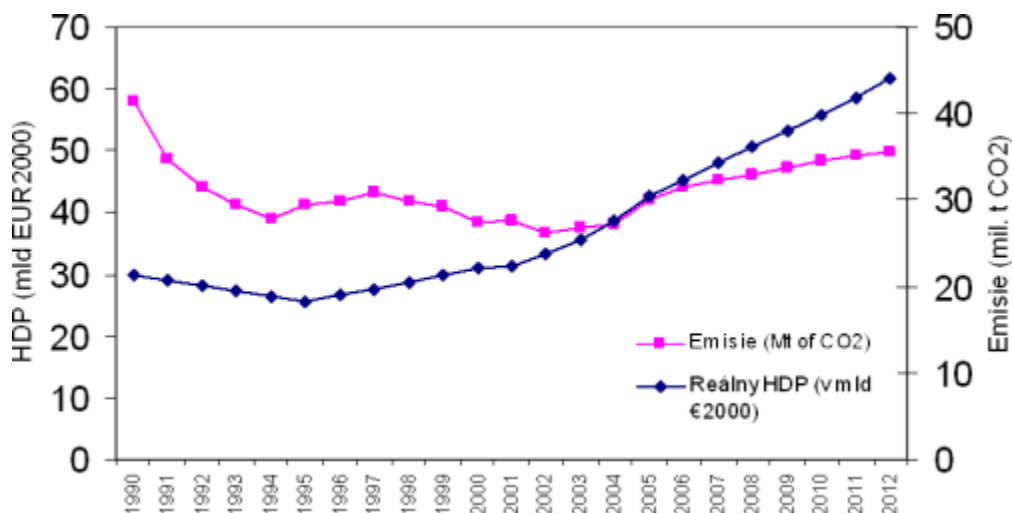


Figure 1: Annual Growth of GDP (HDP) and CO₂ emissions in Slovakia.

For the Kyoto period, total amount of emissions for NAP2 participants was set on the basis of comparison of average share of emissions generated by NAP participants projected for 2008-2012 and amount of total projected GHG emissions in the same period.

Due to step-by-step decommissioning of two nuclear power blocks (first 440 MW block by the end of 2006 and second 440 MW block by the end of 2008) and increase of energy consumption in line with GDP growth, the structure of primary energy sources is changing significantly towards fossil fuels. As a result, the share of NAP2 participants in terms of the overall emissions is increasing. The increasing NAP2 participants' share is also caused by higher utilisation of existing capacities, widening the scope of monitored emission sources in line with EU directives as well as by the construction of new sources fired by natural gas or coal.

In percentage terms, the share of NAP2 participants on the overall emissions has increased from 51,63% in 2005 to 65,99% for the period 2008–2012.

Quotas are allocated free of charge.

The law on emissions trading No. 572/2004, in addition to meeting the needs of the ETS directive, has established an obligatory CO₂ emissions trading scheme for energy sources with capacity 10–20 MW and for other sources, which are under the capacity limit set in annex I of the directive. This Kyoto regime will be implemented from 2008. In addition to obligatory sources, other sources emitting CO₂ that fulfill conditions for monitoring can be included into the scheme on a voluntary basis.

The strategy of Slovakia for fulfilling the Kyoto commitments sets as a priority a flexible mechanism of emissions trading. However, Slovakia can still take part in JI (or in future also in CDM) as donor or host country for projects which do not have impact on the sources within the scheme (energy projects).

According to current emission projections, the fulfillment of Kyoto commitment in Slovakia will not require any specific additional measures targeted at reduction of GHG emissions.

The National Allocation Plan of the Slovak Republic distributes allowances directly among individual installations without defining ceilings within specific sectors, since some sectors are represented by only a small number of installations (1 to 7).

Installations with CO₂ emissions that exceeded 0.5% of the national CO₂ emissions in a given year will receive allowance on the basis of individual negotiations with the Ministry of the Environment (group A).

Installations with CO₂ emissions not exceeding 0.5% of the national CO₂ emissions in a given year will receive allowance according to specific formula relating to each sector (group B).

5.2 Slovak National Emission Registry

Up until 2005 emissions trading in Slovakia had been blocked due to the non-existence of the National Emissions Register. However, given the fact that it was fully launched on 23 December 2005, the market began working immediately and grew rapidly. Experience shows that Slovak companies have an excess of emission allowances and mostly sell them to the Western Europe. Emission allowances are in electronic form, standardised, not limited by borders and can be sold in any EU member state.

The price of emission allowances depends on supply and demand as on any other free market. Current exchange prices of allowances are available for example at www.pointcarbon.com, www.nordpool.com or www.eex.de.

In January 2005 the European Union Greenhouse Gas Emission Trading Scheme (EU ETS) commenced operation as the largest multi-country, multi-sector Greenhouse Gas emission trading scheme world-wide. The scheme is based on Directive 2003/87/EC, which entered into force on 25 October 2003.

Emission allowances, which belong to the certain person are archived in the account opened in the Registry. Registry is normalized electronic database, which keep strict evidence about issuance, allocation, holding, transfer and cancellation of allowances. Pursuant regulation No. 2216/2004/EC of normalized and secured systems of registries each EU member has to establish and administrate its own registry.

Registry is controlled by registry administrator. Dexia banka Slovensko a.s. was designated as Slovak registry administrator by Slovak Ministry of Environment. Slovak Ministry of Environment is central institution of state administration in patens of emission trading. The title of Slovak registry is "Slovak National Emission Registry".

Dexia banka Slovensko a.s. (registry admin) opens operator holding account for each installation, which has permission to exhaust GHG and has allocated allowances in National allocation Plan.

Registry admin opens also personal holding accounts. PHA can be opened for any physical person or legal entity, operators as well.

The Registry represents a standardized electronic database aimed at an exact registration of an issue, allocation, holding, transfer and cancellation of emission allowances.

The Registry shall be permanently accessible via the Internet. It shall contain separate accounts to record allowances held by each person, having been allocated such allowances under the National Allocation Plan or by a person, who has purchased or sold such allowances.

A registry shall be established and administered by each EU member state, while each member state shall designate a registry administrator to operate and maintain such a registry. It is the Ministry of the Environment, which is responsible to establish and maintain the Registry of the Slovak Republic. The Ministry of the Environment has designated Dexia banka Slovensko a.s. the Registry administrator to operate and maintain the Slovak National Emissions Registry.

The Central Independent Transaction Log (CITL) is a registry in the form of a standardized electronic database established by the European Commission. A communication link has been established between each national registry and the CITL to enable to perform an automated follow-up of all processes concerning allowances, verified emissions, accounts and Kyoto units. These processes shall be finalized after having been verified and approved by the CITL.

Dexia banka Slovensko a.s. uses the SERINGAS software , purchased from the French company Caisse des Dépôts et Consignations (CDC).

It is important to point out, that the Registry is not allowance trading market . It registers allowances on holders' accounts and records transactions between two participants. They execute transactions in the Registry themselves via the Registry's web site. It is a seller, who always initializes a transaction in the Registry and who transfers allowances from his account to a buyer's one.

Allowance holding and the Registry's participants Any person (a natural one or a legal entity) may hold allowances. The main condition of holding allowances is to have an account opened in the Emissions Registry, where held allowances are recorded. The procedure of an account opening in the Slovak National Emissions Registry has been published on the web site in the section - " Account Opening ".

There are two groups of participants, i.e. account holders in the Registry – obligatory and voluntary participants.

Obligatory participants are operators of installations , who are obliged to be granted a permit to release greenhouse gases into the atmosphere by the Ministry of Environment of the Slovak Republic. An **operator holding account** has to be opened for such an installation by its operator. By 28 February of each year respective operations will be allocated allowances on their accounts under the National Allocation Plan, drawn –up by the Ministry of Environment of the Slovak Republic, subject to the approval of the European Commission. Each operator may trade with emissions (their selling or buying). However, he has to be aware that by 30th April each year he shall have to surrender allowances in the volume in accordance with the report on the emissions released from his operation in a course of a previous calendar year. Operators submitted emissions reports for the year 2005 for the first time (from 1.1.2005 onwards there is a duty to monitor emissions). Emissions reports shall be verified by the certified verifiers. A verifier means a natural person, who has been granted a certificate of emissions reports verification by the Ministry of Environment of the Slovak Republic. The list of the certified verifiers is published on the website of the Environment Ministry of the Slovak Republic. Any operator who does not surrender the required number of allowances by the set deadline (30th April) , shall be held liable for a payment of the penalty according to Act of Parliament No. 117/2007 Coll. amending Act of Parliament No. 572/2004 Coll. About Emission Trading.

Voluntary participants are persons who open a personal holding account in the Registry on voluntary basis. Personal holding accounts are mostly opened for allowance trading. There is also possibility to use the account for a voluntary cancellation of allowances i.e. a total amount of allowances for emissions trading will thus reduce. A personal holding account holder may arbitrarily sell or buy allowances.

A personal holding account may be opened also by an operator (an obligatory participant).
Allowance transactions

It is possible to execute the following transactions with allowances:

Domestic transfer means a transfer of allowances between two accounts maintained in the same national registry

International transfer means a transfer (a purchase or a sale) of allowances between two accounts, while each of them is maintained in a different national registry.

Surrender of allowances is a transaction which may be executed from an operator holding account. As of 30 April of each year (from 2006) each operator shall be obliged to

surrender allowances in the volume according to the verified report on emissions released from such an operation in a course of a previous calendar year .

Cancellation of allowances. After a surrender of allowances, the Registry administrator shall cancel all surrendered allowances. In addition, each allowance holder may ask the Registry administrator in writing to cancel a determined volume of allowances from his account.

6. Companies in carbon markets

6.1 Emissions Trading

Through the Kyoto Protocol, Slovakia agreed that its Greenhouse Gas (GHG) emissions for the years 2008-12 would not exceed 92% of the 1990 level (multiplied by five). Furthermore, Slovakia declared that it would seek to achieve a further 5% decrease so that its GHG emissions will not exceed 87% of the 1990 level in the 2008-12 period.

Currently, GHG emissions in Slovakia stand at 73% of their 1990 levels.

In 2003, the EU adopted an Emissions Trading Directive to create a new, unified emission quota market for trading of carbon allowances. Slovak Republic implemented the Emissions Trading Directive in November 2004. As a result, in the Slovak Republic, the vast majority of installations producing carbon dioxide and engaged in energy activities cannot operate at all unless they hold a GHG emissions permit.

6.2 General overview and structure of branches

ETS companies have been divided among two categories, A and B. Category A which have been allocated 90 % of all Slovakia allowances comprises 29 companies. Each of these has more than 0.5% of all Slovakia allowances. Allocations to each of these companies were negotiated individually with the Government. The remaining 10% of allowances have been distributed among another 150 category B companies. These are smaller emitters with less than 0,5% of Slovakia allowances. Allocations to each of these have been calculated on a proportional base linked to their previous operations.

Installations within the group A were allotted to individual sectors (A1 to A7). During individual negotiations, enterprises submitted details of their development of emissions since 1990, method of calculation (preferably according to the draft Commission Decision on a Directive on monitoring greenhouse gases emissions and on reporting these emissions in accordance with the Directive 2003/87/EC). Allowances were allocated for the installations after assessing their background and specifications. More detailed information concerning each group of installations is given below.

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 a sharp fluctuations in the price of certificates during the three years.

Seven industrial branches have been covered in the Slovak Republic and corresponding allocations within these branches are listed in Table 6-1.

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

Industry branche		Installati on count	Allocated allowances (kt CO ₂)/a	Verified emissions (kt CO ₂)		
#	Name			2005-2007	2005	2006
1	Bricks & Ceramics	12	217	113	111	113
2	Cement & Lime	10	3469	3035	3110	3316
3	Combustion	150	14483	10486	9680	8858
4	Glass	6	188	140	136	113
5	Iron & Steel	4	9652	9120	10250	9803
6	Other	6	14	13	12	6
7	Pulp & Paper	3	157	32	53	58
8	Refining	1	2291	2293	2190	2250
	All	192	30471	25232	25543	24517

As can be deduced from Table 6-1, verified emissions reached merely 82% from the amount allocated during the years 2005-2007 of NAP 1.

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

	Industry branche	Install ation count	Allocated allowances 2008-2012 (kt/a)	Verified emissions 2008 (kt/a)
1	Bricks & Ceramics	12	431	248
2	Cement & Lime	10	4136	3431
3	Combustion	150	13416	9917
4	Glass	6	189	169
5	Iron & Steel	4	11234	9206
6	Other	6	80	43
7	Pulp & Paper	3	229	74
8	Refining	1	2450	2249
	All	192	32166	25337

As can be deduced from Table 6-2, emissions verified in 2008 reached merely 79% from the amount allocated for that year by NAP 2.

6.3 Key stakeholders

A1 Thermal energy This group includes installations providing heat for inhabitants and the public sector (hospitals, schools, public buildings). These installations do not take part in economic competition and are dependent on requirements for heat supply, which is more or less dependent on the weather.

This category includes five heating plants:

- Heating plant Košice
- Heating plant Martin
- Heating plant Zvolen
- Bratislava CHP plant
- Heating plant Zilina

A2 Production of electric and thermal energy This category includes Slovenské elektrárne (ENEL), Slovenská paroplynová spoločnosť (Slovak Steam-Gas Company) in Ružomberok as a supplier for the industrial sector (primarily for paper and pulp production) and Energetika s.r.o. in Strážske supplying energy mainly for chemical production sector and partly for inhabitants.

Planned production by Slovenské elektrárne takes into consideration the decommissioning of one block of the nuclear power plant Jaslovské Bohunice and reduction of installed output in the Nováky power plant (brown coal combustion) and in the Vojany power plant (I, II). Altogether this represents a decrease of 700 MWe, that will have to be substituted by higher output in the remaining installations. The company Slovenské elektrárne would like to realize a project for cofiring (lignite + biomass) in the Novaky power plant to contribute to this.

Allocation of allowances for Slovenská paroplynová spoločnosť in Ružomberok and Energetika s.r.o. Strážske was determined by planned supplies for operations as main purchasers and planned heat supply for inhabitants. Slovenská paroplynová spoločnosť plans to develop a project focused on the installation of high capacity biomass boilers.

A3 Cement plants and lime works This category contains eight enterprises.

- Slovenské magnezitové závody, a.s., Jelšava (magnesite plant)
- Carmeuse Slovakia, s.r.o., Košice
- Carmeuse Slovakia s.r.o. závod Slavec
- HOLCIM a.s.
- Považská cementáreň a.s. Ladce (cement plant)
- Cemmac a.s. Horné Slnie
- SLOVMAG, a.s., Lubeník
- Východoslovenské stavebné hmoty a.s. (building materials)

A4 Transport of gas This category includes four operations of Slovenský plynárenský priemysel (SPP - Slovak Gas Company)

- SPP a.s. Závod 03 Veľké Zlievce
- SPP a.s. Závod 01 Veľké Kapušany
- SPP a.s. Závod 04 Ivanka pri Nitre
- SPP a.s. Závod 02 Jablonov nad Turňou

Gas consumption in turbines, which are based on compressors used to produce work rather than of electricity, has been taken into account when allocating allowances for individual operations.

A5 Production and processing of ferrous metals This category includes the biggest emitter in Slovakia, the U.S. Steel co. in Kosice. The following operations were taken into consideration: agglomeration, cokery, iron production, steel plant, rolling mill, energy sector.

A6 Production of pulp and paper The two main companies representing the pulp and paper industry are KAPPA Štúrovo a.s. and Bukocel a.s. Hencovce.

Reconstruction of paper mill BUKOCEL. Recently, pulp drying machine at the company Bukocel, a.s., Hencovce, east Slovakia has been reconstructed. This overhaul, amounting to about 1 mil. Eur was focused especially on increased production volumes by 13 %.

The company PAPCEL, a.s. realized the entire work as a “Turn-key” project, i.e. as from initial designing, complex projecting (machinery, building and electric parts), to ensuring all supplies and all necessary building and assembly works on site.

In the next phase they installed a two-rotor pulper of dry broke between a drying chamber and a format splitter. The final machine capacity grew by approx. 25 %, at the same time power demand was reduced by 10%.

A7 Chemical production, refinery

This category includes three installations:

- Sloznaft a.s. Bratislava – energy sector
- Sloznaft a.s. Bratislava – refinery
- CHEMES, a.s., Humenné

Desulphurisation of the greater part of diesel fuels produced resulted in increases in carbon dioxide emissions from 2004 that rose further with treatment of the total diesel fuel production after 2005. This increased energy use and hence CO₂ emissions from associated hydrogen production.

Sloznaft a.s. Bratislava. Deepening global economic crises and recession in Q2 of 2009 negatively impacted the results of the Sloznaft Group, mainly due to significantly lower quoted crude and oil product prices and weaker domestic demand.

The capital expenditures of the Sloznaft Group represented EUR 18.9 mln (EUR 1.6 mln lower compared to Q1 2008) and were focused mainly on the production efficiency improvement, and investments was directed to ecological projects. The biggest was retrofit of Power Generation Division with retrofit of two steam turbine generators each 25 MW resulting in total plant efficiency increase by 15%.

Installations within group B are companies providing inhabitants and the public sector (hospitals, museums, schools, etc.) with heat. These installations do not take part in economic competition and are dependent on heat supply, which reflects weather conditions. Other installations in group B were divided into the following sectors

- B.1 Small municipal heating plants
- B.2 Food processing industry
- B.3 Machinery industry
- B.4 Chemical industry
- B.5 Small pulp and paper industries
- B.6 Small metallurgy industries
- B.7 Mineral industry
- B.8 Textile industry
- B.9 Miscellaneous industries

85% of all allowances are held by the 20 largest companies as shown in Table 6-3.

Table 6-3: CO₂ allocations (in mega-tons per 5 years) of 20 biggest shareholders responsible for 85% of CO₂ emissions in Slovakia

Company emitting CO ₂	Locality (city)	CO ₂ Mt/5y	%	Industry
U.S.Steel Košice s.r.o.	Košice	59	30.1	Iron & steel
Slovenské elektrárne a.s.	Vojany	27	13.7	Combustion
Slovenské elektrárne a.s.	Novaky	19	9.8	Combustion
Slovnaft a. s.	Bratislava	13	6.5	Refining
Holcim (Slovensko) a. s.	Rohožník	6	2.9	Cement
SPP a.s.	Jablonov	4	1.9	Combustion
Považská cementáreň	Ladce	4	1.9	Cement
Paroplynový cyklus a.s.	Bratislava	4	1.9	Combustion
Carmeuse Slovakia s.r.o.	Slavec	4	1.9	Cement
Tepláreň Košice a.s.	Košice	3	1.7	Combustion
SPP a.s.(Veľké Kapušany)	Bratislava	3	1.7	Combustion
Slovakia magnezit.plant	Jelšava	3	1.7	Combustion
Východoslov.staveb.hmoty	Turňa n. Bdv.	3	1.6	Cement
Energetika s. r. o.	Strážske	3	1.3	Combustion
Cemmac a.s.	Horné Sfnie	2	1.1	Cement
Mondi Business Pap. SCP	Ružomberok	2.2	1.1	Pulp & paper
Slovnaft Petrochemicals	Bratislava	2	1.1	Combustion
Smurfit Kappa Štúrovo	Štúrovo	2	1.1	Pulp & paper
SPP a.s.(Veľké Zlievce)	Bratislava	2	1.1	Combustion
SPP a.s.(Ivanka pri Nitre)	Bratislava	2	0.9	Combustion
Total		166	85.0	

It is worth mentioning that several plants indicated in Table 6-3 labeled as „Combustion“ process go across industries in which energy production is not final product.

Table 6-4. Allowances allocated from NAP1 for biggest five emitters in Slovakia

	Company Name	Locality (city)	Allocated allowances (kt CO ₂)/a	Verified emissions (kt CO ₂)		
			2005-2007	2005	2006	2007
1	U.S.Steel Košice s.r.o.	Košice	9,549	9,058	10,128	9,659
2	Slovenské elektrárne a.s.	Vojany	2,798	2,646	2,616	2,005
3	Slovenské elektrárne a.s.	Novaky	2,478	2,155	2,056	2,097
4	Slovnaft a. s.	Bratislava	2,291	2,293	2,190	2,250
5	Holcim (Slovensko) a. s.	Rohožník	999	837	930	970
	Total		18115	16989	17920	16981

Table 6-5. Allowances allocated from NAP2 for biggest five emitters in Slovakia

	Company	Locality (city)	Allocated allowances 2008-2012 (kt/a)	Verified emissions 2008 (kt/a)
1	U.S.Steel Košice s.r.o.	Košice	10794	8960
2	Slovenské elektrárne a.s.	Vojany	2901	1584
3	Slovenské elektrárne a.s.	Novaky	2505	2495
4	Slovnaft a. s.	Bratislava	2450	2249
5	Holcim (Slovensko) a. s.	Rohožník	977	962
	Total		19627	16250

US Steel Kosice Cokery gas desulfurizing project. The project for building a desulfurizing plant for cokery gas is proceeding into the implementation phase. U. S. Steel Kosice plans to bring the new technology into operation by the end of 2010. This is an ecological project which will enable the Company to meet the national legislation requirements for the removal of sulfur from cokery gas, but at the same time it will lead to improvement in the atmosphere and the working environment at the Cokery itself, then at the steelworks generally and in the nearby surrounding area. Another positive aspect is that the purity of cokery gas in the works piping system.

6.4 Identification of technology needs in targeted companies

6.4.1 SET priorities by industry sector

Priorities of technology needs by industry sector are focused to Steel making and Power Generation industries.

Steel making industry. This category includes the biggest emitter in Slovakia, the U.S. Steel co. in Kosice.

The following operations are subject of strongest R&D attention:

- agglomeration,
- cokery,
- rolling mill,
- energy sector.

All of them are subject to innovative re-design and capacity intensification based on energy savings and coal consumption reductions.

Power & heat production. This category includes the second biggest emitter in Slovakia, SEAS – the main power generation utility producing 90% of national power.

This company operates two thermal power plants (Nováky and Vojany), with an installed capacity of 1,843 MW, both based on coal utilization.

SEAS management prepares program for intensive biomass co-combustion in both plants with aim to substitute 500 kt/a of coal with biomass.

6.4.2 SET priorities by technology

Biomass / bioenergy are identified as highest SET priorities among all technologies in Slovak republic.

Ecologisation of Heating Plant Zvolen. Recently two coal-fired boilers in Heating Plant Zvolen were retrofitted with a new cofiring system adopted to simultaneous burning of mix of coal with wood chips. Compliance with stringent emission standards was fulfilled. Process economy and reliability were improved dramatically as well. Project was partly supported by EU and partly from Government sources. Major project incentives were problems of concentrations of SO₂ in flue gases exceeding national limits for greenhouse gases emissions introduced on January 1st, 2007. The Company therefore decided to solve this ecological problem by realization of the Project and applied for a non-recourse financial grant (NFG). In 2005 Government approved grant of 16 Mil. Eur from the sources of the EU and the state budget as NFG, which originally represented 95% of capital costs of the Project.

6.5 Fields of interest

According to the energy policy schedule of the Ministry of Economy, about 18 bn EUR is to be invested in Slovak power production by 2030. This will be distributed as follows:

- 44% - renewable sources,
- 35% - nuclear power,
- 15% - thermal power plants and about
- 5% - to the Ipeľ hydroelectric power plant.

The Government has encouraged the expansion of renewable energy projects by offering tax-based incentives. This indicates that the Slovakian government is in a position to support renewable energy projects that may lead to more significant incentives in the near future. Current feed-in tariffs are relatively low, at 3 Eurocents/kWh. The Government aims to boost the amount of energy produced from RES to around 12 percent by 2020, well below the EU-wide target figure of 20 percent fixed by the Ministry of Economy. By 2010 the Government aims to reach 4.0 percent, reaching 8.0 percent by 2015 and 12.0 percent by 2020.

Biomass, geothermal, and hydro appear to be the most promising renewable energy resources for project development (table 9). Despite the extensive use of forestry wastes for energy production, it is estimated that only 10 percent of this resource is currently being utilized. There is a significant amount of forestry by-products that could potentially be used to generate electricity on a large scale, or more efficiently used to supply heat for residential and industrial needs. Although Slovakia's geothermal reserves are primarily low to medium enthalpy, there are some high enthalpy areas in the Kosice basin suitable for geothermal electricity development. Slovakia also has over 180 small hydropower plants currently in operation. In addition, there are over 250 locations on the rivers of Danube, Váh, Hron, Bodrog and Hornád with nearly 100 MW of generation potential. Slovakia has poor technical potential for solar and wind project development.

Table 9: RES potential in Slovakia.

	Technically exploitable potential (TJ)	Current utilization (TJ)	Unused potential (TJ)
Geothermal	22,680	1,224	21,456
Wind	2,178		2,178
Solar	18,720	25	18,700
Small hydro	3,722	727	2,995
Biomass	60,458	11,491	48,967
Forest biomass	10,480	1,778	8,402
Forest industry	17,570	9,497	8,073
Agriculture	32,708	216	32,492
Energy waste util.	12,726	4,504	8,222
Sludges sewage	828	47	781
Municipal wastes	6,390	1,325	5,065
Other wastes	5,508	3,132	2,376
Biofuels	9,000	1,188	7,812
Total	112,636	19,159	93,477
Large hydro	23,785	18,335	5,45
Total (including large hydro)	136,421	37,494	98,927

Biomass has the highest technical as well as utilizable potential for heat production in the form of pellets, briquettes, wood chips and straw. Co-combustion with fossil fuel in heat power plants and in combined heat and electricity production are options for biomass utilization that can be implemented relatively quickly.

US Steel as the largest producer of CO₂ emissions with a share of 30% has launched an ambitious capital investment program to improve its environmental technology and performance and to enhance production and quality processes. U S Steel Kosice plans to invest 700 million dollars by the year 2010 to modernize existing production and environmental systems, and to install new facilities.

This capital program is expected to align the Companies' operations with environmental standards. The USSK Environmental department also oversees the application of new environmental codes at all management levels and implementation of environmental management systems in compliance with the full scope of ISO EN 14001.

6.6 Realised or planned ETS projects

The first trade of greenhouse gas emissions which took place in 2002/2003, saw credits for the equivalent of 200,000 tonnes of CO₂ emissions go to the Sumitomo Corporation of Japan from the Slovak heating producer Menert. While the official price for the package was not released, experts estimate the deal was worth around 5 euro per ton, or 1 million euro in total. The sale to Sumitomo is theoretically backed up by project-based offsets, though many of these projects would not meet Marrakesh Accord criteria for additionality.

A few Slovak projects were submitted to ERUPT 3, indicating the government's willingness to issue letters of endorsement despite its preference for project-backed AAU transfers. The PCF has no Slovak projects in advanced stage of preparation.

Like its CEE neighbours, Slovakia relies extensively on district heating to supply heat to residential customers. These heating systems are being privatized and will require

substantial improvements in efficiency. Many of them are excellent candidates for biomass fuel switching.

Biomass is the most abundant energy carrier in Slovakia. The country already has a well-developed forestry sector and a number of technology and service providers who are ready to supply biomass to power generation facilities.

Landfill gas recovery will continue to be attractive, especially to multinational companies like Onyx (Vivendi) that own communal landfills in Slovakia.

Slovakia has approximately 2,500 MWe of installed hydroelectric capacity. It is expected that 300 MWe of small hydro capacity may be needed from smaller facilities that could be located throughout Slovakia. It is important to note that projects already implemented since 1998 are also eligible for project-backed AAU transactions. Thus the “pipeline” includes completed projects in addition to new project concepts.

The Slovak Ministry of Environment (MoE) developed and launched Europe’s first sulfur dioxide emissions trading system in 2002. The system has been far from liquid but demonstrated Slovakia’s commitment to try market-based solutions even in its small domestic market. The SO₂ system is downstream-oriented and covers all combustion sources larger than 50 MWth. It has a two-step grandfathering system in which a quota is allocated to district environmental offices, which then allocate to companies. The cap decreases from 180 kt in 2002 to 81 kt in 2010, a cut of over 50% over eight years.

7. R&D priorities and needs

7.1 General National Aspects

Government of the Slovak Republic coordinates state science and technology policies via **Ministry of Education** and the **Academy of Sciences** in line with the European Research Area policy the aims and priorities of which have been laid down in the Lisbon Strategy. It’s policy for the period by 2010 was specified in the Statement of Policy of the Government of the Slovak Republic.

The establishment of a grants system common to the Ministry of Education and the Academy of Sciences in 1995 has been of importance in the recent development of the research activities in the country’s universities.

Slovakia possesses 16 universities, whose links with the institutes of applied research and with SMEs have been strengthened over the last few years. R&D expenditure in the universities has more than doubled since 1994. About 2000 S&T projects are at present under way in the academic laboratories. Some of these have a level of specialisation that is internationally recognised, such as the Slovak University of Technology and Comenius University in Bratislava.

In 2005 **Slovak Research and Development Agency** (SRDA) has been established on base of the Act No. 172/2005 on organization of state research and development. The Agency is a state non-profit-making organization with objective to financially support science, research and development.

SRDA is a non-profit making organisation of the Ministry of Education of the SR established in order to support research and development by providing financial resources for solving research and development projects and projects designed to improve the infrastructure of research and development.

The Agency co-operates with the Ministry of Education of the SR in the development and implementation of national science and technology policy, ensures the research and implementation of new programmes and forms of support of international co-operation in the area of research and development and implements European programmes and initiatives related to research and development in the SR – currently within the 7th Framework Programme for Research and Technical Development for 2007-2013.

The Operational Program of Research and Development in the Department of Education is in place for 2007-2013, financed by the EFRD. EFRD is one of the EU structural funds. This fund supports development and structural changes in regional economies, including transformation of declining industrial regions and less-developed regions and through support of cross-border, national and international co-operation.

The OP implements the program document for support for research and development activities and for the infrastructure of universities to be provided in 2007 - 2013. Geographically, it covers the complete territory of the Slovak Republic.

In the program period of 2007-2013, tasks of the managerial entity for the Operational Program of Research and Development are fulfilled by the Department of Entitlement of Costs of the EU structural funds at the section of European matters at the Ministry of Education of the Slovak Republic.

The mediator under the managerial entity for the Operational Program of Research and Development is the Agency of the Ministry of Education of the Slovak Republic for the EU structural funds.

7.2 RTD assessment of energy efficiency and saving technologies

RTD in Renewable Energy. The diverse landscape of Slovakia and its complex geological structure create opportunities for integrated renewable energy research. High forestation levels (44,3%) and advanced forestry studies at Technical Universities allow for extensive utilization of biomass.

Dozens of both small and large hydro power plants have been built, the Gabčíkovo-Nagymaros hydro power plant of 720 MW capacity being the largest.

Dozens still are planned, creating a unique opportunity to concentrate the research on maximizing renewable energy power output.

New sources of geothermal energy have been discovered in the east of Slovakia in 2007, inciting further interest in renewable energy R&D activities. The total geothermal energy potential in Slovakia is now estimated at 5538 MWt.

7.3 State supporting programmes

The Government prepared and approved a strategic framework document “Conception of state science and technological policy”. This document presents 3 main supporting models

and systems. The coordinator of state supported R and D activities under this conception is the Slovak Ministry of Education.

1. State programmes RTD: Target group: states, public and private organizations and companies. (Universities, R and D Centers, producers of technologies, agencies, state organizations). Aim (from the point of view of Setatwork project): "Utilization of the progressive tools and instruments in energy production". (more information can be found on the website: www.veda-technika.sk).
2. State orders for RTD. Target group: states organizations, universities
3. RTD task initiated by applicants or customers (free topics)

7.4 International supporting programmes

RTD Framework programmes Slovak participation in projects within the Seventh Framework Programme (FP7) was focused mainly on energy, environment and sustainable development specific programme. More than 50 Slovak partners were involved with 20 Slovak partners participating in projects under part B (Energy) while 20 projects were approved with 30 Slovak partners under priority 6 (Climate change, energy, transport).

7.5 Structural funds

Priority – "Growth of competitiveness of industry and services using domestic growth potential" This priority is aimed at tackling problems in the development of existing forward-looking enterprises and development of new enterprises, improving their competitiveness within the EU economy and single market. It is also concerned with the adaptation of businesses in conditions of international labour markets.

Further industrial development will be enhanced by stimulating direct investments, promoting trade, information and communications technologies as well as through e-commerce.

Achieving these objectives should lead to a decrease in use of raw materials, energy and import by businesses, a lowering of their energy costs and so production costs, an increase in added share value, direct investment mobilisation, and an improvement in the quality of management and particular services.

Fulfilment will also be assisted by improved mobilisation of innovative, development and research capacities, involvement of SMEs in innovative business and development of flexible staff-training infrastructures.

Implementation of these priorities depends mainly on:

- linking the development of industry, tourism and trade to research and innovations, using especially the potential of information technologies, and multiplier effects from FDI within the wider economy
- modernisation, microeconomic adaptation and stimulation of enterprise and services development (modernization of productive technologies, appliances, products, etc.)
- development of training, higher workforce adaptability, management capacity, and entrepreneurial spirit
- increase in labour mobility and its entrepreneurial activities
- increased utilisation of renewable and secondary energy sources, reduction in energy consumption and use of potential energy savings, reduction of energy costs

- development of sectors based on advanced technologies and renewable sources improvement of water and air protection, restoration of environmental zones in production spheres, adequate waste management and removal of old ecological burdens to approximate to the EU standards

Another goal of the priority is the use of potential energy saving in industry and services relating to it and the reduction of energy consumption, which could assist long-term sustainable development and economic growth in all areas of economic activity. This priority will also help increase the use of renewable energy sources, construction of small hydroelectric power stations as well as use of solar, wind and geothermal energy.

In recognition of restrictions to the building of industrial zones on green-field sites, it is necessary to concentrate on the revitalisation of regions and buildings of obsolete industries and related activities so as not to destroy them, but make further development possible.

Contribution of research & development to growth in competitiveness of industry and services should be reflected in a higher rate of innovation in Slovak economy and higher share of hi-tech-based businesses.

Priority: “Improvement and development of the infrastructure for the protection of air”

This measure aims to contribute to the reduction of air pollution, in particular by solid pollutants and sulphur dioxide, as well as contributing to the reduction of greenhouse gas emissions. The measure is also designed to improve the quality of air in population centres by introducing technology that reduces air pollution, as well as by introducing low-emission technology in various areas of production.

The implementation of these measures will be based on the following activities:

- change fuel base of energy resources, with focus on low-emission and renewable resources;
- installation of technology to reduce release of air emissions including monitoring

The particular objectives of this measure are to reduce the emissions of primary air pollutants (SO₂, NO_x, CO, C_xH_y, solid emissions), and heavy metals as well as to meet the obligations resulting from the Kyoto Treaty in the reduction of greenhouse gas emissions, use of environmentally favorable fuels and energy resources. It also supports the more intensive use of renewable energy resources and efficient use of non-renewable energy resources.

The final beneficiaries are regional self-governments, local self-governments (municipalities and towns) and their associates, state administration, business entities, etc.

8. Links to relevant and related websites

Chapter/Title	Reference / Website
2. General country overview	http://www.world-nuclear.org/info/inf91.html
2.1 National energy system	http://www.iea.org/textbase/stats/electricitydata.asp?COUNTRY_CODE=SK
2.1.1 Nuclear Power System	http://www.world-nuclear.org/info/inf91.html
2.1.2 Thermal power	http://www.eia.doe.gov/emeu/cabs/NC_Europe/Electricity.html
2.1.5 Natural gas Transmission and distribution network	http://www.eia.doe.gov/emeu/cabs/NC_Europe/Electricity.html
2.1.6 Fossil fuel sources	http://www.foratom.org/index2.php?option=com_content&do_pdf=1&id=49
2.2 Security of supply	http://www.centrel.org/
2.5 Investments planned for Power Production	www.trendanalyses.sk
3. Legislation	https://co2.dexia.sk/hiddendoc/user_guide.doc
4.1 National Allocation Plan	http://www.setatwork.eu/cp_slovakia.htm
4.2 JI and voluntary markets	http://www.pointcarbon.com/wimages/SK_EIT_V_3983.pdf
5. ETS companies	http://www.enviro.gov.sk/servlets/files/15438

9. References

Chapter/Title	Reference / Website
2. General country overview	IAEA 2002, <i>Country Nuclear Power Profiles Energy in E Europe 3/2/06</i> . Early Soviet Reactors and EU Accession http://www.world-nuclear.org/info/inf91.html
2.1 National energy system	International Energy Agency, Electricity/Heat in Slovak Republic in 2005 http://www.iea.org/textbase/stats/electricitydata.asp?COUNTRY_CODE=SK
2.1.1 Nuclear Power System	World Nuclear Association, Nuclear Power in Slovakia http://www.world-nuclear.org/info/inf91.html
2.1.2 Thermal power	International Energy Agency, North-Central Europe Electricity http://www.eia.doe.gov/emeu/cabs/NC_Europe/Electricity.html
2.1.5 Natural gas transmission and distribution network	International Energy Agency, North-Central Europe Electricity Liberalisation Study, Country Report: Slovakia, ECB 2007 http://www.eia.doe.gov/emeu/cabs/NC_Europe/Electricity.html
2.1.6 Fossil fuel sources	http://www.foratom.org/index2.php?option=com_content&do_pdf=1&id=49
2.2 Security of supply	http://www.centrel.org/

Chapter/Title	Reference / Website
2.3 Climate change	Status and development scenarios of RES with focus on GTE in agriculture in Slovakia. Ing. Roman Doubrava, Energy Centre Bratislava, 2007
2.5 Investments planned into the power production	TREND Watch: Slovak Economy in Comments and Analyses, Monthly Research Service for the Ministry of Foreign Affairs of the Slovak Republic, September 2007 www.trendanalyses.sk
3. Legislation	Slovak National Emission Registry – User Guide, 2006 https://co2.dexia.sk/hiddendoc/user_guide.doc
4.1 National Allocation Plan	EU ETS Country Profile - Slovak Republic http://www.setatwork.eu/cp_slovakia.htm
4.2 JI and voluntary markets	Vertis Environmental Finance, Slovakia Country Report 12.05.03 Summary http://www.pointcarbon.com/wimages/SK_EIT_V_3983.pdf
6.1 ETS companies	Ministry of the Environment of the Slovak Republic, Air Protection Department National Allocation Plan for the 2008 – 2012 period http://www.enviro.gov.sk/servlets/files/15438
6.2 General overview and structure of branches	Reconstruction of Paper Mill BUKOCEL http://www.papcel.cz/en/news/reconstruction-for-paper-mill-bukocel/ Slovnaft Economy Results http://www.plasticportal.eu/clanky.php?id_lang=2&id_clanku=15
6.3 Key stakeholders and installations	US Steel Kosice http://www.usske.sk/media/rel-e.htm
6.4 Identification of technology needs in targeted companies	http://www.zvolenskateplarenska.sk/images/Bulletin2008_ekologizacia_EN.pdf
7. R&D priorities	Progressive Methods in Design and their Application in Engineering Industry http://public.carnet.hr/metalurg/Metalurgija/2006_vol_45/No_4/MET_45_4_347_351_Virdzek.pdf
7.1 General National Aspects	Slovakia - Positive Stabilisation http://ec.europa.eu/research/rtdinf22/en/s-slovakia.html
7.2 RTD assessment of energy efficiency and saving technologies	European Fund for Regional Development http://www.minedu.sk/index.php?lang=en&rootId=53