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THE ROLE OF NATURAL GAS IN RECENT DEVELOPMENT OF THE ENERGY SYSTEM OF SLOVAKIA

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The aim of the paper is to evaluate the present role of natural gas in the energy system of Slovakia and its potential contribution to sustainable development of energetics in the context of regional development. Natural gas will presumably be the main energy source in transition from use of not renewable to renewably energy sources. Natural gas as an exhaustible resource is not sustainable. With regard to the possibility of its application in small facilities, gasification helps regional development and represents a stimulus and determining factor for location of additional economic activities and increase of the population's life quality.

Key words: natural gas, energy system, sustainable development, Slovakia

INTRODUCTION

The energy sector is regarded as one of the important sectors influencing the development of the economy and the entire society. It also has an important role in regional development and therefore the problems of energy and energy systems are part of geographical research. The basis for this research was established in the works of George (1950), Manners (1964) and Linton (1965). The specific concept of the territorial "energy-production cycles" was developed by Kolosovskij (1947) and Sauškin (1967 and 1968). We consider the monograph of Chapman (1989), who developed the theory of spatial energy systems in ge-

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ography, to be the most comprehensive work in the field of geography of energy. Chapman's theory was developed and applied in the territory of Slovakia in the studies of Szőllős (1995 and 1998).

Apart from these general studies we could find many geographical studies oriented specifically towards the relation between energy and regional development (e.g. Luukkanen 1991, Vehmas 1994, Szőllős 1997). A significant part of the geographical research in the field of energy consists of works dedicated to geographical aspects of the exploitation of particular energy source and its consequences for regional development (e.g. George 1973, Antal 1983, Franko 1986, Bédi 1998). The work of Hůrský (1965) analyses the process of electrification in the territory of former Czechoslovakia. A similar process by its scope and consequences is the recent gasification and development of the use of natural gas (Szőllős 2001). We consider that it is important to study the geographical aspects of this process.

Therefore the goal of this contribution is to evaluate the recent role of natural gas in the energy system of Slovakia and particularly its possible contribution to the sustainable development of Slovakia including regional development. Although natural gas is not a renewable source of energy and therefore cannot be classified as sustainable, it can play a role in the development of a sustainable energy system as, when used efficiently, it produces 2.5 times less CO_2 per kWh than coal fired power stations.

THE DEVELOPMENT AND RECENT STATE OF THE ENERGY SYSTEM OF SLOVAKIA

The energy system created in the territory of Slovakia is complex, and has been working independently only for a short time so far. Regarding its historical development and the available natural conditions it depends a lot on relations with its environs, as its resource come from outside the territory of the Slovak Republic. Only limited sources of fossil fuels, technically usable hydroelectric power and local sources of geothermal heat occur here. Other energy sources like solar energy, wind energy and biomass produced energy have not been widely used so far and their importance is small.

The Slovak economy is highly dependent on imports of basic energy sources. Indigenous energy sources supplied only about 10 % of the total consumption and import supplied the rest. This dependence makes worse the fact of inherited weak diversification of imports of energy sources. Practically the whole amount of crude oil and natural gas is still imported from one country – the Russian Federation. The nuclear fuel for the Nuclear Power Plant (NPP) in Jaslovské Bohunice and NPP Mochovce is also imported from the same country. Coal is imported from the Czech Republic.

As far as its inner structure is concerned it is concentrated and centralized, based in unrenewable energy resources, hence unsustainable. Its nature is also determined by the inherited inadequate material, energetic and raw material demanding structure of national economy.

Slovak energy intensity, expressed as gross inland consumption of energy divided by GDP, has followed a consistently declining pattern since the establishment of the Slovak Republic. However, when compared to the average in

the EU countries it remains 3.65 times higher (Tabs. 1 and 2) Expressed as the share of total primary energy consumption in GDP, the energy intensity according to official energy policy was 7.7 times higher. When considering this disparity, while also considering the exchange rate and applying the real purchasing power parity, it is 2.3 times higher than that of the EU (MH SR 1999b). This is partially a result of the low productivity of labour compared to the EU countries, but is also reflective of a high share of industry in the generation of GDP and a high proportion of energy intensive branches of industry. A slow-down in the GDP growth in the past years has been accompanied by a slight reduction in primary energy consumption, a decline in final energy consumption, and a decline in electricity consumption. Per capita consumption of primary energy sources in Slovakia is approximately equal to 85 % of the average in the EU countries (MH SR 1999b).

Tab. 1. Energy intensity of the economy – gross inland consumption of energy divided by GDP (at constant prices, 1995 = 100) – kgoe (kilogram of oil equivalent) per 1000 Euro in selected countries

Countries	1993	1994	1995	1996	1997	1998	1999	2000
USA	381.5	374.2	369.1	365.3	353.5	341.8	338.3	333.6
Japan	116.9	121.4	123.1	122.1	121.5	121.3	121.5	120.8
EU15	213.4	207.7	207.0	211.2	205.1	203.6	198.2	193.9
ACC	:	:	936.8	941.9	883.9	822.1	774.3	708.8
Slovakia	1520.2	1379.4	1334.1	1202.9	1167.0	1106.3	1112.8	708.4

ACC – Accession and Candidate Countries
Source: Eurostat 2003

Tab. 2. Energy intensity in the Slovak Republic

Indicator	1993	1994	1995	1996	1997	1998	1999	2000
GDP in c.p. 95 (bil. SKK)	461	483	517	551	587	641	653	668
GDP in c.p. 95 (bil. EUR)	11.1	11.7	12.5	12.8	14.2	15.5	15.8	16.1
Primary energy sources (PJ)	733	712	737	749	739	756	761	768
Final energy consumption (PJ)	549	537	542	552	499	499	491	472
Energy intensity – PES/GDP 95 (PJ/bil. SKK)	1.59	1.47	1.43	1.36	1.26	1.18	1.16	1.15

PES – primary energy sources
Source: MH SR (2001)

Slovakian energy consumption is characterized by the growing role of gaseous fuels, the most important being natural gas, in covering needs and by a decline in the use of liquid and solid fuels. In connection with the commissioning of the Mochovce Nuclear Power Plant (NPP), the share of primary electricity and heat (especially from nuclear fuel) has grown significantly. The share of the total consumption that is composed of gaseous and solid fuels is approximately 30 %. Compared with other Central European countries, Slovakia had the most balanced structure of energy consumption, one that does not reflect the strong

domination of any one single source. Efficiency in the utilization of primary energy sources was around 70 % (Tab. 3 and Fig. 1).

Tab. 3. Primary energy sources used in the Slovak Republic

Year	Total		Solid fuels		Liquid fuels		Gaseous fuels		Primary electricity and heat	
	(TJ)	(%)	(TJ)	(%)	(TJ)	(%)	(TJ)	(%)	(TJ)	(%)
1988	976900	100	396968	40.64	240150	24.58	179848	18.41	159934	16.37
1989	986256	100	396672	40.22	228389	23.16	194029	19.67	167167	16.95
1990	945279	100	360155	38.10	197550	20.90	223014	23.59	164560	17.41
1991	848624	100	309732	36.50	169289	19.95	213980	25.21	155623	18.34
1992	820816	100	333459	40.63	129664	15.80	194777	23.73	162916	19.85
1993	754803	100	263625	34.93	124165	16.45	207591	27.50	159422	21.12
1994	743605	100	235375	31.65	134788	18.13	198369	26.68	175073	23.54
1995	766371	100	228914	29.87	145762	19.02	219132	28.59	172563	22.52
1996	779950	100	227090	29.12	143722	18.43	231621	29.70	177517	22.76
1997	777245	100	216418	27.85	151965	19.55	235123	30.25	173739	22.35
1998	756203	100	198822	26.29	146317	19.35	239848	31.72	171216	22.64
1999	760839	100	193126	25.38	131777	17.32	243244	31.96	192792	25.34
2000	767749	100	181647	23.67	120709	15.72	245474	31.97	219919	28.64

Source: ŠÚ SR (1994-2002)

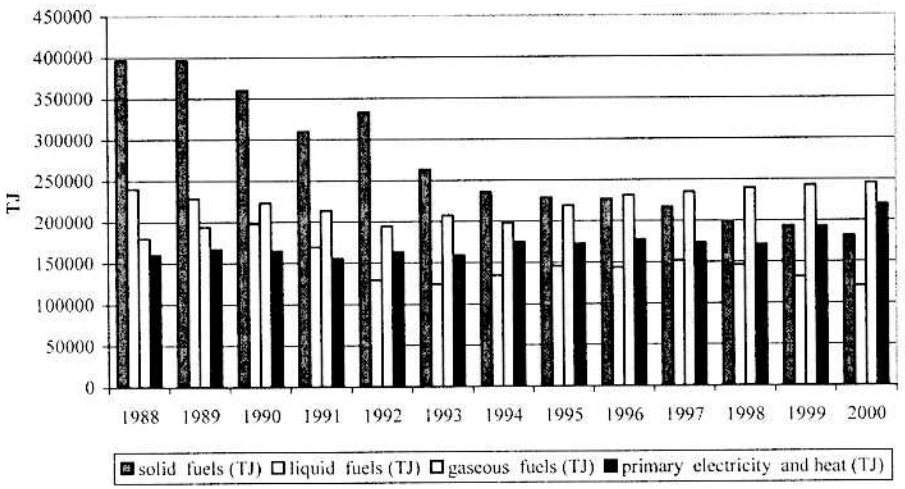

Fig. 1. Primary energy sources used in the Slovak republic
Source: ŠÚ SR (1994-2002)

It can be assumed that the structure of primary energy consumption is going to shift towards a higher utilization of natural gas in industry and households, as well as a shift, in these sectors, towards greater use of electricity and heat production. Currently, there is only one gas fuelled power plant (excluding combined heat and power production – CHP) in Slovakia and thus gas use in the power sector is negligible. Solid fuel consumption will stagnate or be reduced due to more stringent requirements on emission limits (mainly in the case of brown coal). The share of nuclear energy in total primary energy consumption will decrease after the decommissioning of the first and second units of the nuclear power plant Jaslovské Bohunice in 2006-2008 (MH SR 1999b).

IMPORTANCE OF NATURAL GAS IN THE ENERGY SYSTEM OF SLOVAKIA

It is obvious from the description of the energy system given above, that natural gas is becoming the most important energy source in Slovakia and the related gas industry is the most important branch, not only of the Slovak energy sector, but also of the entire economy.

A monopoly enterprise, Slovenský plynárenský priemysel (Slovak Gas Industry, SPP), is one of the most important companies in Slovakia. Owing to revenues from the transit of gas through Slovakia in recent years, it has also earned large profits. Therefore, further developments in the utilization of natural gas in Europe and in Slovakia itself could have a great impact on the country.

Natural gas sources and extraction

The domestic reserves of natural gas in Slovakia are relatively small. Estimates of the geological (total known) stock is 27 991 Mcm (1. 1. 2000) and is concentrated in 25 locations in the Záhorie Lowland (18) and East-Slovakian Lowland (7). Deposits in the Danubian Lowland seem to be so far unproven. Evaluated (exhaustible) stock (11,284 Mcm) comprises 40.3 % of the total geological stock.

Due to a low reserve base, extraction is not very developed and is concentrated in locations in Záhorie (Gajary, Jakubov, Borský Jur, Závod). Extraction capabilities are also being developed in the East-Slovakian Lowland (Ptrukša, Senné, Stretava). The rest of Slovak demand was covered by imports from the Russian Federation through the gas-pipeline *Bratstvo (Brotherhood)*, as well as through the *transit gas-pipeline* (Fig. 2).

Domestic extraction of natural gas in 2001 accounted for 196 Mcm, 2.6 % of the total consumption. Approximately 97 % of the remaining Slovak demand for gas is filled by imports from Russia. In 2001, Slovakia purchased 7.2 Bcm of natural gas. From this volume, 7.0 Bcm of natural gas were purchased from the Russian Federation and 0.2 billion Bcm from the local production company Nafta, a.s. Gbely. According to current estimates, this volume should grow in the future. By 2005 the volume of natural gas imported from Russia should increase to 8 Bcm. Along with the aforementioned quantities imported from Russia, small quantities are also imported from Germany (Tab. 4 and Fig. 3).

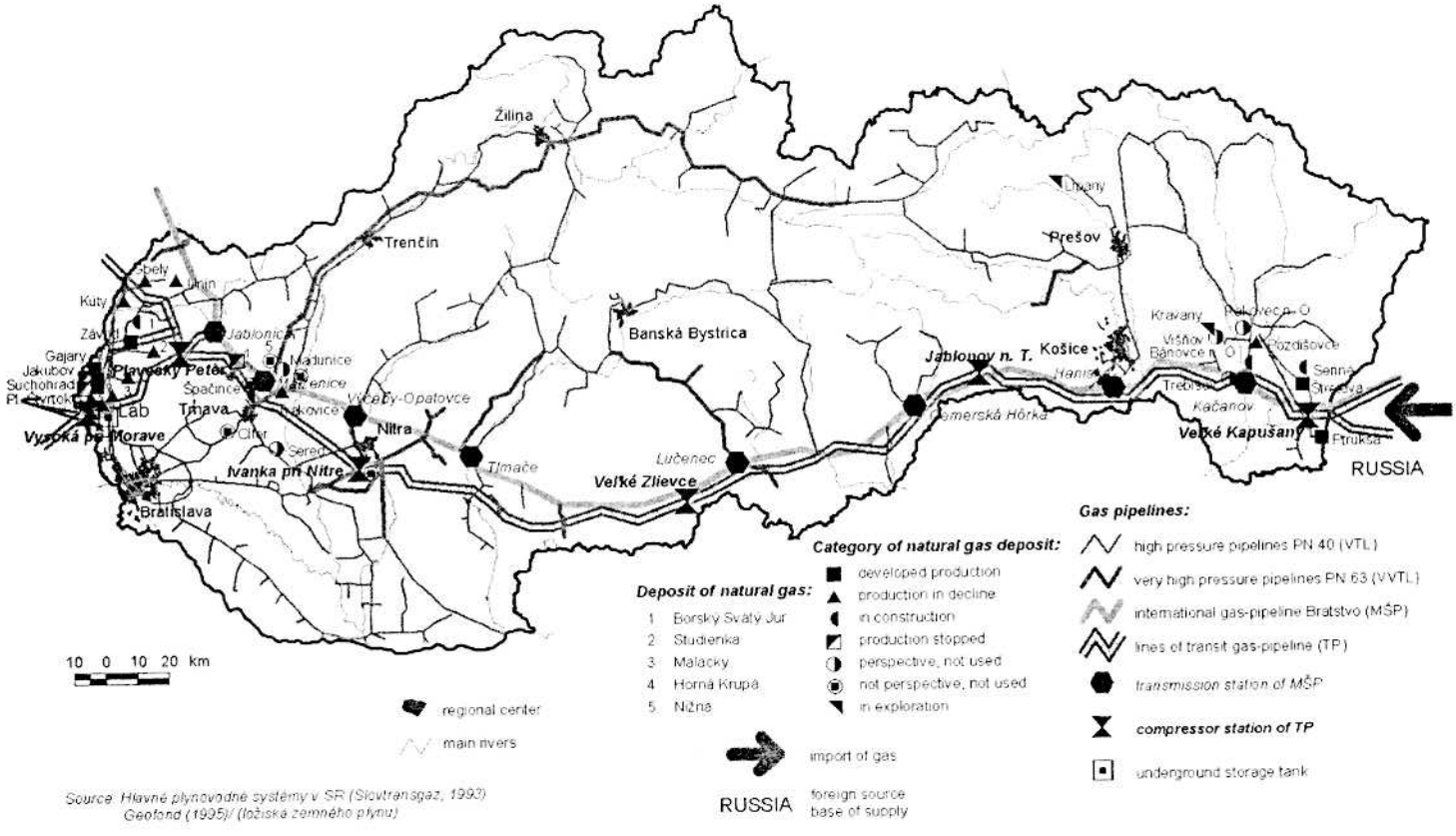

Fig. 2. Natural gas supply system in the Slovak Republic

Tab. 4. Development in securing sources and demand of natural gas

	Unit	1993	1994	1995	1996	1997	1998	1999	2000	2001
Natural gas from Russia (through the transit system)	Bcm	74.1	74.5	79.0	81.4	77.6	84.1	88.3	79.2	71.5
of which: for abroad	*Bcm*	*72.1*	*71.5*	*75.7*	*77.5*	*73.8*	*79.9*	*83.4*	*73,9*	*66.3*
supply for SR	*Bcm*	*2.0*	*3.0*	*3.3*	*3.9*	*3.8*	*4.2*	*4.9*	*5,3*	*5.2*
Natural gas extraction	Mcm	264	288	349	317	289	260	216	203	196
Purchase of gas	Bcm	5.9	6.1	6.3	7.0	7.0	6.9	7.2	7.7	7.2
Consumption (without own consumption and losses = sale of SPP)	Bcm	5.8	6.0	6.5	6.8	6.9	7.0	7.1	7.1	7.6
Capacity of underground storage	Bcm	1.7	1.7	1.9	2.0	2.0	2.1	2.3	2.5	2.6
Production of propane-butane (related to natural gas extraction)	thous. t	1.2	1.2	1.2	1.3	1.0	0.6	0	.	.

Bcm – billion cubic meters
Mcm – million cubic meters
Source: MH SR (2001), SPP (2002)

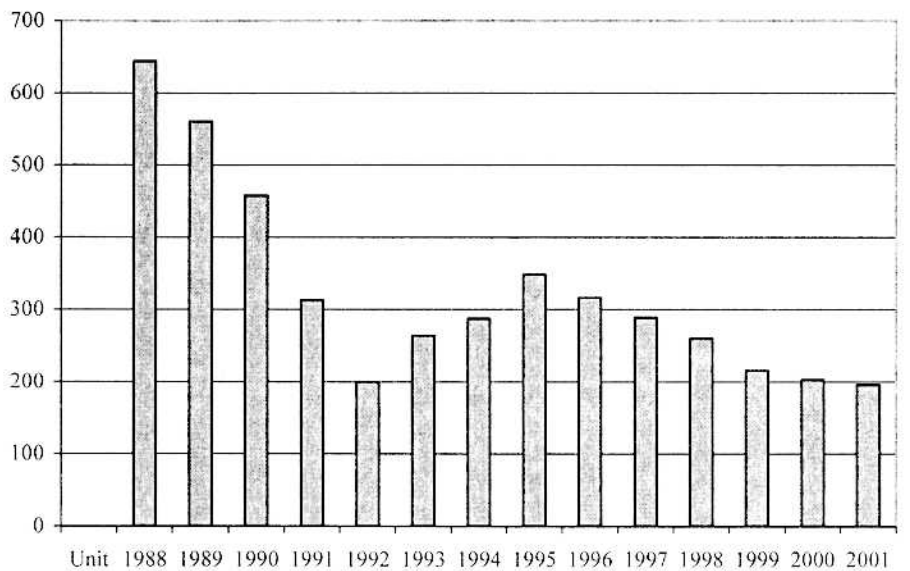

Fig. 3. Natural gas extraction
Source: MH SR (2001), SPP (2002)

The extraction of hydrocarbons, undertaken in Nafta Gbely, is currently affected by a year-to-year decline in extraction and by recession in the crude oil industry. The quantities of gas that are expected to be extracted from Slovakian deposits are shown below (Tab. 5).

Tab. 5. Prognosis for natural gas extraction in the Slovak Republic

Commodity/Year	1999	2000	2001	2002	2003	2004	2005
Gas (Mcm)	236	235	238	215	206	244	220

Source: MH SR (1999a)

The increase in gas extraction predicted for the period between 2004 and 2005 will require there to be some extraction of gas from the cap of the crude oil deposit in Gajary-baden. In 2001, extraction operations are also expected to include the deposit in Bánovce nad Ondavou (near by Trebišov) with a capacity of 200 Mcm, requiring an investment of 250 mil. SKK (5.8 mil. EUR). Currently, these proposed activities are in a phase of technical-economic assessment.

Natural gas consumption

In the period between 1993 and 2000, the total consumption of natural gas grew mostly because of the rising demand in the tertiary sphere, by retail consumers (a 70 % increase) and the residential sector, where 1999 consumption doubled when compared to its 1993 levels. On the other hand 1999 natural gas consumption levels of wholesale consumers had dropped in 1999, after a rise between 1994 and 1996, to 1993 levels (MH SR 1999b) and again rised to its maximum in 2001 because of the revitalization of industrial production after 1999.

By December 31, 2001, sales in the category of large consumers reached a total of 5.0 Bcm, which is 0.2 Bcm more than in 2000 (index 1.04). Compared to the previous year, the following companies recorded the highest growth of consumption: Heat Power Plant Vojany 2, U.S. Steel Košice, Duslo Šaľa, and C-Therm Bratislava. Sales in the category of small consumers reached 0.4 Bcm, which is the same as in 2000. Sales in the residential consumers category amounted to 2.1 Bcm, which is 0.3 Bcm more than the previous year (index 1.04). Evaluation of natural gas consumption in individual categories of customers (Mcm) is as follows (Tab. 6 and Fig. 4):

Tab. 6. Natural gas consumption structure (Mcm) in the Slovak Republic

Customer/Year	1993	1994	1995	1996	1997	1998	1999	2000	2001
Wholesale	4 679	4 522	4 762	4 809	4 786	4 679	4693	4800	5000
Retail and terciary sphere	242	250	274	311	349	355	412	400	400
Households	965	1 120	1 245	1 488	1 644	1 800	1930	1800	2100
Own consumption and losses	277	147	186	214	151	198	66	.	.
Total consumption	6 163	6 039	6 467	6 822	6 930	7 032	7 101	7 000	7500

Source: MH SR (1999a, 2000), SPP (2002)

The projected future development of long-term demand for natural gas will be affected by the decision of the Government regarding the completion or non-completion of units 3 and 4 of NPP Mochovce, the operation of the V-1 units of NPP Jaslovské Bohunice and the source of their replacements. Other factors which will influence developments in natural gas demand will be industry revitalization (chemical and metallurgy), change in the overall social situation of the population and the changes in energy and specifically natural gas prices, which will have a significant impact on any further gasification in communities (territorial gasification).

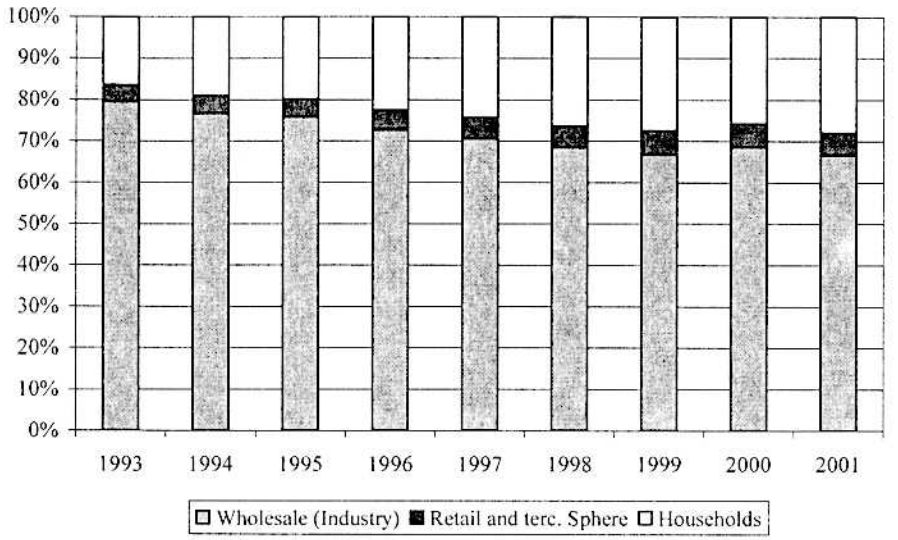

Fig. 4. Natural gas consumption structure
Source: MH SR (1999a, 2000), SPP (2002)

In 2001, 71 new communes were connected to the pipeline network in Slovakia, resulting in a total number of 2006 connected communes, 69 % of the overall number of communes. By the end of 2000, the state-owned company Slovenský plynárenský priemysel supplied gas to 1 372 788 consumers,which is 28 792 consumers more than in comparison with 2000. The residential customer category experienced the most extensive expansion of the gas network (households). After the Netherlands, Slovakia has the second densest gas distribution network in Europe (Tab. 7, Figs. 5 and 6).

Tab. 7. Development in gasification in the Slovak Republic

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001
Number of gasified communes	651	790	1023	1193	1419	1678	1804	1935	2006
Number of customers – residential (thousand)	951	996	1044	1100	1164	1218	1256	1291	1317
Number of customers – commercial (thousand)	33.4	35.4	37.3	39.7	44.4	47.7	49.9	52.8	56.1

Source: MH SR (1999a). SPP (2002)

At the end of 2001, the length of operated inland gas networks was 27,944 km, of which 6,094 km were long-distance networks and 21,850 km (SPP 2002) were part of the distribution network.

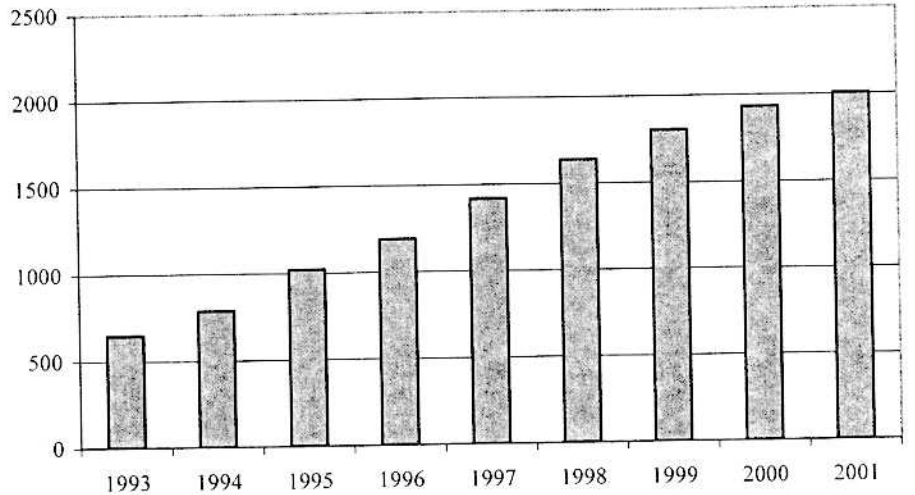

Fig. 5. Number of gasified communities in Slovakia
Source: MH SR (1999a), SPP (2002)

Transit and storage of natural gas

After Ukraine, Slovakia is the second largest natural gas transit country in the world. The transmission gas pipeline of the Slovak Republic is part of the international gas network. The main route of the transit gas pipeline has four lines, including branches to the Czech Republic.

In total, these pipelines amount to 2,268 km of transit networks. In 1998, the transit gas-pipeline on the territory of Slovakia transported 84.1 Bcm of natural gas from the countries of the former Soviet Union (SPP 2000). In 1999, this figure rose to 88.3 Bcm and declined in 2001 to 71.5 Bcm. This represents approximately 80 % of Russia's total gas exports to CEE countries and 25 % of the total gas transported to Western Europe. The capacity of the transit gas-pipeline is currently being expanded by constructing a 5th line (340 km of new pipeline) and through upgrades of the existing compressor stations, so that transport capacity will reach 90-92 Bcm of natural gas.

As a result of their connection to this international transit gas-pipeline, the underground storage tanks in Láb are filled, with a capacity of 2.1 Bcm. SPP leases the remaining 1.3 Bcm capacity to foreign companies. The gas from the storage facilities is pumped into the SPP owned pipeline system. These storage tanks can currently cover around 20 % of demand. Their potential capacity has been estimated at 6.8 Bcm (MH SR 1995). Great importance is attached to the expansion of the existing storage facilities for natural gas, in order to cover 22 % of the total demand per year. Their volume should more than double after the construction of new underground storage tanks in Láb and Jakubov in 2010,

thereby achieving a capacity of over 4 Bcm. As it is expected that 2.2 Bcm will be needed by 2010 there will be an excess of 1.7 Bcm. In 2007, the construction of an underground gas storage facility in Sered' is set to begin. In order to integrate with the European gas system, it will be necessary to make a physical interconnection of gas-pipelines with enough capacity to supply gas to Austria and the Czech Republic.

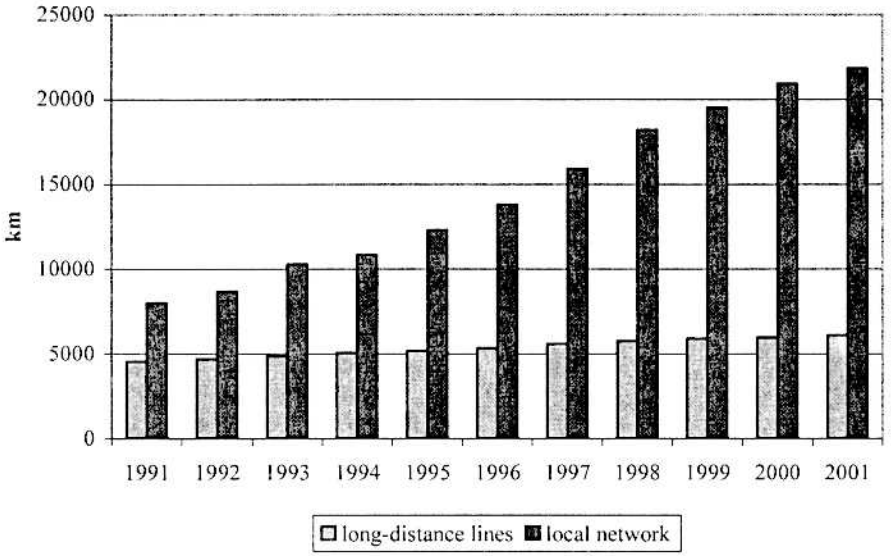

Fig. 6. Network of pipelines in Slovakia
Source: MH SR (1999a), SPP (2002)

Slovakia is almost 100 % dependent on gas imports from Russia. The associated security of supply risk is mitigated by the size and importance of Slovakia in the transit of Russian gas to Western Europe.

Natural gas supplies are currently covered by several long-term contracts. In April 1997, SPP and Gazprom signed a long-term contract that covers the supply of gas until 2008. The major part of supply is covered by transit services for Gazexport Moskva and the cost of the rest of the imports is paid in USD. Any gas needed in excess of the amount contracted for would be supplied according to a short term contract that SPP has also signed with Slovrusgas Bratislava (a joint company of SPP and Gazprom) in which 40 % of supply will be covered through the export of Slovak commodities.

When looking to reduce Slovakia's dependency on imported gas from a single source it would be desirable to seek other sources or other transport routes. Higher energy security will inevitably require increased costs and each new import route will cause an increase in gas prices. Gas storage facilities currently cover more than 100 days of annual gas consumption. The government strategy, with regard to security of supply, is to secure 5-20 % of gas supplies from diversified sources sometime between 2005 and 2007. Realistic considerations for alternative suppliers are Norway and the Netherlands. With such a diversifica-

tion of supplies, the decisive factor will be efficiency and competitive pricing as compared to the import price from the existing gas suppliers in Russia.

In securing a diversification of gas supplies to the Central European market, the potential cooperation of CE countries (Poland, Czech Republic, Hungary and Slovakia) is also significant. Currently, negotiations are in train relating to the potential construction of a gas pipeline from the Polish border. The Russian exporter Gazprom itself is trying to diversify transit routes, and has been pressing Poland and Slovakia to join in the construction of a new route for the Yamal – Europe transit gas pipeline, which would travel via Belarus and thus avoid Ukraine. Other projects of diversification of supplies are Adria LNG, Iran Gas Europe and Inter-connector.

THE ROLE OF NATURAL GAS IN SUSTAINABLE DEVELOPMENT OF THE ENERGY SYSTEM

In the government's energy policy and their projections for the next several years, natural gas is considered as a key source of energy in Slovakia. Its role in electricity production should grow, as new power plants will be based on natural gas. It is expected that the major part of any increase in electricity consumption will be covered by production from independent producers (mainly based on efficient combined cycle power plants and combined heat and power). Their share of electricity production could be increased from 13 % to 23 % in 2010.

Heat supply represents an important part of the Slovak energy sector. District heating (DH) has become the dominant method of heat supply in Slovakia. Almost 100 % of the heat used in apartments, which represent approximately 49 % of households in Slovakia, is supplied by heat from district heating. It is expected that the strong role of natural gas in heat supply will continue to grow. The fuel base of district heating plants is composed of 71.3 % natural gas, 16.4 % coal, 6.7 % fuel oil and 5.6 % from other sources. Currently, district heating covers 38 % of total heat supply for households in the service and household sector.

The possibility of using combined heat and power production (CHP) is an important advantage of district heating. The most significant barrier to a wider implementation of CHP is the distortion of natural gas prices (thus providing an advantage to the construction of individual gas boilers versus district heating and CHP plants). Under market conditions, district heating and CHP are clearly the most efficient, presenting the lowest prices for consumers.

In 1998, more than 30 small co-generation units were in operation in Slovakia, with a total electric capacity of more than 16.9 MW, thereby producing approximately 59.15 GWh (or 0.24 % of total annual electricity consumption). 70% of the electricity produced has been used to cover the producer's own consumption and the rest has been supplied to the grid. By 2010 it is assumed that there will 320 MW in the house and 480 MW of CHP (MH SR 1999b)

According to Slovakia's official energy policy, the implementation of measures for the reduction of emissions and of basic pollutants will lead to a higher utilization of natural gas. The pre-condition for the fulfilment of Slovakia's commitment to the Kyoto Protocol is that the average annual value of CO_2 emissions from combustion and energy conversion of fossil fuels in the period

between 2008 and 2012 will not exceed 51.066 million tons in absolute volume. As demonstrated by the analysis of empirical data, it is mostly the shift of energy sources to natural gas-fired boilers that has enabled a stabilization in the generation of CO_2 in the area of combustion and energy conversion of fossil fuels. According to data for the year 1998, there has been a fall in the use of primary energy resources and a concurrent drop in the generated volume of CO_2 to a level equal to 73 % of the pre-set reduced limit. This drop can be explained primarily through a decline in the consumption of brown coal and coke and by an increased consumption of natural gas and of primary nuclear heat (with respect to the commissioning of the 1st block of the Mochovce nuclear power plant). This implies that the largest share of CO_2 emissions originates from the end use of energy in industrial processing technologies. The potential for the reduction of emissions is represented mainly by the restructuring of the industrial base to increase the manufacturing sector of the country's economy. The program for the utilization of natural gas automotive fuel should also be adopted (MH SR 1999b).

The energy policy includes an ambitious program for energy saving and renewables. Two scenarios suppose the increase of electricity generation from renewables, by 2010, to be 63 % and 133 % of existing energy supply and that heat energy generation should double or triple compared to 1997 levels. The estimated investment costs are 46.6 (1.1 billion EUR) and 98.3 billion SKK (2.3 billion EUR) respectively. Currently, only 3.33 % of the total consumption of primary energy resources are covered by renewables. A long-term goal in the area of the use of renewable energy sources is to attain a higher level. This is comparable to the level of attainment in the majority of EU countries. To achieve this goal it is, above all, necessary to raise fuel and energy prices to create a suitable legislative economic and financial framework and to introduce systematic measures for the support of entrepreneurial activities in renewable energy sources (MH SR 1999b).

There are no adequate legislative, economic and fiscal instruments in the SR to influence the efficient consumption of energy and for the reduction of the energy intensity of the national economy. The funds allocated in the state budget for the support of rational energy use are only symbolic.

The strong position of natural gas in the fuel mix and the gas industry in the economy of Slovakia may have a negative influence on the introduction of renewable sources and energy saving programs.

THE EFFECT OF EU MEMBERSHIP ON THE SLOVAK GAS INDUSTRY

The Slovak gas transit system is an integral part of the European gas network. Due to its geographical location, natural conditions, and its historical development, Slovakia has become an important European natural gas centre.

These plans were affected by the privatization of 49 % of SPP by the consortium of companies Gaz de France, German Ruhrgas and Gazprom from Russia. The state retained a majority share (51 %) in energy companies.

Accession into the European Union is dependent on several measures. It requires a restructuring of the energy sector, a new principle of regulation in the

energy sector, and a price adjustment, liberalization and opening of the market. The main objective of the government, in preparing to integrate into the European internal market, is the transformation of the energy sector into a competitive sector of the economy that is able and prepared to join the European single market. According to the official energy policy of Slovakia, the energy sector should be fully compatible and competitive with European energy markets by 2003. According to the current transformation process in the energy sector, this deadline appears very optimistic.

Effective transformation depend on the fulfillment of four important issues: the restructuring and privatization of energy companies, the establishment of an independent regulatory body, the setting of energy prices on a real level for all consumer categories and the completion of an energy legislative framework.

CONCLUSIONS

The clear advantage of natural gas is of particular significance at the present time as the EU and Slovakia are struggling to meet even the first reduction commitment (an 8 % reduction of 1990 emissions by 2010). Although it is clear that the CO_2 emitted from the burning of natural gas does damage the environment and will negatively impact upon the world's climate, it is also clear that its impact is significantly less than from the burning of coal. Similarly, the particulate emissions and NOx gases from gas fired power stations are also notably lower than in solid fossil fuel power stations.

However, in the long term the use of natural gas is not sustainable and therefore does not offer the same security of supply as other, equally mature, technologies. Within Europe, and in particular Central and Eastern Europe, where the levels of energy intensity are far higher than in the EU, any sustainable and in the long term secure energy system must use energy more efficiently. This will require efficient use on the demand and supply side and a restructuring and reassessment of energy use systems. In particular, significant attention should be directed towards an increasing of the level of efficiency and towards combined heat and power stations.

In addition to energy efficiency, the use of renewable energy needs to become widespread and universally adopted. Only renewable energy technologies can offer electricity and energy services that are largely free from security of supply concerns and will not be depleted or cause significant damage to current or future generations.

However, recognizing this, in the very short term (within the next decade or so) renewable energy technologies, despite significant improvements in energy efficiency, will not be able to provide the full level of energy services the EU currently enjoys. It will therefore be necessary to use natural gas as a bridging or transition fuel. Consequently, natural gas must be used minimally and respectful of its lasting impact and limited resource base.

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Ján Szőllős

ÚLOHA ZEMNÉHO PLYNU V SÚČASNOM VÝVOJI ENERGETICKÉHO SYSTÉMU SLOVENSKA

Energetický sektor je považovaný za jeden z najdôležitejších sektorov ovplyvňujúcich rozvoj hospodárstva a celej spoločnosti a je tiež dôležitým faktorom regionálneho rozvoja. Popri všeobecnom výskume geografických aspektov energetiky tvoria významnú časť geografického výskumu v tejto oblasti práce venované geografickým aspektom využitia jednotlivých zdrojov energie. Z tohto aspektu bola významným procesom elektrifikácia. V súčasnosti je podobným procesom rast využívania zemného plynu a plynofikácia. Hoci zemný plyn nie je obnoviteľným zdrojom energie, a preto nemôže byť klasifikovaný ako trvalo udržateľný, môže hrať významnú úlohu vo vývoji trvalo udržateľného energetického systému, nakoľko pri jeho efektívnom využívaní sa produkuje menej CO_2 ako pri ostatných fosílnych palivách. Keďže sa na rozdiel od jadrovej energie môže transformovať aj v malých zariadeniach a jeho exploatácia si nevyžaduje prísne bezpečnostné opatrenia, môže byť jeho využitie decentralizované, a tak prispievať k regionálnemu rozvoju.

Ekonomika Slovenska sa vyznačuje v porovnaní s priemerom EÚ vysokou energetickou náročnosťou (tab. 1, 2). Z hľadiska zdrojovej bázy sa v energetickom systéme a hospodárstve Slovenska od sedemdesiatych rokov 20. storočia neustále zvyšovala úloha zemného plynu a jeho podiel na spotrebe a v súčasnosti je už zemný plyn najvýznamnejším energetickým zdrojom Slovenska (tab. 3, obr. 1).

Domáca ťažba zemného plynu a aj jeho zásoby na Záhorskej a Východoslovenskej nížine sú malé a zabezpečujú len 2.6 % celkovej spotreby. Zvyšná časť potrieb je krytá dovozom plynovodmi Bratstvo a tranzitným plynovodom z Ruskej federácie a distribuovaná miestnou sieťou (obr. 2). Nediverzifikovaný dovoz vytvára potenciálne nebezpečenstvo pre energetickú bezpečnosť krajiny (tab. 4, obr. 3). Preto je aj z hľadiska trvalej udržateľnosti nevyhnutná diverzifikácia dodávok zemného plynu, nakoľko aj prognóza budúcej domácej ťažby predpokladá jej pokles (tab. 5).

Slovensko prešlo v uplynulých dvoch desaťročiach rýchlym procesom plynofikácie a v súčasnosti je už na rozvod zemného plynu pripojených už 67 % obcí. Slovensko má po Holandsku druhú najhustejšiu distribučnú sieť plynovodov v Európe. Najvyššia, ale stagnujúca spotreba zemného plynu je stále vo veľkoodbere, kým spotreba v domácnostiach sa od roku 1993 takmer zdvojnásobila (tab. 6, obr. 4, tab. 7, obr. 5 a 6). Zavedenie zemného plynu vytvára potenciál pre zvýšenie kvality života obyvateľov obcí a regiónov a ich hospodársky rozvoj.

Významná je úloha Slovenska aj v európskom tranzite zemného plynu. Vetvami tranzitného plynovodu sa cez Slovensko prepravuje 25 % exportu tejto komodity z Ruska do krajín západnej Európy.

Z uvedených faktov vyplýva, že na Slovensku sú vytvorené materiálne predpoklady, aby zemný plyn zohral v budúcich desaťročiach úlohu hlavného zdroja energie v prechodnom období na ceste od súčasného, trvalo neudržateľného modelu energetického systému, založeného na využívaní neobnoviteľných zdrojov, k trvalo udržateľnému modelu, ktorého základom budú obnoviteľné energetické zdroje.