

# THE SLOVAK ENERGY AGENCY

Bajkalská 27, 827 99 Bratislava 27

## DIVISION OF ACCREDITED ACTIVITIES

Rudlovská cesta 53, 974 28 Banská Bystrica

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Title:

ANALYSIS OF PROGRESS TOWARDS AN INCREASED SHARE OF HIGHLY  
EFFECTIVE COGENERATION FOR 2006

Compiled By: **Dr - Ing. Kvetoslava Šoltés, CSc.**  
**Dr - Ing. Jozef Šoltés, CSc.**

Approved By: **Dr - Ing. Jozef Šoltés, CSc.**  
Director of the Division of Accredited Activities



Banská Bystrica, 21.02.2007

Phone .....

Fax

E-mail

Internet

Bank Connection: The

.....Company ID

+421(48)4714630

+421 (48)4714639

lem@seabb.sk

www.sea.gov.sk

00002801.

State Treasury Account

No.: 7000062596/8180

+421(48)4142354

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1	Introduction.....	3
2	Summary.....	4
3	Background for Analysis.....	5
4	Increasing Share of Highly Effective Cogeneration Installed Capacity.....	6
4.1	<b>Newly Installed Devices for Highly Effective Cogeneration.....</b>	<b>6</b>
4.2	<b>Restored Devices for Highly Effective Cogeneration .....</b>	<b>6</b>
4.3	<b>Identified Obstacles to the KVET development in SR in 2006 .....</b>	<b>8</b>
5	Increasing Share of Electricity Production from Cogeneration.....	9
6	Legislation.....	9
7	Current Promotion of Cogeneration.....	10
8	Implementing the National Strategy.....	11
<b>8.1</b>	<b>National Strategy Objectives .....</b>	<b>11</b>
<b>8.1.1</b>	<b>National Policy Objectives in the Energy Sector .....</b>	<b>11</b>
<b>8.1.2</b>	<b>National Strategy Objectives for Cogeneration .....</b>	<b>11</b>
<b>8.2</b>	<b>Current Status of Implementation of the National Strategy.....</b>	<b>12</b>

## Introduction

Sustainable development of the energy sector in Europe with regard to the environment and economy of operation and investment return is closely related to increasing energy efficiency.

Cogeneration is understood as one of the technologies for reaching the EU's objective of increasing energy efficiency. The main benefits of cogeneration include primary energy savings, reducing losses in electricity distribution and reducing emissions. Increased use of cogeneration positively contributes to enhancing the security of energy supplies and increasing the competitiveness of the EU and its Member States in the area of energetics. Promotion of highly effective cogeneration based on a useful heat demand is one of the Community's priorities.

The potential of cogeneration use has not been fully utilised within the Community. Therefore, steps to ensure better use of this potential in the internal energy market are necessary.

Directive 2004/8/EC of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market came into force in March 2004 and its main purpose is:

- *to increase energy efficiency and improve security of supply by creating a framework for promotion and development of high efficiency cogeneration of heat and power based on useful heat demand and primary energy savings in the internal energy market, taking into account the specific national circumstances especially concerning climatic and economic conditions.*

Article 6(3) of Directive 2004/8/EC defines the obligation to evaluate progress towards increasing the share of high efficiency cogeneration for the first time not later than 21 February 2007 and thereafter every four years.

Consequently, the analysis submitted refers to the analysis of the national potential for highly efficient cogeneration drawn up in 2006, and is compiled with the following structure:

- Increasing the installed capacity of highly efficient cogeneration
- Increasing the share of electricity generation within cogeneration
- Existing legislation in the given area
- Current promotion of cogeneration
- Implementing the national strategy for cogeneration

## Summary

In 2006, the total number of cogeneration devices increased by 4 (1.46%). The installed capacity increase is 3.07 MW (0.125%). Generation of electricity in cogeneration devices increased by 5,591 MWh (0.12%). Generation of useful heat in cogeneration devices increased by 162 HU (0.27%).

Cogeneration devices with an installed capacity of 45.1 MW were restored, representing 1.83% of the total installed capacity of cogeneration devices.

From the perspective of primary energy sources, the increase in the installed capacity was based on natural gas. Within the restoration, the fuel basis of these devices was extended mainly by dendromass.

Stagnation in the number of new cogeneration devices is due to:

- Continuously rising natural gas prices (mainly for ultra small scale and small scale devices)
- Large investments needed for cogeneration devices
- Relatively low promotion of cogeneration in purchase prices
- Inadequately high demands on elaboration of projects drawing EU funds.

So far, Directive 2004/8/EC has not been fully incorporated into Slovak Republic legislation.

URSO Regulation No. 2/2006, which lays down the scope of price regulation in electroenergetics and its implementation method, scope and structure of eligible costs, method of determining fair profit amounts and the background for offer prices, establishes fixed purchase prices of electricity generated by cogeneration technology.

The draft Act on the “promotion of cogeneration based on a useful heat demand in the internal energy market and on the amendment of certain acts” was prepared for interdepartmental comment, fully transposing all articles of Directive 2004/8/EC. Also, two implementing regulations were prepared together with the Act.

The current promotion of electricity generation in cogeneration devices is being implemented:

- as an investment support financed by the Structural Funds via “Competitiveness and Economic Growth” operational programmes, measure 1.4
- as an operational support by means of advantaged fixed purchase prices of electricity generated in the process of cogeneration laid down in USRO Regulation No. 2/2006.

The national strategy objectives in the area of cogeneration are being fulfilled in line with the Slovak Republic’s Energy Policy.

### 3 Background for analysis

Based on the data analysis of the potential of highly effective cogeneration in SR, the following may be observed:

- 55% of electricity was generated in SR in nuclear-fuel-based steam cycles and 27% in fossil-fuel-based cycles
- 14% of electricity was generated within renewable energy sources (RES) while the majority of electricity was generated in hydropower plants
- 58.5% of heat was generated in district heating systems (DHS), 54% of which was in cogeneration devices
- The prevailing fuel in DHS sources is natural gas (46.5%) followed by brown coal and black coal (15.5% and 12%, respectively); RES represents 6.2%
- The prevailing fuel in decentralised heating systems is natural gas
- In cogeneration devices, approximately 4,800 GWh (16% of total electricity generation) and approximately 59,000 HU (32% of total heat generation) were generated within the cogeneration process
- Prevailing cogeneration technologies in the Slovak Republic comprise gas turbines with heat recovery and steam backpressure turbines
- The increased use of renewable energy sources and decreased consumption of solid fossil fuels is expected in cogeneration devices
- Energy consumption expectations are based on a continuous increase of energy consumption, a slight increase of heat consumption from DHS and a rapid increase of heat consumption from decentralised heating systems
- The following activities are taken into account from the viewpoint of cogeneration technologies:
  - Restoring existing steam turbine technologies
  - Creating sources of combustion engine cogeneration by means of natural gas turbines
  - Creating ultra small scale sources (up to 50 kW) and small scale sources (up to 1 MW) for renewable energy sources with various cogeneration technologies (combustion engines, ORC cycles, etc.)
  - Creating ultra small scale sources using innovative technology (microturbines, small combustion engines, etc.).

Data from the analysis is taken from the KVET database for 2006 gained from individual providers in line with Section 2 of the Ministry of Economy SR Regulation No. 136/2005 Coll.

## 4. Increasing the share of installed capacity of highly efficient cogeneration

### 4.1 Newly Installed Devices for Highly Efficient Cogeneration

Electricity and heat generation volume in new sources with cogeneration devices is enumerated from the KVET database for 2006 gained from individual providers in line with Section 2 of the Ministry of Economy SR Regulation No. 136/2005 Coll. Basic data on the cogeneration increase in the Slovak Republic is provided in Table 4.1-1.

In 2006, the installation of a single steam backpressure turbine and three combustion engines occurred (for total installed capacity see Table 4.1.1). All technologies use natural gas as their primary fuel. A total of 7 investment operations expected to be finished in 2007 were launched. Overall, there is a decrement in the installation of combustion engine technologies, caused by continual natural gas price growth in 2005 and 2006.

<i>Generation technology</i>	<i>Amount</i>		<i>Installed capacity</i>		<i>Increase in electricity generation</i>	<i>Increase in useful heat generation</i>
	<i>Increase</i>	<i>Total</i>	<i>Increase</i>	<i>Total</i>		
	<i>[pcs.]</i>	<i>[pcs.]</i>	<i>[MW]</i>	<i>[MW]</i>	<i>[MWh]</i>	<i>[HU]</i>
PPC	0	3	0	240	0	0
Gas turbines	0	5	0	25	0	0
Heat recovery turbines	0	24	0	1,432	0	0
Steam backpressure turbines	1	51	2.4	732	2,751	142
Combustion engines	3	188	0.67	36	2,840	20
Other	0	1		1	0	0
Total	4	273	3.07	2,462	5,591	162

Table 4.1-1: Basic data on the cogeneration increase in 2006

### 4.2 Restored Devices for Highly Efficient Cogeneration

In terms of the restoration of cogeneration devices, one restoration of the source containing three backpressure and one heat recovery turbine was finished (for the total installed capacity see Table 4.2-1). The restoration mainly comprised of:

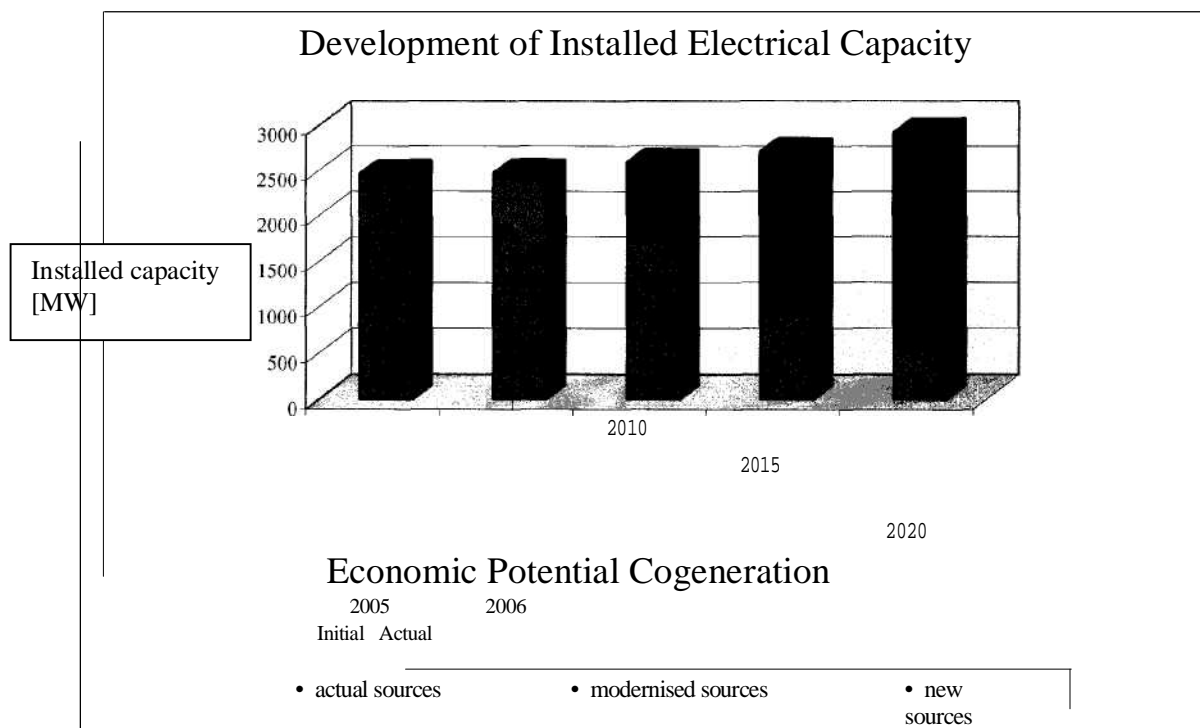
- Expansion of the fuel base (for dendromass combustion)
- Increase of the total efficiency of the cogeneration aiming at fulfilling the criteria for highly efficient cogeneration
- Achievement of higher reliability of supplied electricity and heat
- Increase of the source manoeuvrability.

Furthermore, a total of 4 combustion engine technology devices were restored to increase the efficiency of useful heat generation.

Generation technology	Amount		Installed capacity		Increase in electricity generation efficiency	Increase in useful heat generation efficiency
	Restoration	Total	Restoration	Total		
	[pcs.]	[pcs.]	[MW]	[MW]		
PPC	0	3	0	240	0	0
Gas turbines	0	5	0	25	0	0
Heat recovery turbines	1	24	9.1	1,432	2.1	2.1
Steam backpressure turbines	3	51	34.8	732	2.1	2.1
Combustion engines	4	188	1.2	36	0	3.4
Other	0	1		1	0	0
Total	8	273	45.1	2,462	-	-

Table 4.2-1: Basic data on the KVET sources restoration in 2006

In terms of restoration it can be concluded that in 2006 the investments made in this area correspond to the five-year average.



**Fig. 4.2-1:**

Development of Installed Electrical Capacity  
Economic Potential of Cogeneration and actual state in  
2006

From the above, the following may be concluded:

- Stagnation in the installation of new cogeneration sources is affected mainly by:

- Continually rising natural gas prices (ultra small scale and small scale devices)
- Unresolved security strategy of energy supplies in the area of electroenergetics in the Slovak Republic  
(problems associated with the replacement of the Jaslovské Bohunice VIv nuclear unit)
- Relatively low promotion of cogeneration in purchase prices
- Inadequately high demands on production of projects drawing EU funds.
- Maintaining the investment level in restoration and modernisation of cogeneration devices



Minimal interest in new technology of highly efficient cogeneration, such as ORC cycles, Stirling engines, microturbines, etc. is caused mainly by high investment costs for this technology.

#### **4.3 Identified obstacles to KVET development in SR in 2006**

##### Technical obstacles:

###### General:

- Decrease in industrial production with high energy demands
- Increased energy savings
- Disconnect of consumers from DHS
- Introduction of new technology that has not been tested in practice for long-term use
- Connection between electricity and heat generation; decrease in heat off-take in most technology used is related to the decrease in electricity generation and vice versa
- Non-adapted structure of distribution energy network
- Decrease in generation related to the efficiency of devices and the increase in specific production costs
- Insufficient awareness of highly efficient cogeneration technology
- Insufficient promotion of applied research and development.

###### RES:

- Insufficient technology and organisational fuel logistics
- Considerable gradient and inaccessibility of locations with useful biomass
- Lack of experience in storing and processing of biomass
- Strong dependency on imports of technological devices.

##### Financial obstacles:

###### General:

- Lack of own financial sources
- Lack of funds in the area of public finance
- Lack of guarantees to cover credit sources
- Long term of return on investment
- Actual negotiated cogeneration electricity prices do not take real technology costs into account
- Rapid price growth of natural gas as the most common fuel for cogeneration devices.

###### RES:

- For a biomass producer (farmer and processor) the entrepreneurial risk rises when introducing and producing a new kind of biomass with a 2 to 8-year cycle.
- Breach of timetable of the building, reliability and technical parameters of the new device in connection with the lack of financial sources.

##### Administrative obstacles:

###### General:

- Demanding administrative procedures regarding investment preparations (ownership relationship to immovable assets, consent of the respective bodies, etc.)
- Non-accommodating attitude of distribution companies
- Lack of professional capacity in the area of environmental protection
- Demanding administrative procedures when identifying and approving energy purchase prices.

###### RES:

- More demanding administrative procedures as regards devices with installed electrical capacity of more

than 5 MW.

## Increasing Share of Electricity Production from Cogeneration

Because electricity generation in most cogeneration technology is tied to the generation of useful heat, the consumption of which also depends on climatic conditions, and because at the end of 2006 higher temperatures were recorded in the Slovak Republic than the long-term average, the total increase of electricity generation in the cogeneration process cannot be enumerated. Therefore, the information given in Fig. 5.1-1 is limited and does not provide a full picture of the electricity generation increase in the process of highly efficient cogeneration.

### Development of Economic Potential of Electricity Generation

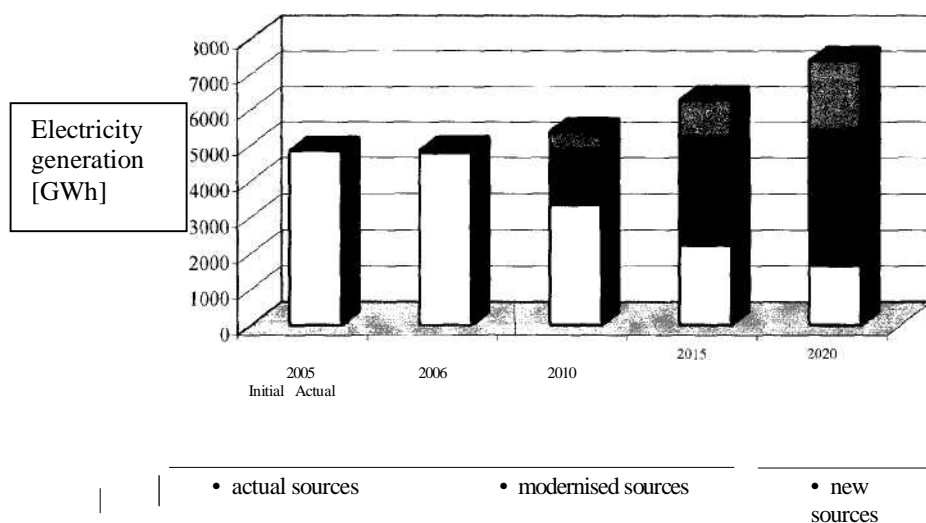


Fig. 5.1-1:

Development of the economic potential of electricity generation from highly efficient cogeneration and comparison with the actual state in 2006\_

## Existing legislation

Directive 2004/8/EC has not been fully transposed to the SR's legislation. Regulation of URSO No. 2/2006 laying down the scope of price regulation in electroenergetics and its implementation method, scope and structure of eligible costs, the method of stipulating the amount of fair profit and the background for offer price, establishes fixed purchase prices of electricity generated by cogeneration technology.

The draft Act on the “promotion of cogeneration based on a useful heat demand in the internal energy market and on the amendment of certain acts” is prepared for interdepartmental comment, fully transposing all articles of Directive 2004/8/EC. Also, two more regulations were prepared:

- Regulation laying down the criteria for the promotion of electricity and heat cogeneration
- Regulation laying down the content and form of an application for issuing a confirmation and the content and form of confirmation on the origin of electricity generated by highly efficient cogeneration.

The deadline for adopting the draft Act and the two Regulations is the middle of 2007.

Directive 2004/8/EC shall be fully implemented following the adoption of the Act and subsequent implementing regulations.

The draft Act on the promotion of cogeneration based on a useful heat demand in the internal energy market and on the amendment of certain acts stipulates that confirmation of the origin of electricity generated by highly efficient cogeneration shall be issued by an organisation established for this purpose by the Ministry of Economy of the Slovak Republic, upon the request of the cogeneration electricity producer.

The confirmation of the origin shall be issued after the following is met:

- A cogeneration electricity producer has submitted an application and provided data as per a separate regulation
- Electricity has been generated by highly efficient cogeneration devices in the process connected to the generation of useful heat.

Confirmation of origin issued in EU Member States shall be valid in the Slovak Republic as well and as such does not imply a right to benefit from national support mechanisms.

The content and form of the application for issuing confirmation of origin and content and the form of the confirmation of origin are governed in the separate draft regulation.

Issuing of confirmations of origin of electricity generated by highly efficient cogeneration (as well as the issuing of confirmations as such) is managed by the Ministry of Economy of the Slovak Republic.

## 7 Current Promotion of Cogeneration

Investment support:

- Funding from the Structural Funds via the “Competitiveness and Economic Growth”

operational programme, measure 1.4 “Increasing energy efficiency in the production and consumption and introducing progressive technologies in energetics” (support of the Kvet generation projects based on the fossil fuels and renewable energy sources with a maximum installed capacity of 5MW<sub>e</sub> in the form of regional assistance and with a maximum installed capacity of 50MW<sub>e</sub> in the form of environmental assistance).

Operational support is currently provided by means of advantaged fixed purchase prices of electricity generated in the process of cogeneration laid down in URSO Regulation No. 2/2006.

## 8 Implementing the National Strategy

### 8.1 National Strategy Objectives

#### 8.1.1 National Policy Objectives in the Energy Sector

The long-term energy policy objectives of the Slovak Republic are:

1. To provide a volume of generated electricity that cost-effectively meets demand
2. To provide safe and reliable supply of the required amounts and quality of all forms of energy and quality with maximum efficiency;
3. To reduce gross domestic energy consumption share in the gross domestic product – reducing energy intensity.

The following basic priorities are set in order to reach the energy policy objectives:

1. To replace the decommissioned production facilities to ensure generation of electricity to an amount that primarily and cost-effectively covers domestic demand
2. To adopt measures for energy savings and increasing energy efficiency in consumption
3. To reduce dependency on energy supplies from at-risk regions – increase diversification of energy sources and transport routes
4. To use domestic primary energy sources for electricity and heat generation in a cost-effective manner
5. ***To increase use of electricity and heat cogeneration***
6. To use nuclear energetics as a diversified, cost-effective and environmentally acceptable option for electricity and heat generation
7. To secure the safe operation of nuclear power plants
8. To increase the share of renewable energy sources in electricity and heat generation in order to create adequate additional sources to cover domestic demand
9. To finish building of the system and network so they are capable of ensuring the safe and reliable transfer, transport and distribution of electricity and gas
10. To build new interconnectors in order to improve connections to the internal EU market and the market of the third countries
11. To support use of alternative fuels in the transportation.

#### 8.1.2 National Strategy Objectives for Cogeneration

To reach the stated objectives and take account of the basic priorities, the following forms are presumed in the energy policy:

##### Securing sufficient electricity generation

- Securing new capacity for electricity generation by means of installing new cogeneration devices
- Improving the capacity of existing cogeneration devices
- Increasing the Share of Electricity Production in Cogeneration.

##### Security and reliability of all energy form supplies in the required amount and quality

- Restoration of existing cogeneration devices
- Diversification of source fuels with cogeneration devices – use of renewable fuels.

#### Decreasing energy demand

- Replacement of separated electricity and heat generation by highly efficient cogeneration
- Increased utilisation of sources by means of cogeneration devices:
  - By increasing useful heat generation volume
  - By trigeneration.

#### Increasing energy efficiency

- Increased energy efficiency of existing sources by means of cogeneration devices
- Increased new energy-efficient sources with cogeneration devices (devices meeting criterion of highly efficient cogeneration).

## **8.2 Current Status of Implementation of the National Strategy**

In 2006, investment support for cogeneration was provided from:

- The State Aid Programme, “Support scheme for energy savings and the use of renewable energy sources”, in which the promotion of cogeneration for combining more small heat sources into cogeneration sources with a maximum installed capacity of 5MW<sub>e</sub> is declared
- The structural funds via “Industry and Services Sectoral Operational Programme”, measure 1.4, “Support of energy savings and the use of renewable energy sources”, (supports cogeneration projects based on fossil fuels and renewable energy sources with a maximum installed capacity of 5 MW<sub>e</sub> in the form of regional assistance and with a maximum installed capacity of 50 MW<sub>e</sub> in the form of environmental assistance).

In 2006, operational support was provided by means of advantaged fixed purchase prices of electricity generated in the process of cogeneration.

The Act “on promotion of cogeneration based on a useful heat demand in the internal energy market and on the amendment of certain acts” and two Regulations setting out the criteria for highly efficient cogeneration, or necessity of the application for issuing confirmation of origin and necessity of the confirmation of origin were prepared in legislation. The Act and the two regulations are expected to be adopted in the first half of 2007.

Investment and operational support of highly efficient cogeneration are incorporated into the draft Act as follows:

- By determining the time period during which the advantaged fixed purchase price of electricity generated in the process of highly efficient cogeneration could be used
- The possibility of using tax expenses for electricity producers in the process of highly efficient cogeneration for their own consumption
- The support of investments for the given area from the State Budget as well as from EU funds.

The abovementioned facts represent a prerequisite for increased enforcement of cogeneration in SR.