INTERNATIONAL ENERGY AGENCY

SLOVAK REPUBLIC

ENERGY POLICY REVIEW

2005

OECD

INTERNATIONAL ENERGY AGENCY

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It carries out a comprehensive programme of energy co-operation among twenty-six of the OECD's thirty member countries. The basic aims of the IEA are:

- to maintain and improve systems for coping with oil supply disruptions;
- to promote rational energy policies in a global context through co-operative relations with non-member countries, industry and international organisations;
- to operate a permanent information system on the international oil market;
- to improve the world's energy supply and demand structure by developing alternative energy sources and increasing the efficiency of energy use;
- to assist in the integration of environmental and energy policies.

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The OECD is a unique forum where the governments of thirty democracies work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

The OECD member countries are: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The European Commission takes part in the work of the OECD.

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ORGANISATION OF THE REVIEW AND ACKNOWLEDGEMENTS

Review Team

The 2005 IEA Energy Policy Review of the Slovak Republic was undertaken by a team of energy specialists. The team visited Bratislava between 31 January and 4 February 2005 to hold discussions with a broad scope of organisations. This report was elaborated based on these discussions and the government's reply to the IEA policy and statistical questionnaires.

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Ministry of Education

Ministry of the Environment
Ministry of Transport, Posts and Telecommunication

Regulatory Office for Network Industries (URSO)
Nuclear Regulatory Authority (UJD)
Administration of State Material Reserves (ASMR)
Anti-monopoly Office
Statistical Office
Slovak Energy Agency (SEA)

Academy of Sciences
Energy Centre Bratislava (ECB)
Association of Energy Managers (ASENEM)

C-Term
SE (power generation company)
Slovnaft
SPP (Slovak natural gas company)
SEPS (Slovak Electricity Transmission System)
SSE (Central Slovakia electricity distribution company)
Terming
Transpetrol
VSE (Eastern Slovakia electricity distribution company)
ZSE (Western Slovakia electricity distribution company)

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- Len L. Coburn, Jan Poucek, Cristobal Burgos and Chakraborty Sabyasachi on the oil, coal, natural gas and nuclear energy chapters, respectively;

- IEA staff: Jason Elliott on oil security, Thomas Guéret on energy efficiency, Nicolas Lefèvre on climate change, Brian Ricketts on coal and Piotr Tulej on renewables;
- Bela Kelenem of Slovnaft on oil and Christophe Poillion of SPP on natural gas.

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EXECUTIVE SUMMARY AND RECOMMENDATIONS

Rapid, Radical Reforms

Slovakia has implemented a range of thorough energy reforms over a short period of time with impressive results. As a medium-sized new EU member state, it plays a strategic role in European natural gas supply.

With limited domestic energy resources, Slovakia relies on imports for almost 80% of its (net) primary energy supply, mainly from Russia. Its energy mix relies heavily on gas (31%) and coal (25%) for electricity and heat generation followed by oil (17%), nuclear (8%) and renewable energy (3.4%), mainly hydropower. Between 1990 and 2003, as a result of structural reforms and energy price increases, TPES decreased by 14% and energy and carbon intensities fell by 30% and 43%, respectively.

Energy Policy: Foundation of Reforms

On the basis of Slovakia's 2000 energy policy, the government has initiated structural reforms and sectoral policies. It separated policy-making functions, enforcement of regulations, now ensured by an independent regulator, and the operation of energy suppliers. Such separation is required to foster market conditions and limit conflicts of interest on the part of the government as policy-maker, regulator and shareholder, and to establish a better balance between energy supply and demand.

Market Reforms: Impressive Results

The 2001 and 2004 energy legislation has helped the government achieve and consolidate a market-based regulatory framework in line with EU directives. The result has been cost-reflective prices and favourable investment conditions, in particular through careful privatisation, attracting major foreign direct investment. Challenges remain in establishing real consumer choice and protection, enabling competition with effective third party access to energy facilities, and integrating the Central European energy market where incumbents maintain dominant positions and gas supply is sourced primarily from one country. A more market-driven and regional approach to the Slovak energy market should be a short-term objective.

A longer-term goal should be the establishment of a common regional energy market with open borders and an integrated point-tariff system.

Sectoral Policies: Crucial Components to be Strengthened

High import dependency and reliance on a single dominant hydrocarbon supplier highlight the importance of vigorous energy security policies based on a combination of measures, focused on oil and gas stocks and an emergency preparedness system, enforced by strong institutional links in order to attain EU and IEA requirements. Securing alternative supply options and diversification of oil and gas supplies can also play a critical role.

Despite improvements, energy policy focuses on the supply side, undervaluing the negative impact of the high costs of energy to the economy and to households. Future decommissioning of electricity generating capacity and high import dependency highlight the need for a robust energy efficiency action plan. This plan would be implemented through an energy efficiency act with a strong national energy agency, and backed by financial mechanisms such as energy efficiency funds and third party financing to tap into significant economic energy saving potential. Additional and sustained benefits include increased business competitiveness, improved household welfare, environmental performance and enhanced convergence with IEA and EU energy performance levels in a cost-effective way.

The environmental impacts of energy use, mainly pollutants and greenhouse gases (GHG), have been dramatically reduced thanks to voluntary policies but pollutant and carbon intensities still remain much higher than the average for OECD Europe. Growth in air pollutants and GHG emissions has been decoupled from economic growth. In addition, climate change issues have been progressively integrated in the policy-making process and sulphur dioxide and carbon trading schemes have been put in place.

Energy research and development might be better integrated with energy policy priorities, in particular energy efficiency and environmental protection, and its resources aligned with the level of Western Europe.

Energy Sector and Markets: Radical Changes and Rapid Transformation

In less than a decade, regulatory reforms and thorough energy company restructuring and privatisation have transformed the energy sector as well as rationalising its markets.

The oil industry is the most advanced in this process and complies now with the latest international standards, and is integrated in the regional market. In the domestic market, stronger and sustained regulatory enforcement, close market monitoring and fair access to facilities are required to enhance competition and attract new players.

Coal use has been decreasing and largely relies on imports as domestic lignite production has continued to decline. This trend is expected to accelerate with stricter emission limits and carbon quotas.

In the gas sector, end-use price rebalancing and partial privatisation have enhanced modernisation of SPP, the national gas company, and consolidated the transit system, which supplied 16% of EU 15 gas supply in 2004. New challenges include the effective opening of the retail gas market (more than one third of final energy consumption) to competition in the face of a dominant external supplier and a domestic integrated incumbent. So attentive regulatory monitoring, in particular of access to gas supply and facilities, as well as an effective and durable diversification of gas supply, are crucial. Apart from the legal unbundling of SPP Transmission and SPP Distribution, the EU Gas Directive requires their functional unbundling.

Nuclear energy, which is dominant in electricity generation, has entered into a phase of substantial changes with the forthcoming decommissioning of a second plant, important waste management investments and the privatisation of the operating company with the planned completion of a new plant in the context of market opening. Given these changes, the nuclear sector will require significant additional resources as well as a close monitoring of safety and financial balance, by the authorities.

The use of renewable energy is still marginal, except for large hydropower and its market potential is modest (4%). Nevertheless, biomass, geothermal and solar thermal could provide low-temperature heat and electricity under economically viable conditions (partly compensating for the declining lignite production) reducing the energy trade deficit and reinforcing reliability of supplies. To this end, an action plan based on realistic objectives can play a key role.

The unbundling of electricity generation ownership from transmission and distribution, large import capacities as well as price reform, have improved market fundamentals and created conditions for competition that should be enhanced by the finalisation of privatisation (in generation and distribution) while keeping the grid operator state-owned. While Slovakia has advanced towards a competitive power market, challenges remain in harnessing the full advantages of cross-border trading opportunities so as to increase efficiency,

reduce costs and improve reliability and security. However, the construction or acquisition of new generation plants by SE, the national electricity generation company, persistence of long-term contracts and the concept of national self-sufficiency in electricity may further reinforce SE's dominant position and conflict with the objectives of creating a competitive market and its progressive integration with the EU internal electricity market.

A single regulation for heat and the establishment of cost-reflective prices have contributed to the rehabilitation and modernisation of existing district heating networks, notably through partial privatisation, which is expected to be finalised in 2006.

Conclusions

Energy reforms in Slovakia have entered a crucial stage, simultaneously consolidating achievements of rapid market reforms, integrating EU energy markets and strengthening energy security. The challenges are even greater up to 2010. They include the gradual decommissioning of electricity generation capacity, increasing hydrocarbon prices, controlling pollutant emissions in line with EU and international obligations, and reducing energy consumption growth and intensity. These tasks require vigorous policies based on clear objectives and time frames within co-coordinated, independent and robust administrations.

The future of Slovakia depends to a large extent on its ability to acquire new knowledge, and rapidly and efficiently to apply it to the design and marketing of products and services that are competitive in European and global markets. Safer, cleaner and more efficient energy can greatly contribute to this objective.

Recommendations

The government of the Slovak Republic should:

- **Energy Policy**

  General Energy Policy

  - Finalise the separation of state functions between policy making, regulation enforcement, and ownership and operation of energy services.
  - Consider reinforcement of policy monitoring, in particular with mid-term policy cycle assessment, and ensure involvement of all stakeholders, including consumers, when developing energy policies and widely disseminating information.

- Ensure that policy design and implementation are balanced between supply and demand, and that energy efficiency/demand-side management (DSM) is made a priority.
- Ensure sufficient independence from political and industry influence, and provide adequate resources to state agencies, in particular the Regulatory Office for Network Industries (URSO), Nuclear Regulatory Authority (UJD), Slovak Energy Agency (SEA), Administration of State Reserves (ASMR) and the Anti-Monopoly Office.
- Ensure the quality of statistics and forecasts, on both supply and demand sides, in compliance with international standards, and satisfy new needs.
- Ensure that the EU *acquis communautaire* and complementary regulation related to energy and energy-related issues are effectively enforced with appropriate monitoring.
- Ensure synergies and joint actions between the energy policies and other state policies such as environment, transport, housing, social and regional development.
- Prioritise on a least cost basis the use of EU structural funds and BIDSF for energy efficiency and sustainable renewable energy projects.
- Ensure that research and development on energy is integrated in a systematic way into state policies and programmes.

Energy Market Reforms and Regulation

- Consider developing regulatory, fiscal and market structures that seek to reflect environmental externalities in energy prices.
- Undertake an assessment of the feasibility of introducing peak tariff and interruptible contracts as a means to ensure investment and reduce peak demand.
- Implement the EU Directives for the internal energy markets as well as market rules that facilitate third party access (TPA) and customer choice.
- Ensure effective unbundling of monopoly activities using the most effective approach and adequate regulatory monitoring to ensure fair competition.
- Ensure co-operation and effective market monitoring by and between URSO, the Anti-Monopoly Office, and the designated system operators for electricity (SEPS) and gas (to be unbundled from SPP), so as to ensure effective market conditions and consumer protection; consider adopting a written agreement of co-operation on competition law enforcement.

- Ensure a transparent and non-discriminatory authorisation procedure for the construction of additional energy capacities to stimulate competition.
- Complete the privatisation of companies in a manner compatible with supply security priorities, diversification and market opening.
- Encourage URSO to develop rules and regulations for energy distributors to develop DSM programmes for their customers.

Energy Security

- Enhance energy security policy by strengthening institutions and diversified instruments with a priority to demand-side policy; assess its effectiveness, preparedness and cost-effectiveness.
- Achieve an energy security system which complies with quantitative and qualitative EU and IEA requirements.
- Consider ways to diversify oil, gas and nuclear fuel supply.
- Clearly define government legal authority to draw upon industry stocks in an oil supply disruption.
- Clarify the ownership of existing oil terminals and storage facilities on a fair value evaluation by 2006 as agreed; ensure that facilities for emergency reserves continue to be used solely for this purpose.
- Enhance efforts to ensure oil supply diversification with at least one viable option for supply of crude oil as for oil products.
- Ensure an effective monitoring of markets to avoid abuse of dominant positions by external and internal suppliers.

Energy Efficiency

- Consider adopting a robust multi-sector energy efficiency action plan with binding sectoral objectives, targeting an energy-efficient economy, and clear institutional responsibilities; an energy efficiency act will support implementation.
- Provide adequate resources to the national energy agency and local energy efficiency programmes and institutions to comply with the objectives; ensure independent monitoring of policies and programmes.
- Ensure co-ordination of activities within the central, regional and local administrations and other stakeholders; adopt most energy efficient standards for state-owned buildings and for the purchase of energy appliances and vehicles.

- Consider as a priority energy efficiency measures for energy poverty mitigation and building rehabilitation programmes.
- Implement EU directives on energy efficiency, including the Buildings and CHP Directives, on a timely and effective basis.
- Ensure that demand side measures are properly considered in least cost plans, in particular to replace future decommissioning of electricity capacities.

Energy and the Environment

- Monitor and evaluate the implementation and cost-effectiveness of the policies and measures in the National Environmental Action Programme (NEAP) and the Climate Change Strategy, using quantitative objectives and time frames.
- Continue to reduce the level of emissions of local pollution and enhance the monitoring system of local pollution.
- Ensure adequate control of emissions rights and trading, and monitor their evolution notably by reinforcing the Slovak Environmental Inspection (SEI) capacities.
- Implement ambitious action plans in sectors, in particular residential and transport which are not covered by the current pollution fee system or EU-Emission Trading Scheme (EU ETS).
- Enhance the promotion of Joint Implementation (JI) projects.
- Consider adding a CO_2 component in the emission tax and vehicle registration tax to support the Environmental Fund.

Research and Development

- Develop an energy R&D strategy by targeting those technologies that can help the country achieve its specific energy goals, in particular improvement of energy efficiency and reduction of CO_2 and pollutant emissions.
- Consider reversing the downward trend in government spending on energy R&D and bringing it more in line with other EU and IEA countries and ensuring its cost-effectiveness.
- Investigate private/public partnerships to ensure continued energy R&D efforts by energy companies in the competitive market.
- Enhance co-operation between institutions and examine advantages for greater participation in international energy R&D programmes such as these developed by the EU and the IEA.

Energy Sector

Oil

- Ensure effective wholesale and retail oil product competition through open trade, access to new entrants and active monitoring of competitive conditions, based on liberal legislation and using market tools by an independent and empowered agency (Anti-Monopoly Office); price regulation should be avoided.
- Ensure fair access to oil terminals to all market players.
- Continue enhancement of fuel quality and modernisation of transport, refining and retail facilities in compliance with international standards.
- In line with the objectives, promote sufficient demand for biofuels to stimulate increased investment in production facilities.
- Ensure that the ownership and operation of oil transit does not conflict with supply diversification, market competition and its sustainability.

Coal

- Continue sector restructuring and closure of non-economical mines in compliance with EU competition, social and environmental rules.
- Allocate adequate support for the employees during the mine closure process and explore alternatives such as natural gas and biomass conversion of power and heat plants.
- Ensure that imports can compete on a fair basis.
- Ensure that large to medium-size coal users comply with the EU and domestic environmental standards.

Natural Gas

- Consider ways to diversify supplies, including regional initiatives, and ensure sufficient gas storage.
- Evaluate whether the long-term contracts that exist in this sector are compatible with EU and Slovak competition rules.
- Evaluate the consequences for competition and diversification of the presence of integrated companies, both upstream and downstream; ensure commercial transparency of supply and import contracts.
- Continue to develop competition in the gas sector in a manner compatible with the objectives of security of supply and new investments.

- Implement the legal unbundling of SPP as soon as possible in order to improve transparency and non-discrimination in the sector.
- Ensure that newcomers have fair access to gas supply transmission, storage and distribution facilities.
- Ensure a fair and transparent entry and exit tariff system for access to the transport network including at international points.

Nuclear Energy

- Continue to ensure the independence and power of the Nuclear Regulatory Authority (UJD), and harmonise the current quality management system with existing and future international standards, taking into account future challenges in the nuclear sector.
- Provide adequate resources to UJD, possibly through licensing fees, in order to maintain, recruit and retain high-level nuclear safety professionals and to involve independent technical support organisations.
- Follow the highest available safety standards by closely monitoring the level of safety and security of all nuclear facilities in the new context of private ownership and liberalisation of the electricity market.
- Make efforts to diversify nuclear fuels supply.
- Ensure that the costs of decommissioning and waste management and storage, including the long term, are covered by the operator, and that the nuclear account is adequately funded and managed.
- In accordance with previous commitments, prepare the shut-down and decommissioning of the two units of Bohunice V-1 NPP, applying the highest available safety and radiation standards; continue timely decommissioning of A1 Bohunice.
- Ensure that the new SE majority owner performs a feasibility study on the completion of EMO 3&4 at Mochovce that will comply with the highest available safety standards and ensure that its commissioning will be carried out under open market conditions, limiting the impact of stranded costs.

Renewable Energy

- Ensure a realistic and ambitious share of renewable energy in the energy mix, supported by an adequate action plan, resources and specific regulations; assess its effectiveness and cost-benefit.
- Consider temporary tax, regulatory and financial incentives, in particular for market and project studies, and renewable energy investment projects.

- Consider the introduction of a purchase obligation for renewable energy supply for electricity distributors.
- Prioritise the use of market tools, in particular green certificates as well as the Kyoto Protocol flexibility mechanisms.

Electricity

- Implement additional measures to promote energy efficiency, possibly through new tendering procedures for electricity operators.
- Complement the BIDSF least cost supply plan for meeting the future loss of generation capacity through studies and audits to identify energy efficiency projects.
- Progressively eliminate distortions in electrical heating tariffs and provide alternative solutions, and phase out fixed long-term purchase and sale contracts.
- Publish authorisation procedures and implement and respect the EU rules for public participation in integrated licensing and environmental assessment of new power plants.
- Ensure a strong regulatory regime, both for nuclear safety and for the power market, including nuclear liabilities and BIDSF funding, especially when SE is privatised; ensure the independence of SEPS from industry and government.
- Establish a more transparent and competitive market structure through more systematic co-operation among the Ministry of Economy, URSO, SEPS, and the Anti-Monopoly Office.
- Establish a framework for short-term power trading in co-operation with the Czech market operator (OTE) anticipating a Central European approach.
- Continue with privatisation of distribution companies to stimulate competition at wholesale level, replacing the current single buyer system.
- Ensure that distribution companies and eligible customers are free to choose and buy from generators, external suppliers, and traders.
- Consider divesting generation assets from SE to set competitive conditions in generation.
- Take additional measures to implement the requirements of the EU directives relating to network access for producers using renewable energy sources or CHP by improving rules for connections and balancing at distribution level.

Heat

- Maintain competitiveness, technical and environmental performance of district heating through active state policy and adequate investment.
- Ensure effective enforcement of the 2004 Thermal Energy Act and consider adaptations when necessary.
- Develop incentive regulation to promote energy efficiency investment, demand-side measures and third party financing; anticipate the abolition of price control.
- Provide financial support for studies on district heating plants' switching from solid and liquid fuels to biomass, geothermal, solar thermal or gas.
- Complete privatisation of district heating companies without hindering heat and electricity competition.

CONTEXT AND ENERGY MARKET

Key Information and Data (2003)

- **Size:** 49,034 km^2
- **Population:** 5.38 million
- **Capital:** Bratislava (430,000)
- **GDP** (USD 2000 billion, exchange rates): 23 (1993-2003 annual growth: +4%)
- **GDP per capita** (2000 USD): 4,272 (OECD Europe: 21,180)
- **TPES:** 18.52 Mtoe; oil (30.7%-net trade: 17%), natural gas (30.6%), coal (24.5%), nuclear (27%-net*: 8%), renewables (3.4%)
- **TFC:** 11.25 Mtoe; industry (42%), residential (25%), transport (20%), services (9%), agriculture (2%)
- **Electricity consumption:** 24.2 TWh (2 Mtoe)
- **CO_2 emissions:** 37.9 Mt

** Excluding generation losses.*

A Vigorous Economy at the Heart of Europe

Located in the middle of Central Europe, the Slovak Republic (Slovakia) is one-fifth larger than Switzerland and is dominated by forests and mountains. Most of the population lives in the western part. Slovaks account for a large majority of the population, with the Hungarians (9.7%) and Roma (5%) being the two main minority groups.

Slovakia, as the other Central and Eastern European Countries (CEECs) and current or future EU members, has faced the historic double challenge of making the transition to a market and open economy, and implementing EU common policies and legislation.

In a short period of time, Slovakia has implemented and sustained impressively strong economic reforms to establish an effective market-based regulatory framework. This has resulted in a macro-economic stabilisation, remarkable economic modernisation and growth as well as rapid international integration. The country, despite its limited size and scarcity of natural resources, has increased its GDP by over 50% during the past 10 years and attracted more than € 11 billion (SKK[1] 440 billion) of foreign direct investments, notably in the energy sector, car industry and services. The share of the private sector in the economy is now over 90%, compared with

1. Slovak currency (Koruna-SKK); 2005 exchange rate: one euro equivalent to SKK 40.

Figure 1

Map of Slovakia

99% state-ownership under the Socialist planned economy. Services account for 66.5% of total GDP, followed by industry (30%) and agriculture (3.5%). These remarkable achievements also laid the foundations for OECD and EU memberships, in 2000 and 2004, respectively.

Many challenges remain, including lowering the high unemployment rate (18%), increasing individual incomes, reducing social transitional problems, redressing regional imbalances, developing competition in the network industries, and integrating fully with the EU internal market. To these ends, the government recently approved an ambitious multi-sector economic strategy to stimulate employment, increase productivity and catch up with more prosperous OECD countries. Since January 2005, an ambitious fiscal reform has introduced a unique flat tax rate of 19% for most contributions (VAT, revenue and corporate taxes). The inflation rate has decreased to 7.5%, while GDP continues to grow at 5% annually, and public debt is at 56% of GDP. Relying on this continuing macro-economic balance, the country aims for membership in the Euro zone by the end of the decade.

Slovakia is traditionally an industrial nation. The industrial sector has been the backbone of the economy and is a magnet for attracting further investments. By 2008 the country is expected to become the largest car manufacturer in Europe. Agriculture plays a smaller role, although much of the population still resides in rural areas. Development of the service sector has been spectacular over the last decade.

At the heart of Europe, Slovakia has developed extensively its trade activities, notably exports. Exports of goods and services account for 78% of GDP. The country represents an important cross-road within Central and Eastern Europe. It operates major transit routes, especially for hydrocarbons.

Energy: an Important Role and a Market in Transition

Energy has played an important role in the country's development, which has relied on heavy industries. With limited domestic energy resources, the country relies on imports for almost 80% of its net energy supply, mainly from Russia. The energy sector now accounts for 2.4% of the GDP, employs 2.1% of the workforce, and plays a strategic role in European natural gas transit. The government's privatisation programme for the energy industry has attracted major investments.

Energy markets are constrained by the size of the country and the low level of income per capita. Final energy consumption (11.25 Mtoe) is dominated by natural gas (35.5%), followed by oil products (25.5%), electricity (17.5%) and heat (9%). Industry accounts for 42% of total energy demand (TFC), followed by two growing sectors (see Figures 2, 3 and 4), residential with 25% and road transport with 20%.

Energy demand declined during the 1990s following industrial restructuring and energy price increases. Between 1990 and 2003, total final consumption dropped by 30%, comprising -45% in industry, -32% in residential and commercial sectors while rising by 105% in transport.

Nevertheless, energy intensity is still almost twice the OECD Europe average. There is a significant potential for energy savings across the business and household sectors.

Energy production is limited to nuclear power (25% of total primary energy supply, 8% of net TPES and 56% of power mix), hydropower (16% of power mix) and lignite (see Figure 5). This covers 36% of primary supply.

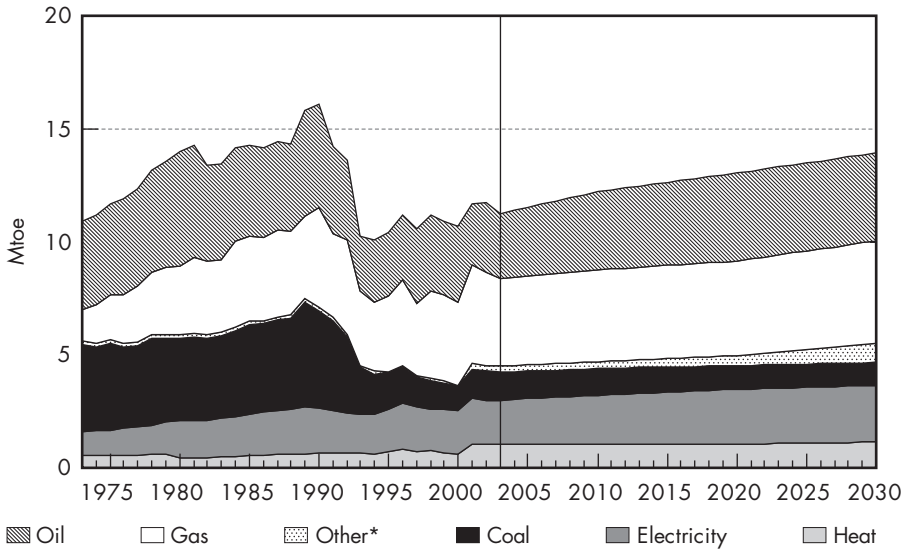
Imports cover the rest and are dominated by gas (30% of TPES) and oil (30%) which both originate almost entirely from Russia.

Government forecasts to 2010 anticipate a slight increase in total primary energy supply (TPES) of 2.6% at 18.7 Mtoe and final consumption by 5.4% at 12.3 Mtoe, pushed by industry and transport. Net electricity consumption is expected to rise by 12% to 25.6 TWh (2.2 Mtoe). Oil consumption will increase by 2.9% to 3.5 Mtoe, while consumption of gas will remain flat at 4.1 Mtoe. This would consolidate the high gasification level and increase the call on nuclear power, oil imports and biomass.

Accurate, reliable and adequate reporting of energy markets provides the very foundation for policy analysis, market monitoring and regulation, supporting the policy-making process and the tailoring of policy and legal instruments suited to meet domestic and international objectives. The government also has a critical role to play in developing high-quality data system and energy forecasts (see chapter on General Energy Policy).

Figure 2

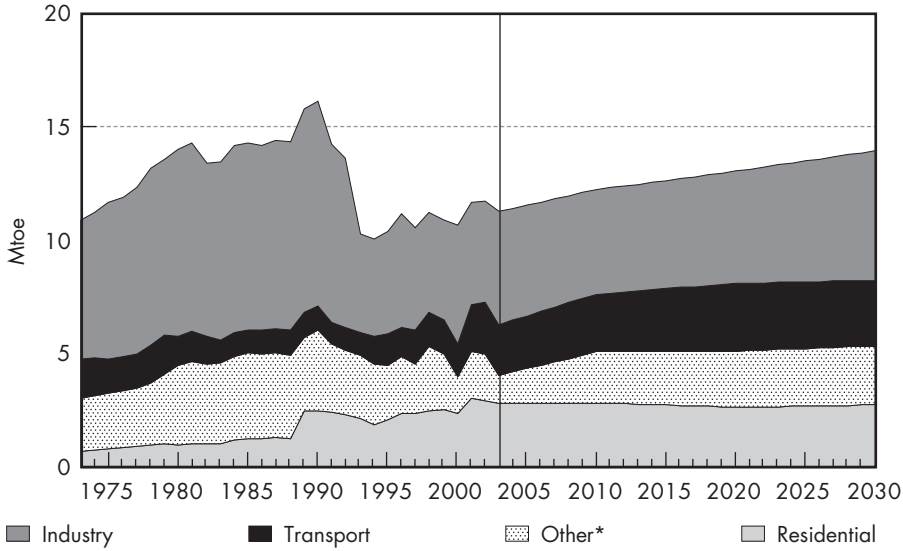
Total Final Consumption by Source, 1973 to 2030



** Includes geothermal, solar, wind, combustible renewables and waste.*
Sources: Energy Balances of OECD Countries, *IEA/OECD Paris, 2005 and country submission.*

Figure 3

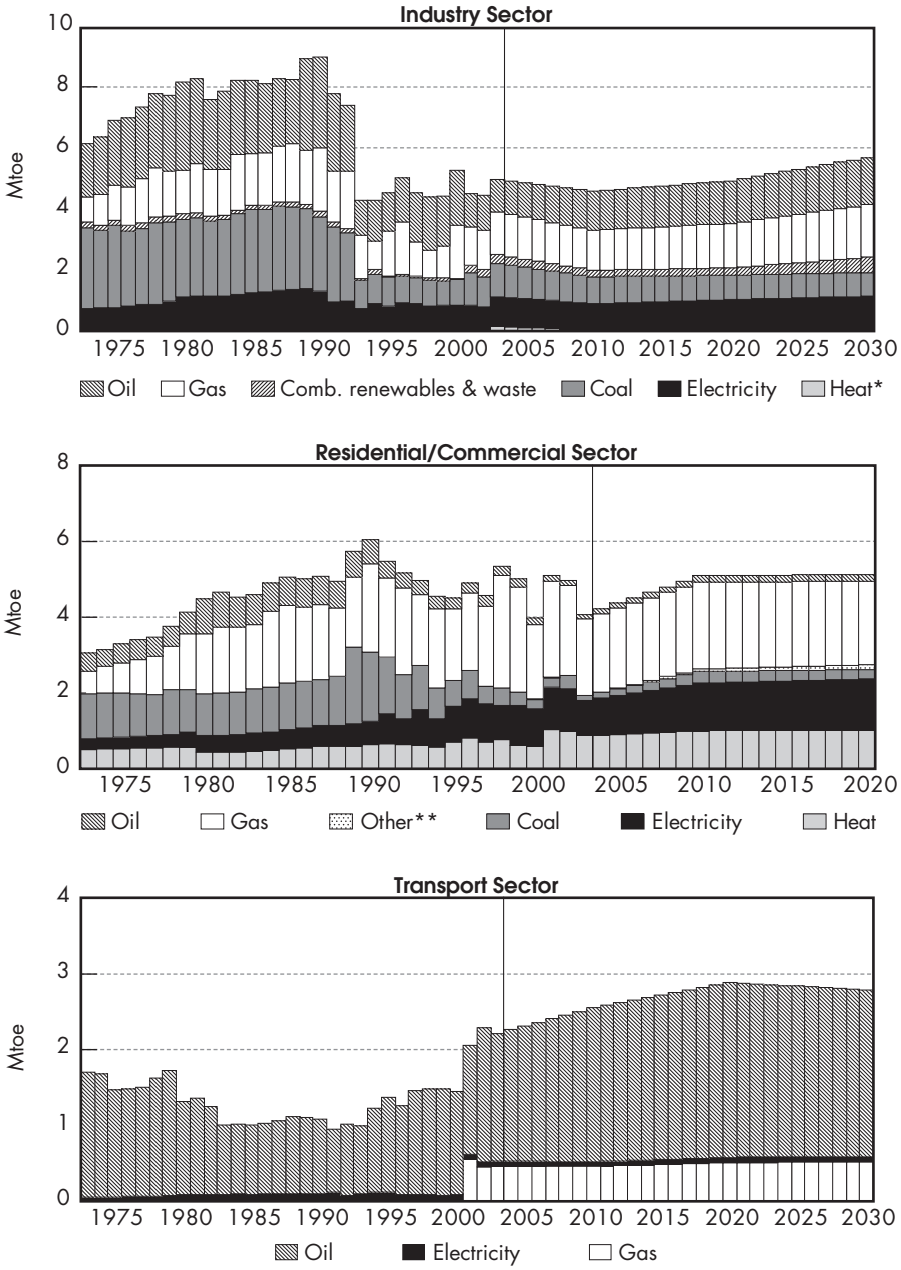
Total Final Consumption by Sector, 1973 to 2030



** Includes commercial, public service and agricultural sectors.*
Sources: Energy Balances of OECD Countries, *IEA/OECD Paris, 2005 and country submission.*

Figure 4

Total Final Consumption by Sector and by Source, 1973 to 2030



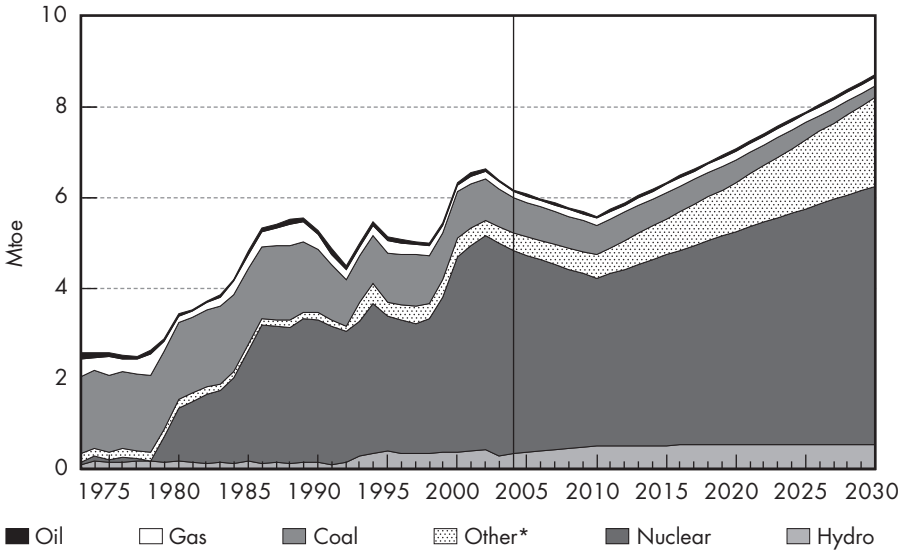
** Negligible.*

*** Includes geothermal, solar, wind, combustible renewables and waste.*

Sources: Energy Balances of OECD Countries, *IEA/OECD Paris, 2005 and country submission.*

Figure 5

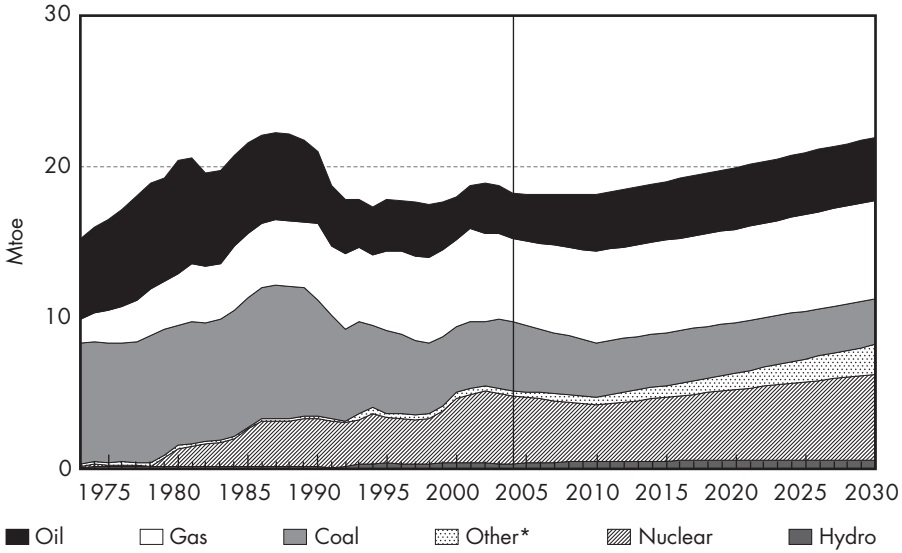
Energy Production by Source, 1973 to 2030



** Includes geothermal, solar, wind, combustible renewables and waste.*
Sources: Energy Balances of OECD Countries, *IEA/OECD Paris, 2005 and country submission.*

Figure 6

Total Primary Energy Supply, 1973 to 2030



** Includes geothermal, solar, wind, combustible renewables and waste.*
Sources: Energy Balances of OECD Countries, *IEA/OECD Paris, 2005 and country submission.*

PART I:
ENERGY POLICY

GENERAL ENERGY POLICY

Key Information and Data (2003)

- Administrative staff: Ministry of Economy (57), URSO (75), UJD (80)
- Energy sector: 2.4% of GDP, 2.1% of employment (EU 25: 1.2%-2001)

The national energy policy has largely shaped the design and execution of energy market reforms and State policies since 2000. The design and enforcement of policies have evolved in the context of an increasingly open international and market-orientated economy.

Energy Policy as Foundation of Reforms

- **2000 Energy Policy: Market Orientation Towards the EU Membership**

  The policy statement adopted in 2000 provided the guidelines for reforms, placing first priority on integration into the EU internal market as well as on security of supply and sustainable development. The objectives included the acceleration of the restructuring, including the unbundling of monopoly activities and privatisation of state-owned energy companies.

  Implementation of the 2000 policy has been supported by the adoption of new legislative texts including the Regulatory Act (2001), which shaped the regulatory reforms focused on price reform, the Act on "Emergency Stock of Crude Oil and Oil Products and on Managing the State of Crude Oil Emergency" (2001) and the Atomic Act (2002). In addition, a State programme for energy efficiency and renewable energy was approved in 2003 (see respective chapters on energy regulation, security and efficiency).

  The progress of reforms and commitments led to the closing of negotiations with the European Commission on the Energy chapter in 2001 to comply with the EU regulations on oil stockpiling and opening the gas market to competition.

- **2004/2006 Energy Policy statement: New Orientations in the EU Context**

  The 2000 policy stated that the government will review policy implementation and adopt a new policy every five years. In effect, since 2004, the Ministry of Economy has been developing a new policy concept that has

been under consultation within relevant ministries and the parliament before being submitted to the government for approval.

Its first policy statement as a full EU member state has three main priorities:

- Economic performance, environmental acceptance;
- Market development and integration into the EU market; and
- Reduction of energy dependence.

The new energy policy concept focuses on: consolidation of the 1998-2005 reforms; implementation of the EU *acquis communautaire*, notably by creating competitive and open energy markets before their full integration into regional and EU internal markets; enhancement of energy security in the context of high import dependence and decommissioning of power plants; and reduction of the high energy and carbon intensity. The goal is to complete the transition to a competitive energy sector under transparent market regulation to be achieved by state policies in strategic fields.

In addition, long-term (2020/2030) priorities were elaborated as follows:

- Secure sufficient electricity generation to meet demand on a sound economic basis;
- Ensure safe and reliable energy supply at maximum efficiency; and
- Reduce national energy intensity.

Organisation: Missions, Activities, Resources

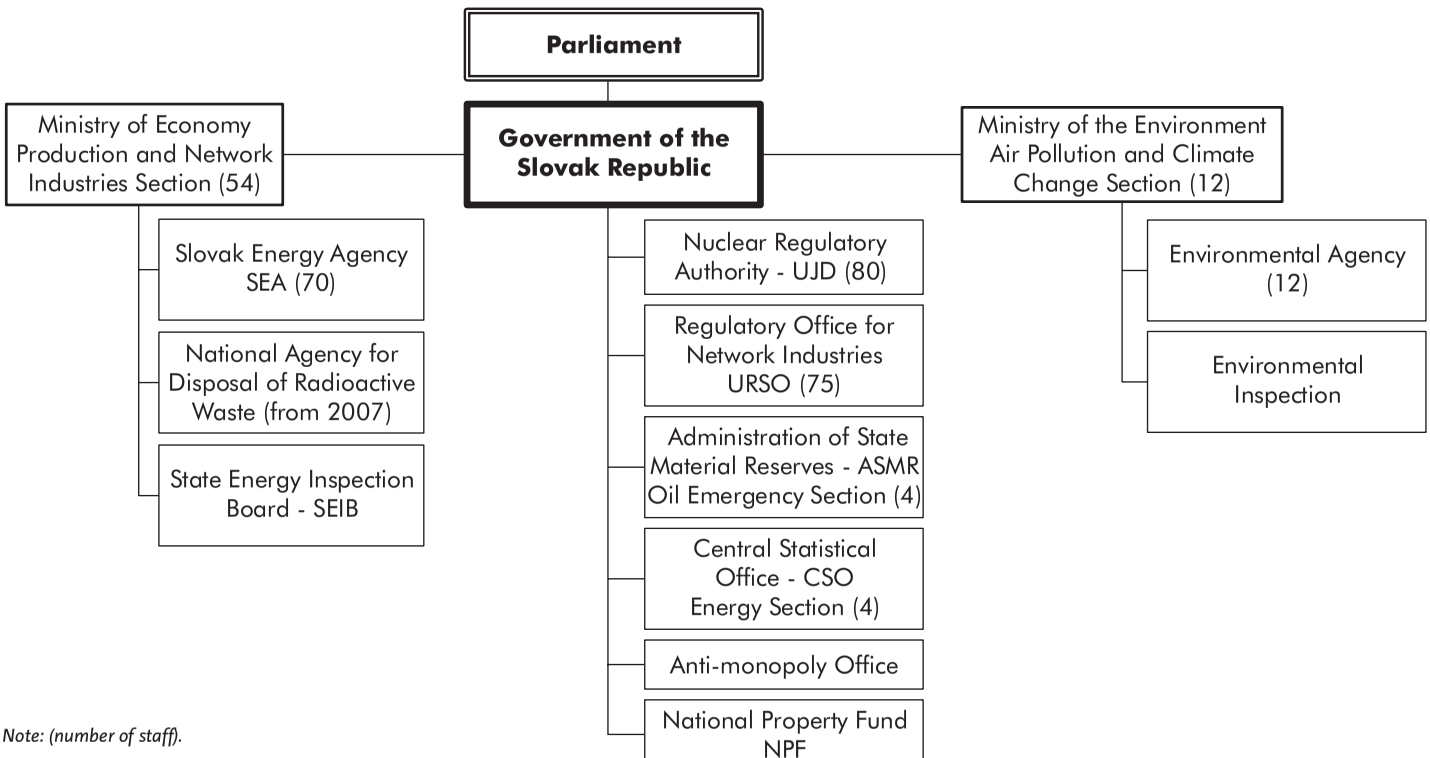
The institutional structure was reorganised and reinforced, notably with the establishment of an independent regulator (see chapter on regulation).

The Production and Network Industries Section of the Ministry of Economy has a central role in policy making. It is in charge of the design, implementation and monitoring of energy policy. It drafts primary energy legislation for approval by the parliament and adopts secondary legislation.

The enforcement of regulation and state policies is now largely in the hands of independent agencies; the Regulatory Office for Network Industries (URSO) for energy regulation, the Slovak Energy Agency (SEA) for energy efficiency and renewable energy, the Nuclear Regulatory Authority (UJD) for nuclear safety, the Administration of State Material Reserves (ASMR) for oil security and the Statistical Office. The National Property Fund (NPF) and the Ministry of Economy manage state-owned assets (see Figure 7).

Figure 7

Administrations Involved in Energy Policy-making and Implementation



Note: (number of staff).

Source: IEA.

Main Energy Policy Issues and Priorities

- **Energy Supply and Demand**

  Recent trends indicate that energy consumption is growing more slowly than GDP, owing to structural changes in the economy (*e.g.* increased share of services and light industry) and the effects of price increases. Nevertheless, in the household and transport sectors, energy consumption is increasing.

- **Supply Security and Safety**

  The Slovak energy mix largely relies on fossil fuels (75%) owing to an intense gasification policy, an increase of oil use in road transport and continuing use of coal for power and heat generation. The vast majority of those fuels are imported, mainly from Russia, accounting for 70% of total energy supply. The share of nuclear energy has increased to 8% of (net) TPES though that of domestic lignite dropped below 5% while hydropower, the only renewable energy source developed, remains stable at 2.5%.

  The high dependence on fossil fuel imports and a single supplier generates supply risks. The policy response has focused on oil security, notably with the building of emergency oil stocks equivalent to 90 days of consumption by 2009 (see chapter on energy security).

  The safety of energy installations, in particular nuclear power plants and nuclear waste management facilities, has been a priority. Regulation and organisation have been strengthened, the upgrade and modernisation of large installations largely implemented, and Bohunice V-1, the oldest nuclear power plant is scheduled to be shut down from 2006 as agreed with the EU (see chapter on nuclear energy).

  The closure of the V-1 nuclear power plant and other power generation units owing to environmental requirements will decrease the installed electric capacity by 20%, reducing the domestic reserve margin, which will still be 1.8 times higher than the winter peak demand. The government has developed the concept of electricity self-sufficiency, indicating the need to replace the decommissioned capacities to avoid electricity import dependence.

- **Economic Performance**

  In the second half of the 1990s, most of the energy state-owned companies had accumulated inefficiencies and financial losses despite their domestic

monopoly, which generated high indebtedness particularly in electricity generation. In those companies, transformed into joint stock companies, the government implemented thorough restructuring and enhanced corporate governance standards. Together with pricing reflecting true costs, this prepared the way for the transfer of ownership to strategic investors, which started in 2000 with Slovnaft (see chapter on regulation)

The development of competition in the respective energy markets as envisaged by the EU internal energy market directives confronts the domination of incumbent companies.

- **Environmental Acceptance**

The improvement of the initially degraded environmental situation caused by energy use has resulted in a reduction of energy, pollutant emission and carbon intensities. Environmental policies in the energy field have targeted a reduction of energy use and associated emissions, installation of new equipment, a switch from coal to gas and biomass, and promotion of renewable energy sources (see chapter on environment). Stricter emission limits and environmental taxes have been gradually enforced and emission trading schemes put in place.

Critique

The government has largely succeeded in separating its policy-making functions, its regulation enforcement, now implemented by an independent regulator, and the operation of energy suppliers. Nevertheless, the Ministry of Economy appears to retain influence, potentially impacting on the functioning and operation of the market. For instance, under the new energy legislation, ministerial discretion has been augmented in certain key areas, such as whether to authorise the construction of new energy facilities, a task formerly assigned to URSO. In the latter case, the criteria and procedures to be applied by the Ministry of Economy in deciding upon authorisations are not set out in the energy law.

So, further efforts will be needed to finalise this separation among these three functions, which is a pre-requisite to developing effective markets and limiting conflict of interest within the government as policy-maker, regulator and shareholder.

Enforcement of regulation and state policies is now in the hands of independent agencies whose power and resources have to be adequate to fulfil their duties. At the same time, the Production and Network Industries

Section in charge of energy issues at the Ministry of Economy should be sufficiently staffed to carry out both domestic tasks and international commitments.

The government has taken the lead in initiating market and structural reforms and sectoral policies. Based on the 2000 energy policy principles, the government achieved impressive results in a short period of time. It created a market-based regulatory framework based on the relevant EU directives, resulting in cost-reflective prices and favourable investment conditions. Progress was clearly acknowledged by the EU membership and by investors through large foreign direct investment (FDI) in the sector, principally for the purchase and investment in the former state monopolies. These companies are among the largest in terms of turnover and tax contribution in the country.

The 2004 policy aims at market development and integration into the EU, finalisation of privatisation and reduction of energy dependence. It is consistent with the EU principles and the IEA Shared Goals. While some of these objectives appear to be complementary and synergistic, certain aspects may be contradictory. If the limited size of the Slovak energy market explains the creation of national energy companies, maintaining a vertical integration structure, including transmission activities, will largely prevent it from benefiting from the stimulus of new entrants that might also provide additional security and diversification of supply. A noteworthy contrast separates the electricity sector, with an ownership unbundling of the grid with SEPS from the generation and distribution companies, and gas where the entire sector, including the grid and storage, is owned by a single company.

The government supports the concept of national self-sufficiency in electricity, for reasons of security of supply and greater energy independence. However, this may conflict with the objectives of creating a competitive electricity market and progressive integration with the EU internal electricity market. Implementation of self-sufficiency will reinforce the market power of SE in the Slovak market. In addition, in contrast to oil and gas imports, electricity suppliers and routes are manifold, mostly from EU and OECD countries, which reduces risks of dependence and monopoly abuses.

Furthermore, the decision to complete two nuclear reactors at the Mochovce (EMO 3 & 4) and new generation investments by SE to replace Bohunice V-1 nuclear plant, to keep unchanged long-term purchase and sale contracts will maintain the dominant position of SE in generation and wholesale. This will prevent supply diversification and effective wholesale competition. Security of supply does not appear threatened by the large existing overcapacity and a significant and diversified import capacity.

Furthermore, the new energy policy will have to be implemented in the context of more liberalised and open markets dominated by private operators and relying on independent market regulation and market tools.

Significant efforts have been made to adjust prices to costs and to eliminate subsidies and cross-subsidies, which were distorting the market and discouraging proper investment. This process has advanced in the electricity sector but tariff distortions remain in electrical heating.

The nuclear sector would require closer monitoring by the authorities for the following reasons: an expected increase of tasks with the decommissioning of two nuclear power plants, possible completion of one plant, waste management investment and the ownership of operational plants by a private company with no direct expertise on the VVER reactor-type; and all the above in the context of market opening. Assessment of associated decommissioning and waste management costs, as well as of their funding by the State Fund for the Decommissioning of Nuclear Power Generating Facilities and for Spent Fuel and Radioactive Wastes Treatment (SNIDF) through levies on customers, will be needed to balance the deficit foreseen in the 2000 Energy Policy, so avoiding risks of insolvency for SE like that which assailed the nuclear generator company British Energy plc after its privatisation.

Despite some improvements, policy guidelines are largely orientated towards supply-side solutions, without fully taking into account economic constraints and negative impacts of high energy intensity on the economy and households. The large energy saving economic potential at a minimum of 22% of total energy consumption, has been largely untapped. Improving energy efficiency policies has proved to be a cost-effective option, especially for peak demand offset and decommissioned generation capacities that will occur in the next five years. Additional benefits include enhancing supply security, reducing import dependency, improved business competitiveness and household welfare, environmental gains and development of new activities and jobs at local level, as emphasised by the 2005 EC Green Paper on energy efficiency.

However, the persistent lack of policy priority for energy efficiency and the absence of action and of sufficient funding, notably the lack of revolving funds, have hindered the energy saving potential. If implemented, the energy efficiency action plan could rely on new and significant external sources of funding, such as EU structural funds and the Bohunice International Decommissioning Support Fund (BIDSF). Since 2004, structural funds can provide substantial co-funding (up to 65%) to energy

efficiency investments. The first tender awarded SKK 580 million to 51 projects, indicating a large potential for growth.

The BIDSF is an international fund, managed by the EBRD, to assist the decommissioning of the nuclear power plant V-1 at Bohunice. The fund is expected to finance indirect costs (up to 45%) such as new investment in generation and electricity imports. Directing part of these funds to electricity generation up-grades identified in the recent least cost study and energy efficiency projects to be identified in end-user sectors, will be more cost-effective and longer lasting for replacing lost generation capacity. They can also be used as a revolving fund, as developed in several Central European countries. Easy access to co-funding and loans for viable energy efficiency projects will lift the key barrier of initial investment, which is paid back gradually from savings generated.

In terms of future energy consumption trends, the relatively low number of cars and household appliances as well as the development of greenfield industrial projects, notably in the car industry indicate that growth could be amplified significantly and rapidly, as happened in Spain. This scenario would have serious economic and environmental consequences, as energy expenses are already an increasing burden for businesses and households (10 to 15% of total revenues). It would worsen import dependency and compromise the compliance with the Kyoto objectives.

The development of the legal and policy framework on energy efficiency and the implementation of an ambitious energy efficiency action plan implemented by an adequately funded national energy agency can help deliver the benefits of energy efficiency and enhance the convergence with IEA and EU energy performance levels.

Domestic energy production relies on lignite, which is under a controlled decline, and hydropower whose potential is 80% exploited. However, there is still only low-level support for non-hydro renewable energy sources, such as biomass, biofuels and geothermal despite multiple economic, security (grid and supply) and environmental benefits.

The environmental impact of energy use, mainly from pollutants and GHG, remains important but has been dramatically reduced thanks to voluntary policies. Co-ordination and links with energy policy could be improved however, notably on energy efficiency and renewable energy sources. Enforcement of EU regulations, in particular the EU Emissions Trading Scheme (EU ETS), has raised new challenges.

In the design stage, discussion and consultation with a broad range of stakeholders is not only crucial to ensuring an accurate assessment of the situation and identification of most valid options, but also reaching the broad consensus that is required for effective and durable implementation throughout the country. Establishing a formal and independent consultation process, as has been developed for consultations on the 2004 energy legislation, could provide an effective and stimulating contribution to policy design and endorsement by the stakeholders and the public.

The on-going preparation of a new energy policy concept has been developed in parallel with the process of preparing and adopting new energy acts in October 2004 following EU accession. However, the links between the two processes and possible plans to adopt new legislation following the future adoption of the new policy statement remain to be seen. A review of the implementation and impacts of the previous energy policy objectives adopted in 2000 would be valuable for the monitoring of policy.

At all stages of the policy cycle and for market operations, the availability of accurate and reliable supply and demand data and indicators, is essential to assess developments. As markets open further and their complexity increases, data quality is crucial to enabling proper monitoring, in particular of competitive conditions. However, important outstanding issues persist, notably the reliability of the breakdown of energy demand data. Also, the preparations for market opening as well as the enhancement of energy security have made necessary the collection of new data and the development of new indicators for policy makers, regulators and market operators.

It does however appear that current resources for energy statistics at the Statistical Office are insufficient (*i.e.* four staff) and the methodology (data collection and processing) needs to be improved to fulfil current and new tasks. The Ministry of Economy, after consultation with stakeholders, should specify objectives and mandate specifics for delivery by the Office. The reformed data information energy system should comply with the needs of a market economy and bring it up to international standards (Eurostat, IEA) in conformity with the 2000 energy policy.

The recent elaboration by the Ministry of Economy of the 2005 policy indicated the need for additional support on energy forecasts and policy options, possibly by a specific body (energy institute type), which could also provide support to the Statistical Office on energy statistics.

In the EU, Slovakia now has a role to play in the energy and environmental policy development and legislative process, and in ensuring that specificities of the country, in particular the transition process, are taken into consideration.

Recommendations

The government of the Slovak Republic should:

- Finalise the separation of state functions between policy making, regulation enforcement, and ownership and operation of energy services.
- Consider reinforcement of policy monitoring, in particular with mid-term policy cycle assessment, and ensure involvement of all stakeholders, including consumers, when developing energy policies and widely disseminating information.
- Ensure that policy design and implementation are balanced between supply and demand, and that energy efficiency/demand-side management (DSM) is made a priority.
- Ensure sufficient independence from political and industry influence, and provide adequate resources to state agencies, in particular the Regulatory Office for Network Industries (URSO), the Nuclear Regulatory Authority (UJD), the Slovak Energy Agency (SEA), the Administration of State Reserves (ASMR) and the Anti-Monopoly Office.
- Ensure the quality of statistics and forecasts, on both supply and demand sides, in compliance with international standards, and satisfy new needs.
- Ensure that the EU *acquis communautaire* and complementary regulation related to energy and energy-related issues are effectively enforced with appropriate monitoring.
- Ensure synergies and joint actions between the energy policies and other state policies such as environment, transport, housing, social and regional development.
- Prioritise on a least cost basis the use of EU structural funds and BIDSF for energy efficiency and sustainable renewable energy projects.
- Ensure that research and development on energy is integrated in a systematic way into state policies and programmes.

ENERGY MARKET REFORMS AND REGULATION

The establishment of an efficient energy market has been a high priority of Slovak energy policy. To this end, an effective, transparent and stable legal and regulatory framework is essential. It affects not only the functioning of the energy sector but even determines energy customers' behaviour, international integration and the development of other State policies such as energy security, energy efficiency and environmental policies.

Energy Legislation: Profound Overall Changes

Since the IEA energy policy review in 1997, Slovakia has made substantial achievements in the adoption of new energy legislation, which transposes the EU internal energy market (IEM) directives and institutional reform. The Act on Energy Management (February 1998) introduced new concepts into Slovak energy law and defined the respective roles of state authorities and the rights and duties of those involved in energy. This basic energy law was supplemented in 2001 by the Act on Regulation of Network Industries (No. 276/2001), or so-called "Regulatory Act", which defines the status and activities of the Regulatory Office for Network Industries (URSO).

To implement the requirements of EU accession and of new EU energy directives, notably on the internal energy market, and to take into account other significant changes and needs, the government adopted a package of three separate energy laws in October 2004. These include a new Energy Act (656/2004), a Thermal Energy Act (657/2004), and a comprehensive set of amendments to the 2001 Regulatory Act (658/2004). These three energy laws constitute a revamped and comprehensive legal framework for regulation of the network industries in the energy sector. Nevertheless, further development will still be necessary through the elaboration of secondary measures, such as market rules and operating codes, as well as the establishment of new pricing methodologies for market participants.

- **New Institutional Responsibilities**

Under the 2004 energy legislation, the state has less discretion than previously in the regulation of the network energy sector, in large part due to the responsibility assigned to the regulator. The 2004 Energy Act no longer

defines "state regulation" as a central legal concept, but instead refers to "the performance of state administration". This task is now performed under a tripartite structure, comprised of the Ministry of Economy, Regulatory Office for Network Industries (URSO), and the State Energy Inspectorate Board (SEIB). This has been a manifestation of the new sharing of power within the State for the supervision of the energy sector and market.

Ministry of Economy

The Ministry of Economy formulates policy, updates it at least every five years, monitors security of supply, adopts various measures, publishes reports, and prepares primary legislation for submission to the Parliament. The Energy Act provides various powers to the Ministry that allow some scope for intervention in the activities of the energy sector. This includes regaining responsibility for the authorisation procedure for construction of energy facilities, a role previously assigned to the regulator. The new rules do not set forth the detailed criteria or procedures. The Energy Act indicates generally that a proposed facility must be in accordance with the State energy policy, but allows the Ministry to set the relevant criteria and procedures for authorisation of such facilities.

The Ministry of Economy is also responsible for monitoring and reporting obligations as required by the EU Electricity Directive and other EU energy legislation, such as monitoring and publishing an annual report on security of electricity and gas supply, and notification to the European Commission of the technical rules for electricity connections, and any imposition of public service obligations on electricity or gas undertakings.

Regulatory Office

The "Regulatory Act" (2001) established the Regulatory Office for Network Industries (URSO), which after a transition period from 2001 to 2003, has responsibility for enforcing energy and water regulation. URSO is charged with responsibilities previously performed by the Ministry of Finance on the setting of prices, by the Ministry of Economy issuing licences, as well as certain functions of the Anti-Monopoly Office. URSO's powers and duties have been confirmed and further defined in the 2004 legislation, specifically on price regulation for end-users and tariffs to access electricity and gas networks, and market monitoring functions.

URSO is a state administration office and a budgetary organisation headed by a Chairperson and a Regulatory Council of six members (including the Chairperson), who are nominated for (staggered) terms of six years by the Slovak President upon recommendation of the Government (3) and the

Parliament (3) dismissed only in restricted cases. The Office employs 75 staff under Civil Servant status with an annual budget of SKK 74 million voted by Parliament, to which it reports annually.

The Chairperson's decisions on prices for end-use energy on the regulated market and prices to access transmission facilities are subject to judicial review, not of the decision itself but of its procedural. Other decisions can be appealed in the first instance to the Regulatory Council, whose decision on appeal may be reviewed by the administrative court.

The Office issues licences to the various operators in the energy sector. As of end-2004, 335 electricity licences, 73 gas licences, and 579 heat licences had been granted either by the Ministry of Economy or URSO. The 2004 Energy Act requires existing licence holders to re-apply for new licences no later than 31 October 2005. These new licences are under preparation and should be valid as of 1 January 2006. They can be issued for an indefinite period. URSO is empowered to issue licences separately for each activity or can grant a "bundled" licence involving several activities. It can issue additional transmission or distribution licences. License fees are not determined by URSO and are paid to the state budget, as are the fines that URSO may impose on licence holders for non-compliance. A one-time administrative fee applies to the issuance of a licence instead of annual fees.

The 2004 Energy Act does not make a specific cross-reference to the Slovak Competition Act, nor does it allocate responsibilities between URSO and the Anti-Monopoly Office. But the definition of "regulation" in the Regulatory Act includes "the application of regulatory measures aimed at reducing the risk that rules of competition are breached by an abuse of a dominant position in the market...". The prohibitions in the Slovak Competition Act against anti-competitive behaviour may serve to protect consumers when effectively enforced. The Anti-Monopoly Office has commented on draft laws affecting regulation of the power sector, and issued decisions in the case of notified concentrations. URSO has not entered into a written agreement on co-operation with the Anti-Monopoly Office on competition enforcement or monitoring. It must report regularly to the European Commission on relevant market shares in the Slovak electricity and gas sectors, industry compliance with competition rules, and measures adopted to enhance competition, in line with the reporting requirements of the IEM directives.

State Energy Inspectorate Board

The power to impose fines (sanctions) for non-compliance with the Energy Act has been given to the State Energy Inspectorate Board regarding the

fulfilment of obligations by the licence holders, including compliance with unbundling obligations. URSO has certain sanctioning powers under the Regulatory Act, and co-ordination between the two entities is based on practice and not on a written agreement.

● Prices, Taxes and Subsidies: Deep and Continuous Reform

Prices

The situation related to prices and taxes prior to 1998 was marked by significant distortions. Most energy prices, in particular for electricity, gas and heat, were below effective production and delivery costs, requiring direct subsidies and/or generating substantial losses for state-owned energy monopolies. Moreover, cross-subsidies from beneficial activities (*e.g.* gas transit) and customers (industries) were provided to other activities and customers, mainly households. This initial situation put at risk the sustainability and competitiveness of most of the energy sector since the necessary maintenance and investment had been deferred.

Since 2003, the regulator has set end-user prices of network energies with the objective of attaining cost-reflective prices which are necessary for securing sufficient maintenance and investment in energy infrastructures, an effective competitive market and privatisation. To this end, URSO has during the first regulatory period (2001-2005) continued reforms by establishing pricing methodologies and by steadily increasing prices to phase out cross-subsidies. Electricity, gas and heat prices for residential customers have soared between 2000 and the end of 2004 by 99%, 126% and around 5%, respectively. For the same period, the inflation rate reached almost 40%. This has resulted in the elimination of cross-subsidies from industry to residential for electricity and heat, and from transit revenues to residential for natural gas. The regulator decided to increase residential electricity prices by 5% from 1 January 2006. Residential gas prices soared by 20.3% from 1 October 2005 and 5.8% from 1 January 2006. Also, prices of oil products and coal are no longer regulated, being largely linked to international markets.

In less than five years, these reforms have brought prices to a level similar to the rest of Europe (see Figures 26 and 39). However, as customers' incomes have not yet caught up with the European average, the real energy prices (using purchasing power parities-PPP) are much higher in Slovakia than in Western Europe (see Table 1). This level of price (see Figure 8 and Table 32), combined with an energy intensity double that of OECD Europe, has impacted on consumer revenues. For households, energy expenses account in average for 10/15% of their revenues (3% in Germany) and up to 25/30% for

Table 1

Energy End-use Prices for a Selection of OECD Countries, 2004 (in €/unit, including taxes)

Products (unit)	Slovakia (at exchange rate)	Slovakia*	Austria*	Czech Rep.*	Hungary*
RON 95 (l)	0.9	1.7	0.85	1.5	1.55**
Diesel (l)	0.88	1.6	0.7	1.4	1.4**
Electricity (kWh) for residential	0.11	0.20	0.12	0.14	0.15**
For industry	0.7	0.13	0.07	0.10	0.12
Natural gas (cm) for residential	0.21	0.37	0.29	0.44	0.51
For industry***	0.19	0.34	0.18	0.37	0.37

** PPP (purchasing power parities).*
*** 2003 data.*
**** Small and medium customers.*
Sources: Energy Prices and Taxes *(IEA/OECD 2005), ERRA* (Tariff database), *Eurostat and URSO.*

low-income families. Similarly, businesses spend a larger share of their expenses on energy than their counterparts in Western Europe. The share is even higher for energy intensive industries without preferential energy tariffs.

Therefore, the government had to develop a specific social programme to protect the most vulnerable customers from the social consequences of energy price hikes. This programme provided direct subsidies and was stopped in the early 2000s.

The second regulatory period is set for 2006-2009 during which URSO will continue to determine end-user prices, even after full opening in July 2007 and tariffs to access electricity and gas networks (see regulation sections in respective chapters).

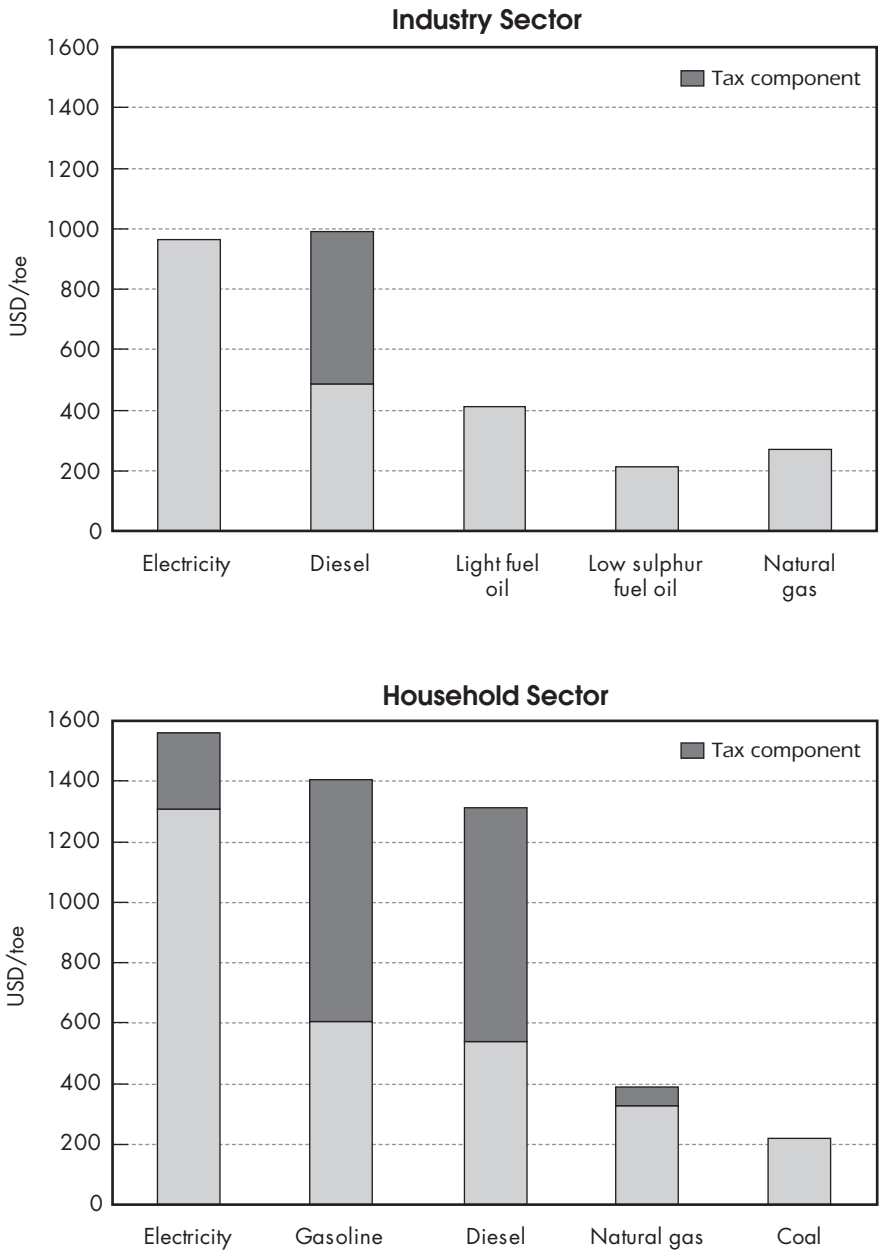
Taxation

The taxation system for energy has been extensively reformed, notably to comply with EU regulation. The main taxes applying to energy products are the following:

- VAT: 19% on all energy supply (uniform since May 2004);
- Customs levy (on non-EU imports): up to 15% on natural gas; and
- Excise tax (see Table 2 below).

Figure 8

Energy Prices, Industry Sector and Household Sector; 2004



Note: Average price of district heating for households in 2003: 590 USD/toe.

Source: Energy Prices and Taxes, *IEA/OECD Paris, 2005.*

Table 2

Excise Taxes on the Main Liquid and Gaseous Fuels, 2004

Products	Excise tax
Gasoline unleaded	15,000 SKK/cm
Gasoline leaded	18,000 SKK/cm
Diesel	14,500 SKK/cm
LPG	7,800 SKK/t
Natural gas	0
CNG, biofuels	0

Source: Ministry of Economy.

Note: Some uses such as for agriculture, freight transpo t by railway and on the Danube and power generation, benefit from a reduced rate. Aviation is exempt.

A mining tax applies for the extraction of coal. A levy is collected on electricity generated from nuclear fuel for the State Fund for the Decommissioning of Nuclear Power Generating Facilities and for Spent Fuel and Radioactive Wastes Treatment (SNIDF), which funds expenses for nuclear waste management and plant decommissioning (see chapter on nuclear energy).

Subsidies

Since 1998, the government has eliminated direct subsidies for energy use, notably for district heating, replacing them by social programmes. The government has the power to allocate direct subsidies or transition support for specific energy efficiency and renewable projects under the de minimis scheme and R&D programmes (see chapters on energy efficiency and R&D).

Due to the inherited liabilities in the coal sector, Slovakia has provided social aid to the coal industry. Single payments of SKK 8.9 million (€ 0.23 million) and SKK 4.3 million (€ 0.1 million) were notified to and approved by the European Commission in 2005 as state aid (see coal chapter).

The government can provide tax breaks in the form of reduced VAT rates for equipment. Local authorities can also reduce construction and housing taxes for renewable projects and efficient energy substitution. State-owned energy companies benefited from more favourable loan conditions thanks to (implicit or explicit) state guarantees.

Energy Sector Restructuring and Privatisation

The government has coupled the development of the market-based regulatory framework with a programme of restructuring of state-owned energy enterprises. This has resulted in a more efficient and pluralistic industry structure.

The first stage of industrial restructuring involved the transformation of former monopolies controlled by central ministries into independent and autonomous companies monitored by the National Property Fund (NPF) and the introduction of international corporate governance principles, notably on financial transparency. Companies have developed more customer-orientated strategies and have rationalised their productive structure to improve their readiness for competition.

A second stage of restructuring has focused on the unbundling of monopolies to permit new entrants to use existing facilities in order to provide alternative supply options to customers.

This process is most advanced in the electricity sector, with a clear ownership split among generation, transmission and distribution activities. Thus, in this sector, the government has gone beyond the unbundling currently required under the Electricity Directive. The transmission grid company, SEPS, created in early 2002, remains in state ownership for an indefinite period. This sectoral structure, combined with sustained price reforms and effective regulatory powers, provide an adequate basis for opening up the market.

In contrast, the gas sector is dominated by a vertically integrated company with a monopoly status for the import, storage and distribution of gas in the domestic market. In compliance with the 2004 Energy Act introducing the latest EU requirements, SPP plans to enforce an unbundling limited to a legal separation of transmission and distribution by July 2006. Already, separate companies, Nafta Gbely and Pozagas, operate gas storage facilities and are owned by SPP/Ruhrgas and SPP/Gaz de France, respectively.

● Privatisation: Impressive Results

With the objective of attracting investment in the energy sector, contributing to its modernisation and integration into international markets, the government initiated an ambitious but gradual privatisation plan. Open tenders have attracted considerable interest from international strategic investors, reassured by the rapid and solid regulatory reforms. In less than three years, the major energy companies have been privatised, either partially (49% of Transpetrol, SPP and the three electricity distribution companies), or by selling a majority of stock shares (an expected 66% of the shares of SE) or entirely (Slovnaft). This achievement provided earnings to the state in the range of € 4 billion, accounting for 14% of total GDP in 2002. Meanwhile the State retains majority control in companies that have strategic national interest, in particular the gas monopoly company.

Table 3

Main Privatisations in the Energy Sector, 1995-2006

Company	Full name	English name	Activities	Equity share sold (year)	Selling price in € m	Buyer
SN	Slovnaft, a.s.	Slovnaft	Oil refining, storage and retail	98.4% (1995-2003)	85	MOL
TP	Transpetrol, a.s.	Transpetrol	Oil transport	49% (2002)*	62	Yukos B.V.
SPP	Slovensky Plynarensky Priemysel, a.s.	SPP	Natural gas	49% (2002)	2,250	Slovak Gas Holding B.V (E.ON, GDF)
SE	Slovenské elektrárne, a.s.	Slovak Electric Co.	Electricity generation	66% (pending - 2006)	840	ENEL SpA
PPC	Paroplynový Cyklus, a.s.	PPC	Electricity generation	90% (2004)	49	PPC Holding SE (10%)
ZSE	Západoslovenská energetika, a.s.	Western Slovakia Energetics Co.	Electricity distribution	49% (2002) 41% (planned 2005)	330	E.ON Energie (& EBRD 9%)
SSE	Stredoslovenská energetika, a.s.	Central Slovakia Energetics Co.	Electricity distribution	49% (2002)	158	EdF International
VSE	Východoslovenská energetika, a.s.	Eastern Slovakia Energetics Co.	Electricity distribution	49% (2002)	130	RWE
BAT, TEKO	Major District Heating Networks (6)	Bratislava and Košice District Heating Co., and four other companies	District heating	51% (planned in 2006)	135 (est.)	–

** Resold by Yukos B.V. to Russneft in February 2006.*
Sources: Ministry of Economy and NPF.

Market Opening: Preparatory Stages and Enforcement

The Slovak energy market is in transition from a monopolised market to an open international environment. The EU Directives on electricity and gas internal markets have shaped these changes. Since 2001, the application of these directives and their progressive enforcement has formally given to an increasing number of eligible customers the opportunity to choose their electricity and gas suppliers. Since January 2005, all non-household customers have been granted this possibility, which will be extended to households in July 2007.

Despite this important step, a wide range of customer choice and switching suppliers have not yet developed. Too many barriers remain. The domestic market opening will be effective only if market conditions are set, if the sector's structure includes sufficient players and if regulation is effectively and fairly enforced.

Due to the small size of its energy market and the objective of integrating the EU internal energy market, Slovakia will increasingly be integrated into neighbouring Central European energy markets and other EU markets. Energy regulators and grid operators in Central Europe have been developing plans to establish regional co-ordination of cross-border capacity exchange through open auctions in order to enhance security of supply, supply diversification and competition. Moreover, development of a regional power exchange and gas hubs are envisaged. Thanks to its location, its progress in reforms and the capacities of its energy operators, Slovakia is expected to play a significant role in these efforts.

In the petroleum products market, development of competition has been more rapid with the abolition of restrictions on trade and establishment of new retailers. Slovnaft, the first fully privately-owned, export-driven energy company (53% of the volumes produced are exported, accounting for 80% of revenues) controls 72% of the wholesale market and 37% of the retail market in Slovakia. The company was investigated by the authorities for abuse of its dominant position, and fined.

Table 4

Market Shares of Incumbent Companies, 2004

Companies	Market	Wholesale	Retail
Slovnaft	Oil products	72%	37%
SE	Electricity	95%	25%
SPP	Natural gas	100%	100%
HBP	Brown coal	52%	13%

Sources: IEA and Ministry of Economy.

Critique

The establishment of the regulatory body URSO with broad independence and full autonomous responsibility for decisions on prices and other important regulatory issues has brought credibility and strength to the regulatory reforms of the sector. URSO now has to fulfil important regulatory enforcement and monitoring functions as well as handling international co-operation, all of which require adequate funds to attract and retain highly-skilled professionals. Hence, changes to the civil servant salary scheme are justifiable.

The transfer of responsibility for authorising construction of energy facilities from URSO to the Ministry of Economy should not be allowed to weaken the effective monitoring of competitive conditions by URSO. Close co-ordination between the two bodies will be necessary to maintain the coherence of regulation of network industries for electricity in particular. In the perspective of privatisation, URSO, which has a central role in the monitoring of competitive conditions, would be better positioned to assume this responsibility.

Tangible results have been accomplished relating to taxation and subsidies, greatly contributing to market convergence with EU countries. The tax system for energy is now aligned on the EU standards. Price reform has achieved remarkable results, notably cost-reflective prices, balancing economic fundamentals in less than four years. Nevertheless, the favourable electrical heating tariff generates apparent distortions. In the gas sector, while cross-subsidisation from transit fees to households has been eliminated, the differential between residential and industrial prices remains smaller than in other OECD countries.

With this stage of the price reform almost finalised, the completion of effective market conditions during the second regulatory period (2006-2009) will require the development of tariff-setting that incorporates long- to medium-term investment in particular for grid infrastructure and energy efficiency, notably using Third Party Financing mechanisms. Moreover, mechanisms to internalise externalities into prices and taxes should be considered and enforced as in several OECD European countries.

Currently, the tariff system is uniform in time and geographical location for continuous supplies. In order to generate sufficient funds for investment in supply, to limit costly investment, to supply peak demand and provide a price signal to customers, URSO together with the Ministry

of Economy and suppliers may study the feasibility of peak tariffs and interruptible contracts.

The final phase-out of uneconomic (purchase and sale) long-term contracts in the electricity and gas sectors, increased monitoring of subsidies in line with EU rules and a review of preferential electrical space heating tariffs, would contribute further to market integration.

Overall, the government has transposed the IEM directives on schedule with the exception of the unbundling in the natural gas sector, which should be effective in July 2006.

In the late 1990s, the government decided to implement a social programme instead of maintaining cross-subsidies, which generated distortions. In this programme, even if direct and targeted subsidies could have provided some relief, their effects were either temporary or necessitated repeated renewals as levels of consumption have remained high. Only improvements to the energy performance of buildings and appliances can durably lower energy bills as well as increasing welfare. The initial funding of these low cost measures, possibly through an energy efficiency fund, could be guaranteed by a fraction of the government's share in SPP profits.

Privatisation has been a rapid success for the government in terms of revenue and of attracting strategic investors. Yet, active oversight will be necessary to ensure that short- to long-term objectives of security of supply, market efficiency and opening are not compromised by abuse of dominant positions by incumbents. Privatisation of dominant companies or monopolies operating on competitive markets must be compatible with long-term goals. In the regulation of the network industries, continued close monitoring and law enforcement is required to guard against abusive practices that may deter market entry of potential competitors.

Despite the government's intentions, the privatisation of energy companies appears to have reinforced the market power of the incumbents, now under the control of private entities. This presents an enduring challenge for the authorities to regulate the activities of the companies and promote more effective competition.

The role of the State is evolving from being the unique owner and manager of the main energy companies to a controlling shareholder of commercial companies with or without majority stakes but without management responsibilities. State ownership rights are exercised by the NPF, representing the management of State assets instead of the Ministry of Economy which has a policy and legislative role.

In the oil products market, based on Slovnaft's significantly improved profitability in 2004, the Ministry of Finance and the Anti-Monopoly Office launched detailed enquiries on Slovnaft for both possible price abuse and the alleged abuse of its dominant position. The Ministry of Finance imposed a heavy initial fine on the company.

In the Slovak gas market, retail competition is merely anticipated. No customers have yet switched from SPP to another supplier. Control by SPP owners of the entire domestic gas supply chain and the transit business, offers advantages *vis-à-vis* possible new entrants that URSO will find difficult to counter-balance.

Furthermore, the ownership shift among downstream activities in favour of upstream interests which are also sole suppliers of oil and gas, has raised issues of increased supply dependence, restricted diversification and competition. Yukos, under threat of being dismantled, may not be able to keep its 49% share in Transpetrol. Gazprom decided not to exercise its option on 16.3% in SPP's capital.

In the electricity sector, even though the restructuring and unbundling of the industry has provided an adequate basis for a competitive market, SE retains a dominant position on the generation side (84% in 2003) and wholesale market (90-95%). Its privatisation would call for continuous monitoring by URSO and the Anti-Monopoly Office. In particular, the issue of past investments or stranded costs has clear relevance to competition. Stranded costs include the two uncompleted reactors of the nuclear plant in Mochovce, the hydropower plant of Gabčíkovo, and SE's long-term agreements for its coal supply and for power sales to certain large customers, such as the domestic aluminium producer, Slovalco. The construction of new generation units by SE for a total of 1.3 GW, including completion of the nuclear power plant EMO 3&4 at Mochovce, as agreed between the future majority owner of SE and the Slovak government in October 2005, will reinforce the dominant position of SE.

The regulator and SEPS should co-operate on a more systematic basis to ensure market orientation and monitoring, instead of relying on *ad hoc* information requests. Active oversight by the Anti-Monopoly Office and co-operation with the regulator is also necessary to curtail the risk of anti-competitive agreements or practices. Negotiation of a written agreement of co-operation on competition law enforcement would help to clarify roles and responsibilities. This agreement could address also the mechanisms for monitoring and scrutiny of long-term contracts, their effect on competition, and possible elements of state aid. New reporting obligations on licence

holders could be considered, given that URSO does not currently monitor existing nor new long-term contracts in the power sector or receive advance notice of disposal of key assets or significant changes of ownership.

Difficulties in developing competition in the network energy market while no electricity and gas customers are yet switching suppliers, contrast with those of neighbouring countries, in particular Hungary (cumulative switching in volume at 32% for electricity and 7% for gas), Austria (29% and 6%) and to a lesser extent the Czech Republic[2] (6% and 0%). Development of an effective monitoring system for energy supply security and market opening is needed to assess impacts of reforms and compare developments with the EU and other countries.

The parallel development of privatisation and market opening is arduous, as customers and the public may confuse the new market conditions and the ownership of the operators to conclude that market opening equals privatisation. The ongoing privatisation of companies in dominant positions may limit the prospects for real competition for a period possibly extending beyond the next few years. Strong regulatory powers are needed to monitor such markets to ensure security of supply, protect customers and attract new operators, and guarantee fair access to facilities. The sequencing of reforms is crucial to establishing effective and durable market conditions for investment and a competitive market.

Recommendations

The government of the Slovak Republic should:

- Consider developing regulatory, fiscal and market structures that seek to reflect environmental externalities in energy prices.
- Undertake an assessment of the feasibility of introducing peak tariff and interruptible contracts as a means to ensure investment and reduce peak demand.
- Implement the EU Directives for the internal energy markets as well as market rules that facilitate third party access (TPA) and customer choice.
- Ensure effective unbundling of monopoly activities using the most effective approach and adequate regulatory monitoring to ensure fair competition.

2. *See* Energy Policies of IEA Countries; Czech Republic 2005 Review: *http://www.iea.org/Textbase/publications/free_new_Desc.asp?PUBS_ID=1566*

- Ensure co-operation and effective market monitoring by and between URSO, the Anti-Monopoly Office, and the designated system operators for electricity (SEPS) and gas (to be unbundled from SPP), so as to ensure effective market conditions and consumer protection; consider adopting a written agreement of co-operation on competition law enforcement.
- Ensure a transparent and non-discriminatory authorisation procedure for the construction of additional energy capacities to stimulate competition.
- Complete the privatisation of companies in a manner compatible with supply security priorities, diversification and market opening.
- Encourage URSO to develop rules and regulations for energy distributors to develop DSM programmes for their customers.

SECTORAL POLICIES

Essential Complements to Market Mechanisms

The previous chapter shows the crucial role of the State in the design, implementation and assessment of energy market reforms, enabling market mechanisms to shape the functioning of the sector. However, market mechanisms appear insufficient or irrelevant in several strategic fields, such as energy security, efficiency and environmental protection for which the State develops and implements policies to complement or substitute market tools.

For instance, the existing risks of oil supply disruptions in a normally supplied oil market do not provide sufficient incentives to build emergency oil reserves backed by adequate procedures and institutions, since the complexity and cost cannot be borne by individual customers. Only a mutualised approach coordinated by the government, can establish such a system at a cost lower than that of the economic damage of a lengthy disruption, even one of low probability. Based on the experiences of IEA countries, a well-functioning and cost effective energy security system should rely on close co-operation between the government and the energy sector. This follows the principle of the insurance premium.

The energy policy sets the objectives and priorities for other sectoral policies that are enforced by independent institutions. They include the following:

- Energy security;
- Energy efficiency;
- Environmental protection; and
- Research and development (R&D).

ENERGY SECURITY

Key Information and Data (2003)

- **Total energy import dependency:** 65% (78% with net* domestic production); oil and gas import dependency: 98%
- **Energy imports:** SKK 100 bn (12% of total imports); exports: SKK 40 bn (5% of total exports)
- **Energy deficit:** SKK 60 bn (4.3% GDP)
- **Main energy suppliers**:** Russia (74%), Czech Rep. (16%), Poland (5%)
- **Share of first and first three fuels in:**
  TPES: 31.5% (gas) and 88% (gas, oil, nuclear)
  Electricity generation: 56% (nuclear) and 90% (nuclear, hydropower, coal)

** Excluding generation losses.*
*** In energy content.*

Energy Security: A Key Policy to Alleviate Import Dependency and Disruption Risks

Security of energy supply has emerged as a priority for OECD countries' energy policies since the first oil supply crisis in 1973. Since then, relevant concerns have come to include price hikes, as well as issues related to production, transmission, distribution and supply of electricity and natural gas.

The dependence of the OECD economies continues to increase on information technology and on energy, in particular for road and air transport. This heightens the potential that a significant supply disruption would be destructive for those economies and for the functioning of societies. This increasing dependency highlights the need to develop specific energy security policies able to identify and mitigate risks or threats.

In Slovakia, energy security for civil purposes has emerged in the transition process following decades of energy supply from countries to the East. The sovereignty regained and exposure to international markets have created a very different situation, but have also brought about new constraints and risks.

In 2003, net energy imports covered almost two-thirds of the Slovak primary gross energy supply (78% with net domestic production) compared to 77% in 1990. Dependence reached 100% for nuclear fuel, 99% for crude oil, 97% for gas and 80% for solid fuels (100% for hard

coal). Even if the level of dependence is proportionately lower than before the transition, its economic impact and the geopolitical situation have dramatically changed. Before 1989, high-energy intensity and import dependency were made possible by the supply of energy and energy equipment from USSR and COMECON countries at artificially low prices. Since the 1990s, energy imports have been based largely on international commercial practices and world prices.

This quantitative dependence is doubled by a full dependency on sole oil and gas supply routes, entering the country at the Ukrainian border. Also, Slovakia imports exclusively from Russia its nuclear fuel, crude oil (5.5 Mtoe) and gas (5.5 Mtoe), and 35% of its hard coal (1 Mtoe). Overall, Russia is the largest energy provider with 12 Mtoe (74% of imports and 65% of TPES), followed by the Czech Republic (16% of imports with 1.9 Mtoe of coal and 0.5 Mtoe of electricity). Imported fossil fuels account for 85% of primary energy supply and 60% of TFC. This dependence on sources and routes resulted from Czechoslovakia's membership in the Warsaw Pact and the COMECON.

In 2003, total energy imports amounted to SKK 100 billion or 12% of total imports, one of the leading import categories and at the same level as imports of energy equipment. Crude oil and natural gas imports account for 75% of total imports followed by oil products (8.7%) and electricity (4.5%). Imports of oil products and electricity account for 30% and 27% respectively, of total domestic consumption.

The country is a net exporter of oil products (2.45 Mtoe) and electricity (0.35 Mtoe or 4.2 TWh). Energy exports are valued at SKK 42 billion (oil products: SKK 33.4 billion, electricity: SKK 6.7 billion) or 5% of total exports. Over 50% of refined oil is exported, mainly to Central Europe, and 35% of electricity generated is exported.

The energy trade deficit accounts for 60% of the total trade deficit or 4.3% of total GDP. Despite this relatively high level, the economic impact remains limited as the result of lowered energy intensity owing to economic restructuring, an increased relative share of services and manufacturing industry of the Slovak economy, which has boosted its added value and improved the terms of exchange.

Risks: Limited but Multiple and Complex

The potential risks of an external supply disruption include technical causes and geopolitical events in supply and transit countries. Even if the level of risk appears limited in that oil and gas exporters (*i.e.* Russia) and

transit countries (*i.e.* Russia and Ukraine) are highly dependent on these revenues (Gazprom sends through Ukraine and Slovakia 85% of its exports to EU 15, which accounts for around 70% of its revenues), the high dependence on a single source of supply and a sole route means that a disruption would have serious consequences, not only for Slovakia but also for Central and Western Europe.

This dependence on export and transit revenues could also create and exacerbate tensions, as illustrated in three recent cases. In January 2005, the dismantling and takeover of Yukos by the Russian State led to an interruption of crude supply to Slovnaft despite a long-term contract signed in 2003 and an intergovernmental agreement between Slovakia and Russia signed through 2014. This interruption was significant as the long-term contract with Yukos covered around 60% of Slovnaft requirements, obliging the company to reduce its refining operations until Lukoil stood in for Yukos by means of a new long-term contract. A similar situation occurred in Hungary and Poland at the same period. Since 2002, Yukos B.V., established in the Netherlands, also owns 49% of Transpetrol and exercises management control of the company. In early 2005, Yukos management indicated its intention to keep its existing interest in Transpetrol. Nevertheless, in February 2006, Yukos B. V sold its shares to Russneft, a Russian oil company.

In February 2004, Gazprom cut off natural gas supply and transit to Belarus, affecting the countries supplied by the Yamal pipeline, the second largest Russian gas export route after the Ukrainian-Slovakia route. This was the first interruption of supply affecting non-CIS countries. It occurred in a context of persisting disagreement between Gazprom and Beltransgas, the Belarus gas company, on price levels for gas supply and transit fees as well as on a possible joint consortium for gas transit. This cut-off did not affect Slovakia nor its transit operation.

Gazprom and the Russian government had advocated that the Ukrainian oil and gas company, Naftogaz Ukrainy (NAK), establish a similar joint consortium to manage gas transit in Ukraine, with Gazprom in majority ownership. With the election of a new and reformist government in Ukraine in early 2005, this has not taken place. Since autumn 2005, a complex and perilous game of mutual pressure has developed over the price increase proposed by Turkmenistan for deliveries to Ukraine, transiting through Russia, and Gazprom's request for a fourfold price increase for gas supplied to Ukraine. Russia and Gazprom stated that the impasse in gas negotiations might threaten gas transit volumes flowing through Ukraine. The dispute escalated on 1 January 2006, when Gazprom announced it was suspending

Russian and Turkmen gas deliveries to Ukraine. As a result, Russian volumes received at the Slovak border dropped by around one third for two days, affecting Slovakia and other Russian gas importing countries, before coming back to contracted volumes on 3 January. Volumes held in storage, other gas sources and industry switch to other fuels helped to overcome the drop in supply for Slovakia and other European countries. Also, Gazprom asked POGC, the Polish gas company, to renegotiate the existing price indexation formula, which appears very similar to the Slovak supply contract.

Within the Slovak energy market, risks are related to the high level of concentration of energy facilities (see Figure 9), in particular for oil refining (the sole refinery accounts for 87% of supply), and to a lesser extent for power generation with two nuclear sites accounting for 60% of total electricity production. The country inherited, from decades of central planning, outdated technologies and infrastructure with lower performance which have been progressively replaced or modernised. Nevertheless, it has to be noted that no significant external or domestic energy supply disruptions occurred during the 15 years of the transition period.

Energy Security Policies: in Development

Since the transition and the creation of the Slovak Republic, energy security has been a high priority of energy policy. Energy security has been one of the three priority objectives of the 2000 energy policy and the preliminary 2004 strategy paper.

The main energy security tools have been supply diversification, stockpiling, emergency preparedness and demand side policies.

- **Supply Diversification: Still Limited for Hydrocarbons, Effective for Oil Products and Electricity**

In the event of disruption of the Druzbha pipeline or Russian oil supplies (current annual supply at 5.6 Mt),or both, it may be possible to replace them with imports from the Adriatic Sea via the Croatian port of Omišalj and the Adria Pipeline (maximum rated capacity at 3.65 Mt/y in the Slovak section). This can be activated within three weeks assuming that the technical, technological and economic conditions are met. In 2005, it was used several times in both directions without delay. The current project to use in reverse flow, the Adria pipeline to export Russian crude, should make operational

facilities that have not been fully used since 1991. If it materialises, the initial stage of this project should not affect the possibility of importing non-Russian crude through Adria since spare capacity would still be large (total: 20 Mt/y).

Another alternative may be a possible use of the Trans-Alpine Line (TAL), which ties in with the Ingolstadt-Kralupy Line (IKL), thereby allowing for oil deliveries from the Adriatic Sea via Ingolstadt to the Czech refineries in Litvínov and Kralupy. A section of the pipeline linking Slovakia with the Czech Republic would have to be reversed to allow reverse pumping between Kralupy and Bucany (Slovakia). This would require an investment of SKK 100 million in pipeline infrastructure and would reportedly take about four weeks, as all pumps and documentation required for the reversal are ready. If the Bratislava-Schwechat pipeline (see chapter on oil) is built, it might also be used by reversing the direction of flow to supply non-Russian oil.

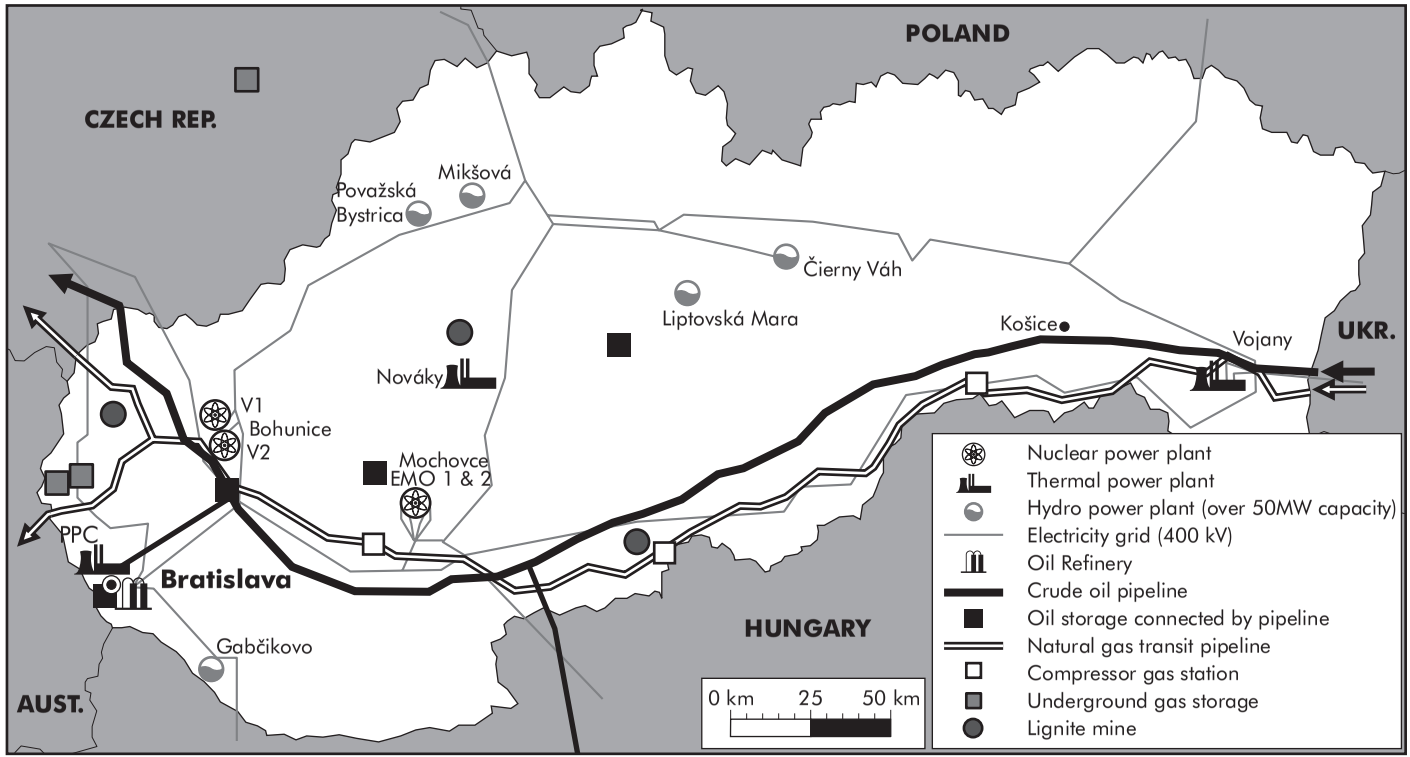
However, the logistics of these alternatives as well as the possibility of processing other types of oil at the Slovnaft refinery have technical limitations and have not yet been tested, as the refinery was designed to use Russian crude oil. All alternative crude sources imply more complex logistics and requirements and therefore will be more expensive.

The Slovak wholesale and retail markets have also been supplied by six external major refineries, belonging to three major oil groups (MOL, OMV and PKN-Orlen) and located within 300 km of the Slovak borders for up to 30% of consumption. In case of emergency and under existing conditions, this level can be increased to cover all consumption as the import capacity of oil products and deliveries to storage and retail facilities appear to be sufficient.

Options for natural gas diversification are limited. It is technically possible to import through the Western borders (Austria, Czech Republic) from alternative sources by reversing the direction of flow in the main pipeline, which is habitually used to send gas westward. This being the case, gas interconnections with neighbouring countries are constrained. From the East, gas imports from Ukraine and Central Asia are potential options but their economics and approval by the dominant Gazprom remain uncertain. In the medium term, the development of new pipelines from the Caspian and the Middle East to Europe, possibly through the Nabucco pipeline project between Turkey and Austria, as well as the reversing of flow along the Trans-Balkans pipeline from Turkey to Ukraine, can bring effective diversification to Central European gas markets as well as enhancing market competition and transparency.

Figure 9

Map of the Main Energy Infrastructures



Sources: Country submission and IEA.

Coal imports originate from four main sources, of which 60% from neighbouring OECD countries (Czech Republic and Poland). Coking coal, which has no substitute in the steel industry, a major component of the Slovak industry, is supplied from Czech Republic (60%) and Russia (30%).

In terms of energy mix, the existing domestic energy sources, mainly lignite and renewables (mostly large hydropower) contribute to less than 10% of TPES but provide a significant contribution in the electricity mix, with 6.5% and 16.5%, respectively. If the production of lignite is declining and the remaining potential for large hydropower is limited, the development of biomass, notably through co-fuel and cogeneration and small hydropower, offers interesting perspectives (see chapter on renewable energy).

In 2003, a long-term contract on the supply of nuclear fuel for all nuclear power plants until 2010 has been concluded by SE with the Russian company TVEL after a tender in which the company BNFL/Westinghouse participated, in 2002-2003.

The Slovak electricity system has a cross-border transmission capacity valued at 3 GW of Net Transfer Capacity or about 90% of the base load demand and two-thirds of peak demand (see chapter on electricity) in the event of domestic generation failure. In addition, it is at the heart of the CENTREL electricity network, comprised of the interconnected systems of the three other Visegrad countries (Czech Republic, Hungary and Poland), with a combined 64 GW of generation capacity and electricity export balances ranging between 1.9 and 3.5 GW per month. Furthermore, from 1995 the CENTREL block has been synchronised with the networks of the UCTE, the association of transmission system operators in continental Europe. However, there is no Slovak electricity interconnection with Austria as the projected 2 x 400 kV line (Vienna to Stupava) has not been decided, and Ukraine is not a member of the UCTE.

Recent black-outs in OECD countries were often caused by the transmission networks which could not withstand the effects of incidents from generation units or from the grid's lacking capacity or efficient monitoring. In Slovakia, the frequency of outages affecting the grid is relatively low[3] and the Slovak transmission system operator, SEPS, appears able to undertake sufficient investments to maintain and modernise the grid.

3. 220 kV lines (0.01%), 400 kV lines (0.02%).

● Stockpiling and Emergency Preparedness: Constant Progress Towards Operationality

Other important tools are stockpiling and emergency preparedness. The emergency stocks of crude oil and oil products are state-owned and administered by the Administration of the State Material Reserves of the Slovak Republic (ASMR[4]) according to the Act on "State Material Reserves" (No. 82/1994) and by the Act on "Emergency Stock of Crude Oil and Oil Products and on Managing the State of Crude Oil Emergency" (No. 170/2001). ASMR has the responsibility for stockpiling.

ASMR is an independent body and reports to the Prime Minister. It has its own funding from the State budget for purchasing and storing emergency stocks. A National Emergency Sharing Organisation (NESO)-type organisation has been established and co-ordinated by ASMR. An advisory committee on oil security questions for key decision-making assists the ASMR chairman.

The 2001 Act covers the creation and management of the emergency stocks of crude oil and oil products and the implementation of demand restraint measures. It permits holding oil stocks abroad and provides the legal basis for ASMR to administer and regulate:

- the creation of the 90-day governmental oil stocks;
- the use of stocks in an oil emergency;
- the implementation of demand restraint measures during oil emergencies; and
- the co-ordination of crisis management, constituting the core of a NESO structure.

Under the Act of Accession to the EU, Slovakia has a transitional period until the end of 2008 to meet the obligations of the EU Directive on Oil Stocks.[5] The expansion programme of the state-owned oil emergency reserves will be administered by ASMR and financed from the state budget. Stocks of petroleum products shall correspond to at least the following number of days of average daily internal consumption:

- 47 days by 1 May 2004;
- 55 days by 31 December 2004;
- 64 days by 31 December 2005;
- 73 days by 31 December 2006;

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4. ASMR also administers the reserves of other commodities such as cereals, metals, coal and nuclear fuel.

5. Directive 68/414/EEC of 20 December 1968 imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products, as amended by Directive 98/93/EC of 14 December 1998.

- 82 days by 31 December 2007;
- 90 days by 31 December 2008.

State emergency oil reserves are held by ASMR. On 1st January 2005, these reserves stood at 362 kt (around 55 days of net consumption or the equivalent of 48 days of net imports under IEA methodology), including 130 kt stored in ASMR storage. They comprised crude oil (43%), motor gasoline fuels (13.4%) diesel and jet fuels (40.6%) and fuel oil (3%).

The ASMR emergency reserves have been stored in facilities owned by ASMR with a capacity of 198 kt of oil products, Slovnaft (130 kt of oil products) and Transpetrol (206 kt of crude oil). With the planned increase of reserves by 2009, new storage capacities for 130 kt will be needed. The ownership of the storage facilities between the State and Slovnaft is mixed, as a direct consequence of previous investments, executed jointly by the Ministry of Economy, ASMR, Slovnaft and Benzinol before 1989. The government intends to settle this ownership issue by early 2006.

There is no stockholding obligation for the industry. All industry stocks are therefore held for operating and commercial purposes and financed by oil companies. On 1st January 2005, these industry stocks amounted to 465 kt (or 56 days of net imports), approximately 33% of this is held as crude oil.

Significant gas storage capacities have been established for a total of 2.1 bcm, or around 30% of total annual consumption. Two facilities are located in Western Slovakia. In addition, one facility in the Czech Republic is leased. Overall, storage can cover 100 days of base load consumption. SE has sufficient nuclear fuel in its nuclear reactors for one-year electricity generation. In addition, ASMR stores the equivalent of 10 months while SE and US Steel Košice have developed storage of coal.

In case of electricity or gas deficiencies or failure, emergency plans prove useful in crises on the supply and transmission sides but also to reduce demand load in order to avoid disruption of supplies. Several OECD countries (Norway, New-Zealand, US/California) and non-OECD (Brazil, Chile) managed to develop emergency demand programmes allowing sufficient reduction of consumption to permit continuous supply until the end of the crisis.[6] In Western Europe, the 2003 heat wave caused a reduction in power supply from fossil and nuclear power plants and increased electricity demand for air conditioning. Similar demand programmes, if operational, would have reduced the peak demand at low or no cost.

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6. Saving Electricity in a Hurry *(IEA, 2005): www.iea.org/Textbase/publications/free_new_Desc.asp?PUBS_ID=1481*

- **Demand Side Policies: an Important Tool with Significant Potential**

  Finally, demand side policies play a crucial role in improving energy efficiency and reducing consumption of energy, in particular fossil fuels. Sectoral programmes using a combination of measures and incentives are often the most effective and cheapest way to reduce import dependency, its subsequent financial burden on the households and businesses and the risks and impacts of supply disruptions. The average saving potential, using existing technologies and process with a short payback period, has been estimated at 22% of total Slovak energy consumption.

Critique

High hydrocarbon import dependency and reliance on one sole supplier clearly call for vigorous energy security policies based on a combination of measures designed, implemented and monitored by strong institutions. Even though energy security has been a policy priority since 2000, it still lacks enforcement.

The external risk to imports, which make up two-thirds of supply, appear limited in the short term owing to the revenue dependency of supply and transit countries. Nevertheless, it is manifold and complex, generating new medium-term risks. For instance, Slovakia has recently experienced temporary reductions of Russian oil and gas supplies.

In effect, the vertical expansion strategy by Gazprom, as a single company along the entire gas chain, and also horizontally in the oil, electricity and nuclear sub-sectors raises concerns about the economic efficiency and financial exposure of the company. The control of gas as well as of oil exports will increase risks of anti-competitive practices that could distort domestic competition, create disincentives to supply diversification, generate higher price levels, and lead to cut-offs. Furthermore, for Slovakia and other European countries, the development of offshore energy traders, which are not subject to the same rules, offer neither proper guarantees nor financial transparency, thus generating commercial risks and distorting competition.

The regional upstream context determines the level of supply and transit risks for Slovakia, which range from political to commercial risks. This calls for further co-operation with the Russian and Ukrainian governments and a joint policy and regulation for EU countries.

It remains to be seen how national regulatory and competition authorities and the European Commission will address the issue of the market power of dominant supply companies and a monopoly, preventing abuse and its consequences for supply security and diversification, and market transparency and opening.

Tentative efforts to diversify oil and gas import sources, routes and suppliers have been made difficult because of economic conditions, commercial advantages, transit contracts and the influence of Russian energy companies. These provide advantageous long-term contracts for supply and transit, and for investment downstream. Since 2002, Yukos has been a shareholder of Transpetrol and Gazprom had an option in SPP. Thus, incentives and latitude to develop and diversify have been limited, reinforced by the limited size of the domestic market (oil: 3.5 Mt, gas: 7 bcm).

Nevertheless, in the second half of the 1990s, the neighbouring and former federal partner, the Czech Republic (annual consumption for oil: 11 Mt/y and gas: 9.5 bcm) achieved an effective diversification of its oil and gas imports through the IKL oil pipeline (30% of supply) and a gas connection to Germany to annually import 3 bcm (30%) of Norwegian gas. In the EU context with its policy and such financial tools such as the Trans European Network (TEN) and European Investment Bank (EIB) soft loans, diversification efforts by countries and groups of countries would be favoured. For gas, the Nabucco pipeline appears as the most promising option to supply Caspian and Middle East gas to Baumgarten in Austria, at the Slovak border. If it happens, the existing transit system could be used by reversing the flow.

Slovakia has limited domestic energy resources. Nevertheless, local and decentralised renewable energy production enhances national and local security of supply, brings environmental benefits and creates value and jobs in regions in economic transition. This positive contribution to an energy balance, largely dominated by carbon-intensive energy also reduces the energy trade deficit, reinforces networks and reliability of supplies.

The Slovak electricity system has sufficient capacity in both generation and transmission, considering an apparent reserve margin of 93% in domestic generation capacity (8.2 GW) and a net transfer capacity valued at 3 GW on cross-border interconnections (mostly with OECD countries), which is close to peak load (3.3 GW in summer and 4.3 GW in winter). Moreover, the level, number and quality of electricity interconnections within CENTREL and UCTE systems have continuously provided a high level of supply security and diversity. Finally, the probability of a total failure in domestic

generation is very limited, considering the number of units and relative generation and geographical diversity.

The government has stepped up its efforts to increase oil stockpiling and enhance emergency preparedness in order to comply with the EU and IEA requirements. From 2009 this will include the maintenance of stocks covering at least 90 days of internal consumption (as required by the EU) the drawdown of stocks in emergency and non-emergency situations, and the fulfilment of allocation obligations in accordance with the IEP and the Emergency Management Manual. To reach these objectives, the government will have to include measures for funding the new storage capacity and oil stocks. Also, governmental authority over commercial stocks in case of oil emergency needs to be clarified, as is planned in amending legislation. The storage facilities used for emergency reserves should continue to be devoted solely for this purpose. Emergency preparedness by relevant institutions, in particular through the NESO, needs to be ensured to guarantee the flexibility of the energy security system and the availability of emergency reserves in a crisis. Finally, mixed ownership of storage terminals raises legal issues and has to be addressed, as intended by the government, by 2006.

The credibility and effectiveness of the emergency response policy at domestic level should be reinforced by co-operation with supply and transit countries, through EU policies notably for the Central European and EU energy markets, and the diversification of oil and gas supplies.

Further to the oil sector, the country would have to develop effective emergency plans with clear responsibilities in the electricity and gas sectors. In particular, co-ordination of administration and industry and demand-response are crucial in case of crisis.

Energy intensity has decreased as a result of economic restructuring, in particular energy intensive industries and energy price increases. To date, however, energy efficiency policies have been insufficiently developed to have a significant impact on consumption (see chapter on energy efficiency).

Energy efficiency policies should be made a priority in Slovak energy policy. Even if such policies and measures take time to produce effects, they have a low or negative cost and durable impact, in particular for energy security. These efforts will be repaid over four to five years, and should be initiated at the earliest possible date.

Overall, the Slovak energy security policy has achieved a remarkable performance over the last decade, establishing structure and guidelines. Nevertheless, the diversity and complexity of risks call for an amplification of

efforts by significantly reinforcing policies and institutions. As demonstrated by the two IEA countries in Central Europe, a small core and highly skilled team can manage an effective and responsive energy security system based on risk management, sufficient stocks and emergency measures. At the same time, diversification of supplies and better use of energy are essential to mitigate risks and reduce dependence.

Recommendations

The government of the Slovak Republic should:

- Enhance energy security policy by strengthening institutions and diversified instruments with a priority to demand-side policy; assess its effectiveness, preparedness and cost-effectiveness.
- Achieve an energy security system which complies with quantitative and qualitative EU and IEA requirements.
- Consider ways to diversify oil, gas and nuclear fuel supply.
- Clearly define government legal authority to draw upon industry stocks in an oil supply disruption.
- Clarify the ownership of existing oil terminals and storage facilities on a fair value evaluation by 2006 as agreed; ensure that facilities for emergency reserves continue to be used solely for this purpose.
- Enhance efforts to ensure oil supply diversification with at least one viable option for supply of crude oil as for oil products.
- Ensure an effective monitoring of markets to avoid abuse of dominant positions by external and internal suppliers.

ENERGY EFFICIENCY

Key Information and Data (2003)

- **Energy consumption per capita:** 3.5 toe (OECD Europe: 3.4)
- **Energy intensity** (using PPP, 2000): 0.28 toe/USD 1,000 GDP (OECD Europe: 0.16); evolution 1990-2003: -30%
- **Economic potential for energy saving** (all sectors): 22%
- **Average equipment rate of electric appliance of Slovak households:** 30% of EU 15 average
- **Employment:** SEA (70), ECB (10), regional energy agencies (10), energy auditors (400)

At the beginning of the transition period, overall energy performance was poor as a result of the supply-dominated approach, low efficiency standards and artificially low prices, reinforced by the heavy burden of energy-intensive and heavy industry. The high energy intensity generated significant environmental and health problems and high import dependency. With the increase in energy prices, this legacy has become burdensome for the competitiveness of businesses and household welfare.

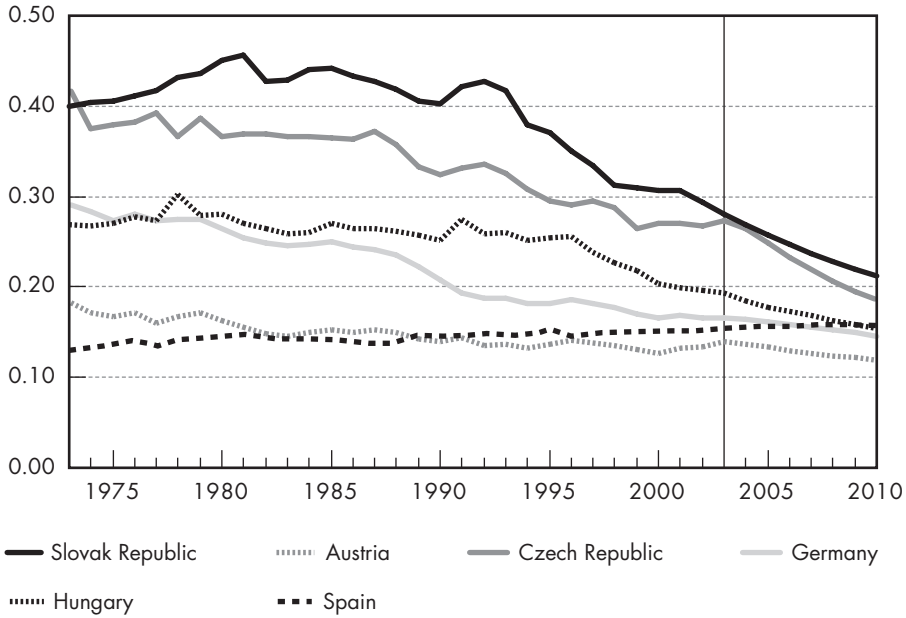
Energy Performance has Improved but is Still Below the OECD Europe Average

Energy performance is generally measured by the energy intensity (*e.g.* toe per unit of GDP) of the productive activities. Despite some structural bias (*i.e.* relative low weighting of GDP, different economic structures including higher shares of energy intensive industries and a possible higher role for the informal economy), this indicator provides useful information and trends, and allows international comparisons.

During the period 1990-2003, the combined impacts of structural reforms and energy price increases, both in the energy sector/supply and end-use sectors, reduced energy intensity by 30% at 0.28 toe/USD 1,000 of GDP (at purchasing power parities (PPP), 2000 prices). The industrial recession, in particular of energy intensive sectors benefited light industries and services, which have developed in response to domestic and international customer demand. Energy intensity is, however, still almost twice that of the OECD Europe average and 50% higher than in Hungary. Recently, this reduction has stabilised, the price effect having become less influential.

Figure 10

Energy Intensity in Slovakia and in Other Selected OECD Countries, 1973 to 2003 (toe per thousand USD at 2000 prices and purchasing power parities)



Sources: Energy Balances of OECD Countries, *IEA/OECD Paris, 2005*, National Accounts of OECD Countries, *OECD Paris, 2005 and country submissions.*

Expressed in physical ratios (GJ/sq. m, kWh/ etc), after correction for the influence of climate, the energy performance of buildings, industries or appliances appears lower than in Western Europe usually owing to inefficient building and appliance design, outdated buildings and equipment, and lack of regulation and awareness.

High energy intensity and physical consumption ratios underlines a significant untapped economic savings potential estimated by the Energy Efficiency Action Plan (EEAP-see box below) to be at least 22%, equivalent to 3.1 Mtoe of the consumption forecast for 2012 (see table below). This is based on a maximum payback period of four years for households, five years for industry and private services, seven years for energy sector and public administration, and based on the use of existing and proved techniques.

At 1.35 Mtoe (10%) for 2012, the market potential for energy savings estimated by the EEAP, is below the economic potential of total consumption as the result of current energy efficiency policy and regulatory framework.

Table 5

Energy Consumption and Economic Saving Potential by Sub-sector, 2003 and 2012 (in Mtoe, TWh, %)

Sectors*	Consumption (2003)			Forecast (2012)	Economic energy saving potential (2012)	
	Fuel & heat (Mtoe)	Electricity (TWh)	Total (Mtoe)	Total (Mtoe)	%	Total (Mtoe)
Energy sector (own uses and losses)	1.47	1.27	1.58	1.70	20	0.34
Industry	3.70	11.35	4.68	4.90	20	0.98
Tertiary	1.10	4.93	1.52	1.85	20	0.37
Residential	2.40	5.05	2.83	2.92	25	0.73
Transport	2.15	0.70	2.20	2.34	25	0.59
Other	0.2	0.90	0.29	0.35	20	0.08
TOTAL	**11.02**	**24.20**	**13.1**	**14.06**	**22**	**3.09**

** Detailed energy consumption by sector in the 2003 energy balance (see Annex I).*

Sources: 2002 Energy Efficiency Action Plan (2002) and IEA estimates.

Recent indicators show that, despite high absolute and relative energy prices, there is a potential for rapid growth in demand based on high energy intensity. While household electricity demand has recently been dampened by price increases, it has increased by 35% over the past 10 years owing to an increase of electrical space and water heating stimulated by favourable tariffs (see chapter on electricity, tariff section). More recently, it has been growing at a much slower pace (*e.g.* - 0.5% in 2003).

The potential for growth is high for electricity demand by residential customers (+35% up to 2020) with appliances and equipment standing at only 30% of the EU 15 average. In road transport, the number of private cars is expected to double by 2012 and average mileage to continue to increase. Trucks now ensure the vast majority of freight transport (80%) but use twice as much diesel per km as in the EU 15.

Policies and Measures

As with supply security, the government has the responsibility to develop energy efficiency policies and regulation to address what market mechanisms

do not. Energy demand is fragmented in numerous decision-making units whose core focus is outside the energy field despite its relatively high economic weight. Thus, the main goal of energy efficiency policies is to encourage energy users to be more aware and rational in their use of energy and purchase of appliances, vehicles and property.

The 1997 and 2000 energy policies as well as the preliminary 2005 policy document highlight the importance of increasing energy efficiency. This has resulted in the adoption in 1999 of the "Programme in support of decreasing of energy intensity and utilisation of renewable energy resources" with SKK 30 million. This programme was changed according to EU rules in 2003 to *de minimis* scheme "Programme in support of energy conservation and utilisation of renewable energy resources". Also, a specific Energy Efficiency Action Plan (EEAP) was developed (see box below).

2002 Energy Efficiency Action Plan (EEAP)

In 2001, the Ministry of Economy, with the support of the World Bank and the Austrian Trust Fund commissioned an overall study on energy efficiency and renewable energy policies. The main objective was to "contribute to the formulation of future energy policy and define concrete steps for its implementation... to improve energy efficiency and develop the use of renewable energy". The study included a policy document and two detailed action plans for energy efficiency and for renewable energy for the period 2002-2012*.

The Energy Efficiency Action Plan (EEAP) included an assessment of the policy, institutional and regulatory framework. The recommended actions are laid out in a calendar targeted to overcome the identified barriers for each sub-sector to better realise the economic potential of energy saving.

*Available on www.ecbratislava.sk/download/enefap_en.pdf

● Institutions

The Ministry of Economy defines energy efficiency policies and regulation. The Energy Policy section co-ordinates activities in this field, notably the energy conservation programme and *de minimis* scheme (see below).

The Slovak Energy Agency (SEA) is a "state subsidy organisation" whose main mission is to provide information and support to energy end-users and implement programmes on behalf of the government. For instance, the

Ministry of Economy contracted the SEA to implement the energy efficiency annual programme for SKK 30 million (€ 0.75 million). The SEA also fulfils the role of focal point for energy audits and EU structural funds related to energy. The SEA employs 70 staff in its headquarters and four regional offices.

There are two local energy agencies at the city or region level, both established by the EU SAVE programme in the cities of Šal'a (1998) and Žilina (2000). Another structure is the Energy Centre Bratislava (ECB), which was created in 1993 by the EU Thermie programme and the Austrian Energy Agency of Linz. It is now an autonomous association, member of the EU Organisations for the Promotion of Energy Technologies (OPET) network. ECB has developed a broad range of activities including awareness and information (*e.g.* household web platform "eFilip"), training courses, organisation of seminars and conferences through local, national and international projects. ECB employs ten full time experts and staff, and manages projects worth SKK 15 million.

- **Awareness and Information**

Despite high energy prices and consumption, and their impact on business competitiveness and household welfare, energy users largely lack awareness of energy efficiency potential and ways to save energy. SEA has developed a series of leaflets in particular for households. The eFilip web platform developed by ECB provides detailed information on energy efficiency. However, computer and internet equipment has remained limited in the population (23.6% in 2004) reducing the visibility and impact of this tool.

During the second half of the 1990s, the SEA developed a two-month training programme for energy auditors, in which more than 400 energy auditors were certified until 2005. Also, all licensed bodies must have a qualified person responsible for energy issues. Currently there are 550 qualified persons for electricity, 900 for heating and 200 for gas.

- **Regulation**

The legislative field has been dominated by the transposition of the EU directives related to energy efficiency. Further to formal transposition, the challenge is now to ensure effective implementation, monitor impacts and participate in the legislative process at the EU level.

The implementation of the national energy efficiency programme and other measures is not supported by a specific legislation. The four SEA regional branches are the main bodies responsible for the implementation at the local level.

Financing

In all sectors, the availability of effective financial mechanisms of energy efficiency investment projects is essential. The Ministry of Economy operates a grant facility (*de minimis* scheme) for energy efficiency and renewable projects up to SKK 4 million for a maximum duration of three years. Grants can cover interest on bank loans (up to 100%) and investment costs (up to 75%). The total available budget is SKK 30 million per year. Eligible investments include thermal insulation, regulation, retrofitting of heating systems for households and energy saving and fuel substitution in other sectors.

Other domestic market-based financial mechanisms including commercial leasing are limited and do not take into account the specificities of the energy efficiency investment. Unlike in neighbouring countries, no energy efficiency funds have been created.

Third Party Financing (TPF) of new investment and modernisation proved an attractive option for customers in many OECD countries, in particular Hungary. TPF companies or ESCOs offer a complete package of energy efficiency services including a feasibility study, investment financing, completion and maintenance, usually through an Energy Performance Contract (EPC) in which guaranteed energy savings repay the loan and remunerate the ESCO. These turn-key energy efficiency projects result in a new or renovated installation requiring less energy and maintenance and no up-front investment for the customers.[7] In Slovakia, the current price methodology, which is based on "cost-plus fees" largely prevents an effective use of this mechanism (see chapter on heat).

Over the past decade, IFI support to energy efficiency investment has remained very limited. In the mid-1990s EBRD supported an ESCO/TPF project but the World Bank Group has not funded projects in this field.

Energy efficiency studies and projects have been eligible for EU energy programmes, including SAVE which provided SKK 339 million during the period 1999-2001. In addition, since 2004, EU structural funds could co-fund up to 65% of the investment cost of projects submitted by SMEs. For the first tender, a total of 64 applications for energy efficiency worth SKK 1.5 billion were made and 51 projects received co-funding of SKK 887 million, or SKK 17 million each on average.

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7. Detailed analysis in the Energy Charter Secretariat study Investing in Energy Efficiency - Removing the Barriers (2005): *www.encharter.org/index.jsp?psk=16&ptp=tDetail.jsp&pci=179&pti=55 .*

Sectoral Situation and Policies

- **Energy Sector**

  In 2003, transmission losses in the energy sector have been estimated on average at 4.5% of the energy consumed.

  As a part of the sector's restructuring and modernisation, energy efficiency improvements through up-grade, new technologies and operation optimisation have been combined with enhanced safety, reliability, productivity and quality of products (*e.g.* automotive fuels in Slovnaft refinery).

  The average efficiency for electricity and heat generation amounts to 30% and 64%, respectively, suggesting a significant potential gains exist. Combined cycle gas turbines (CCGT) have increased efficiency to 45-60%. Already, a unit (PPC, 218 MW) has been commissioned in 1996 and a new unit of 385 MW has been planned, which will bring the share of this technology in the generation mix from 4% to 10-11%. Where there is a need for heat, CHP generates electricity at 60-80% efficiency, as well as providing economic and environmental benefits. CHPs account for 20% and 52% of electricity and heat generation, respectively (see chapters on electricity and heat). Also, the conversion from solid fuels to natural gas and biomass provides substantial efficiency generation gains.

  In 2003, transmission and distribution losses for electricity averaged 0.9% and 7.1% of the electricity supplied, respectively. SEPS plans to continue the modernisation of the transmission lines (replacement of 220 kV lines by 400 kV) and transformers. The three distribution companies have to reduce the bulk of losses towards OECD Europe's lowest level (5%), contributing to their competitiveness.

  Gas transmission losses amounted to 2% of gas transported (including for transit), just above the most efficient networks (UK: 1.5%). SPP has continuously modernised its compressor stations, mostly gas-powered, whose installed capacity is 1.1 GW. Estimations for gas distribution losses indicate 2% of volumes.

  The retrofitting and modernisation of the Slovnaft oil refinery (see the Apollo programme in the oil chapter) has reduced refinery losses to 2.6% and its own consumption including feedstock at 12%.

- **Industry**

  Industry is the largest consuming sector with 37% of TFC, of which 16% is accounted for by the metallurgical and chemical industries, dominated by

large units producing mostly low-value-added semi-finished products. Metal and non-metal industries account for around two thirds of the total energy consumption in industry. The economic energy saving potential in industry is in the range of 20-35% of consumption, or the equivalent of all of the consumption by the iron and steel sector (see Table 5).

The restructuring and modernisation in the remaining industries have generally generated energy efficiency gains through process changes (*e.g.* continuous casting in Košice steel plant), more efficient equipment and regulation and control (*e.g.* energy management systems). If between 1994 and 2001, the average energy intensity in the sector dropped by around 65%, of which 38% for efficiency gains and 27% represented change in the structures of the sector, it remains higher than comparable in Western European industries.

- **Buildings in Tertiary Sector**

  Energy consumption in the tertiary sector grows regularly (22% of TFC in 2003). Building energy needs (heating, cooling, lighting) account for most of this consumption. Natural gas remains the most used energy in tertiary activities despite a decrease since 1995 to the benefit of electricity and heat. The economic potential for energy saving has been estimated above 20%. For heating alone, potential savings have been estimated at 40%. Lighting performance can be improved by at least 30% with existing techniques within short payback period.

  The enforcement of building codes (enacted in 1976) and the implementation of building certification under the EU Directive on energy performance of buildings constitute the main legislative tools to increase energy efficiency in this sub-sector. The Directive includes minimum efficiency standards for all new and existing buildings above 1,000 sq. meters, individual certification and inspection, and should be enforced from 2006. The standard for new residential buildings has been reduced by 35% from over 120 kWh/sq. m/y in 1990 to 80 since 1998.

  The Ministry of Building and Regional Development, with the support of two research centres has developed a comprehensive and effective implementation programme for certification of buildings. Activities have been based on an extensive database of public buildings. The EU-supported programme "Energy Display"[8] assists public administrations to calculate

8. Launched in 2001 (www.display-campaign.org) in partnership with Energie Cités (www.energie-cites.org).

energy and water consumption as well as CO_2 emissions from their building facilities. In Slovakia, one municipality (L'ubochňa) is participating in the Energy Display programme.

- **Residential**

The 1.7 m households account for 21.5% of TFC (39% of natural gas, 21% of electricity and 78% of heat). During the period 1993-2001, the average dwelling energy consumption increased by 15% at 67 GJ (1.6 toe) as the result of a slight growth in the average surface area of dwelling spaces at 57 sq. m and an increase of electricity consumption, in particular due to new appliances and space and water heating, which now accounts for 35% of the total residential electricity consumption. Estimates indicate that in average at least 25% of current energy consumption by the residential sector (3 Mtoe) could be saved on the basis of a rehabilitation programme for 11,000 dwellings. The sector includes broad diversity in terms of building types, equipment, consumption characteristics, leading to a multi-disciplinary approach. The growth of consumption has been limited, except for electrical heating, by energy price increases and the better energy performance of new buildings and appliances.

Thermal isolation of buildings appears as one of the most attractive measures both in terms of energy efficiency, cost and comfort. 40% of blocks would need to be properly insulated by 2012. The Ministry of Construction and Regional Development implemented an insulation-building program until 1997. Since then, the State Fund of Building Development has been able to support investment operations with energy saving of at least 30%.

The effective enforcement of the standards and labelling of appliances, notably by targeted awareness campaigns, over the last five years, proved a very cost-effective measure. SEA participated and contributed to the first two phases of an international capacity building programme, titled Central and Eastern Europe Countries Appliance Project (CEECAP[9]). Nevertheless, the initial investment cost in energy efficient equipment (condensation boilers) and appliances is a clear barrier for their purchase although the energy savings generated during their use do repay the additional investment.

- **Transport**

Road transport is the sector where consumption grows fastest despite the high price of automotive fuels, indicating a low inelasticity of demand to

9. www.ceecap.org

prices. Individual cars and trucks account for the largest share. With passenger cars, 40% of the consumption can be saved, notably through vehicle replacement, proper maintenance and behaviour changes.

The Ministry of Transport has responsibility for energy use in the sector and has developed a specific energy programme. With regards to information on vehicles for buyers, further to the current compulsory display of fuel consumption and CO_2 emissions, the European Commission has proposed the labelling of CO_2 emission performance for new vehicles.

The Ministry plans to introduce an electronic toll system for trucks based on effective mileage by 2007. For the period of 1992-2004, major investments on the road network have been made, especially for express highway and motorways (SKK 77.4 billion).

Critique

Over the last decade of economic and energy transformation, the country's energy intensity has significantly decreased but is still much higher than OECD Europe, indicating a large untapped energy saving potential of at least 22% of total consumption. High energy intensity, combined with higher energy prices, have impacted negatively on businesses' competitiveness and household's welfare and purchasing power.

However, energy efficiency policies, at the moment, appear to lack ambitious and clear targets as well as sufficient resources for implementation and monitoring. Thus, as energy efficiency gains can no longer rely on the initial economic restructuring and price increase, current policy efforts may prove insufficient to reach in the medium term the EU 15 energy intensity level.

On the contrary, rising energy demand under low efficiency standards will significantly increase consumption and therefore energy intensity and the burden on the economy. Furthermore, a persistent coupling between energy consumption and economic growth and development can lead to uncontrolled energy demand and create supply bottlenecks at the expense of businesses and households. Already, energy demand in transport and residential is growing as current policies are limited in scope and strength.

Untapped economic potential, coupled with the need to substitute future decommissioned electrical capacities and to reduce import dependency, are among the factors that highlight the need for a higher policy priority to energy efficiency and access to its benefits.

The current energy efficiency programme priorities, implementation and institutional set-up raise several issues. First, the lack of detailed and accurate energy saving potential analyses by sector could call into question how priorities and measures were identified. The programme seems to lack clear priorities, targets and focused activities. The absence of overall and sectoral quantitative objectives and time frames makes it difficult to monitor impacts and effectiveness of measures.

Furthermore, despite being a "state subsidy organisation", the SEA has not received direct public funding. The financial and human resources appear noticeably inadequate to implement comprehensive and effective energy efficiency sectoral programmes, together with EU requirements and regional and international activities. In particular, the state budget allocated to the national programme (SKK 30 million) implemented by the SEA appears insufficient to undertake a policy able to produce effects. Staff numbers in energy agencies is a simple but effective indicator of the match between objectives and resources. The SEA with a staff of 70 (including regional branches and renewables) has the mission to implement energy programmes for a population of 5.4 m and energy saving potential of 22%. In the Netherlands, which has a population of 15 million inhabitants and a lower energy saving potential, Novem, the energy and environment agency, employed almost 500 staff in 2003.

Overall, the current shortfalls of the energy efficiency policy contrast with the comprehensive and operational policy and action plan developed in 2002 for the Ministry of Economy.

The policy challenges and the current situation of high energy intensity and burden call for drastic changes. The initial financial efforts of the State will pay for itself as it will contribute to enhanced competitiveness, reduce the burden of price increases on citizens' incomes and create new activities and jobs at local level, in synergy with the national economic strategy and in line with the EU Lisbon agenda.

The adoption of a multi-sector action plan, with measurable and binding medium-term objectives, together with the establishment of a strong public energy agency with adequate resources is needed to implement the new policy priority. The adoption of relevant and accurate indicators for monitoring, and an independent evaluation of the action plan and sectoral programmes, would be useful in updating the action plan.

Despite its advanced status, the limited initial financial efforts and higher global benefits, the action plan developed in 2002 was not adopted by the

government. Nevertheless, it still appears valid and would need only to be up-dated to take into account new developments, in particular the decommissioning of electricity capacity together with new EU regulation. Notably, the forthcoming Directive on Energy Efficiency and Energy Services includes an annual recommended energy-saving target of 1% as well as mandatory national action plans.

If the action plan targets short- to medium-term objectives, the energy policy should develop longer-term objectives for energy efficiency. Eventual adoption of new EU measures will be reflected at the policy level, in the future action plan, and in the sectoral programmes. Already, energy efficiency has gained importance in EU energy policy and regulation. The recently released EC Green Paper on energy efficiency ("Doing More With Less") develops a comprehensive set of measures and actions to reduce EU energy consumption by 20% by 2020. Already, several EU countries (UK, Germany, France) have set the objective of cutting CO_2 emissions (not including air transport) by a factor four by 2050 through reliance on energy efficiency.

Energy efficiency improvements, in particular for the decommissioning of electricity generation capacities have not been sufficiently considered. despite their importance and low relative cost. In industry alone, the potential of electricity saving represents 36% of the nuclear capacity to be decommissioned in Bohunice. A detailed least cost plan analysing both supply and demand options (see chapters on electricity and nuclear energy) should provide the basis for a specific energy efficiency programme for the most promising sectors and uses.

The definition of policy objectives by sector will imply a clarification of responsibilities, for both policy design and implementation between the various ministries and agencies, notably for transport.

The creation of a national public energy agency is of the utmost importance. Its resources, in particular staff and financial resources for operation and programmes, must be sufficient to implement the objectives of the action plan and its horizontal and sectoral activities. Identifying and developing synergies with local and regional agencies as well as international programmes and projects, could help implementation.

Over the past decade, global and targeted energy efficiency awareness campaigns have been limited and their impacts have gone unmeasured. Awareness and information campaigns are aimed at the main energy end-user sectors (residential, industrial and service companies) through suitable channels to influence behaviours and investment decisions in the context of

energy efficiency opportunities. They also support the implementation of other programmes. The availability of information and advisory focal points for the customers is crucial.

The financing mechanisms to support energy efficiency studies and investment are still limited and inadequate for customer needs. The potential funding from the SEA programme is insufficient for individual projects (maximum of SKK 4 million) and total funds are limited to SKK 30 million or the equivalent of eight projects, including those for renewable energy. In contrast to the Czech Republic and Hungary, there are no energy efficiency revolving funds. These have proved valuable in providing adapted co-funding and hence sustainability. The authorities should consider developing such funds in collaboration with commercial banks and IFIs, notably the EBRD, as well as providing adequate legal structures and tax incentives for energy efficiency investment, in particular implemented through third party financing.

An energy efficiency act can support the implementation of the action plan, define respective duties and powers and provide the legal framework for development of future measures, including helping local authorities to promote energy efficiency. Regulations for heat should likewise be adapted to allow third party financing (TPF) projects (see chapter on heat).

In the action plan, the government can decide that public procurement favours buildings, appliances and vehicles complying with most energy efficient standards (*e.g.* "Energy Star" for office equipment), and can use third party financing for modernisation of energy facilities. This would have an exemplary effect, demonstrating technical performance and economic utility, thus promoting energy efficient markets. Similarly, public financial rules should encourage administrations to achieve energy savings by allowing accumulated budgetary savings to be spent for other purposes rather than reducing the budgetary allocation as is the case. In addition, for administrations opting for TPF/ESCO for their facilities, the length of the corresponding budget should match the duration of the contract (three to five years).

In the energy sector, regulatory and fiscal incentives should encourage energy companies to increase the energy efficiency of their operations, notably by further use of CGCT and CHP and continued reduction of generation and transmission losses (electricity, gas, oil and heat) as well as developing DSM programmes with customers (see chapter on electricity). The role of the regulator is crucial in developing price signals and complementary incentives for energy operators. A possible option is to include in the regulation specific rewards to energy distributors enforcing demand side measures for their customers.

In industry, the largest energy consuming end-use sector, active policies are important. For heavy and energy-intensive industries, compulsory audits resulting in operational and cost effective measures will enhance competitiveness. Companies should be fully informed of opportunities for energy efficiency provided by the EU Emissions Trading Scheme (EU ETS). Voluntary agreements with sectors and companies could increase energy efficiency if objectives, implementation and results could be assessed by an independent body. For light industries and SMEs, sectoral programmes should be developed according to the potential of the various sub-sectors.

In the building sector, implementation of the certification directive for service industries has progressed and could further develop synergies via the building labelling of the Display Campaign. Additional gains can be achieved in both service sector offices and new residential buildings by strengthening building codes and enforcing them. Retrofitting of existing buildings, including enhancement of thermal isolation, heating systems and appliances, results not only in lower energy bills and increased comfort but also in keeping them viable and marketable.

Efforts should focus on effective regulation and enforcement of appliance standards and labelling, and its extension to additional appliances. Significant energy efficiency gains can be achieved by switching from low-efficiency energy use such as solid fuels (*e.g.* stove efficiency: 20-25%) and electric heating (*i.e.* 27% global efficiency) to high-efficiency and cleaner, direct techniques and fuels such as natural gas (80-95% efficiency) and biomass (60-85%). The substitution of electricity consumption by natural gas for space and water heating would reduce the consumption by around 2 TWh (8% of total electricity consumption or 40% of household consumption), saving 0.6 Mtoe (3% and 21%, respectively). Furthermore, this would avoid satisfying peak demand by building new capacity or by imports.

In the transport sector, oil consumption is growing rapidly, generating environmental damage and congestion, in particular in urban areas, as well as requiring increasing resources for new infrastructure. The Ministry of Transport lacks a detailed cross-sectoral action plan and an implementation agency. The energy efficiency action plan should therefore include the main transport modes. Enhanced co-ordination between central and local authorities will be required to enhance the performance and attractiveness of public transport, notably by the high quality of service supported by infrastructure development (railway rapid lines, bus lanes, inter-modal freight). Enforcement of speed limits in order to reduce the high rate of accidents (2000 mortality rate of 21.9 per 100,000 inhabitants for men; UK: 8.4, Netherlands: 10) will also mitigate fuel consumption growth.

The government should ensure strict compliance with vehicle emission requirements which are linked to fiscal instruments. The forthcoming adoption of an EU directive on car labelling (energy efficiency and emission label indicating the level of efficiency per category of car) would be an opportunity to ensure coherence with the tax system. Introduction of low-cost measures such as eco-driving have a strong potential (15-25% savings) and have been already incorporated in the driving learning programmes in the Netherlands and Switzerland, and recently in other countries like France.

Recommendations

The government of the Slovak Republic should:

- Consider adopting a robust multi-sector energy efficiency action plan with binding sectoral objectives, targeting an energy-efficient economy, and clear institutional responsibilities; an energy efficiency act will support implementation.
- Provide adequate resources to the national energy agency and local energy efficiency programmes and institutions to comply with the objectives; ensure independent monitoring of policies and programmes.
- Ensure co-ordination of activities within the central, regional and local administrations and other stakeholders; adopt most energy efficient standards for state-owned buildings and for the purchase of energy appliances and vehicles.
- Consider as a priority energy efficiency measures for energy poverty mitigation and building rehabilitation programmes.
- Implement EU directives on energy efficiency, including the Buildings and CHP Directives, on a timely and effective basis.
- Ensure that demand side measures are properly considered in least cost plans, in particular to replace future decommissioning of electricity capacities.

ENERGY AND THE ENVIRONMENT[10]

Key Information and Data (2003)

- **Total air pollutant emissions:** 0.59 Mt; CO (50%), SO_2 (18%), NOx (17%), NM VOC (15%)
- **GHG emissions** (CO_2 eq.): 46.8 Mt CO_2: 37.9 Mt, CH4: 4.7 Mt (10%), N2O: 3.95 Mt (8%), F-gases: 0.7 Mt (1%)
- **CO_2 emission ratios:** 7 t/cap.; 0.59 t/USD 1,000 GDP-PPP, 2000 (OECD Europe: 7.5/cap.; 0.36 t/USD 1,000)
- **1990-2003:** CO_2 (-28%), SOx (-81%), NOx (-57%), VOC (-67%), lead (-65%); GDP: +53% (1990-2003)
- **Employment:** Ministry of the Environment/Air pollution & climate change (12), related agencies (12)

The environment was largely neglected under the centrally planned economy, resulting in chronic and severe pollution, in particular in mining and industrial areas. Energy production and use have been a major source of pollution. In the course of the transition towards a market economy, the country has made impressive progress in environmental protection by establishing an institutional and regulatory framework and by defining policies to address this inheritance. In addition, climate change issues have been progressively integrated in the policy-making process.

Evolution and Assessment of Emissions

While the monitoring of polluting emissions is ensured by a central emissions inventory, in line with international standards, two-thirds of the twenty initial automatic stations measuring local air pollution are no longer operating.

Over the past decade, the combination of voluntary policies, in particular emission standards, industry restructuring and investment in cleaner techniques and fuels has contributed to a significant reduction of pollutants and greenhouse gas (GHG) emissions. After the first stage of massive reduction of emissions from large stationary units in heavy industry and the energy sector, the residential and transport sectors have increased their share in total emissions.

10. *Main reference:* OECD Environmental Performance Review of the Slovak Republic (2002): *http://www.oecdbookshop.org/oecd/display.asp?lang=EN&sf1=identifiers&st1=97200203 1e1* .

Air Pollutants

Between 1990 and 2003, sulphur oxides (SO_x), (nitrogen oxides) NO_x, carbon monoxyde (CO) and volatile organic (VOC) emissions dropped by 81%, 57%, 41% and 867%, respectively. With total air pollutant emissions of 0.59 Mt (2003), CO accounts for 50% followed by SO_2 (18%), NO_x (17%), VOC (15%) and lead (0,001%) (see table below). The twenty largest emitters (mainly industrial and energy plants) account for 78% of SO_2 and 45% of NO_x emissions.

Table 6

Main Air Pollutants, 1990 to 2003 (in kt)

	1990	1992	1995	2000	2003	% 1990/2003
SO_x	526,111	389,630	246,288	126,952	106,096	-80.8%
NO_x	221,616	188,396	177,709	108,828	97,700	-56.9%
CO	505,458	440,611	415,645	307,089	301,765	-41.3%
VOC	252,281	147,613	153,914	84,552	86,613	-66.7%
Lead	0.17	0.18	0.098	0.053	0.060	-65.0%

Source: Ministry of the Environment- annual reports on air pollution.

Over the past decade, pollutant emissions in the main sectors have evolved under different patterns. In the power and heat generation sectors, improvements in generation and transport efficiency, closure of obsolete units, conversion to natural gas and installation of filters and desulphurisation have been the main tools to reduce pollutant emissions. Similarly, in the industrial sector, economic restructuring, dissemination of more efficient techniques and processes and greater use of natural gas have reduced by half fuel use and associated emissions. The residential sector has also been using cleaner appliances and fuels. Although higher performance of vehicles and higher quality fuel standards, notably by replacing leaded gasoline by unleaded have reduced emissions in the transport sector, the growth of private and commercial fleets and higher mileage are increasing emissions.

Despite a significant decrease in emission levels, unit ratios (SO_2 and NO_x at 1.6 t/1,000 USD GDP) remain higher than the EU 15 average (0.7 t and 1.1 t) and several industrial and urban areas still face a high concentration of pollutants, increasingly from the transport sector. In particular, while the yearly average concentrations in major cities no longer exceed the annual

standards of 50 µg/cm for SO_2 and 80 µg/cm for NO_x, daily concentrations have been above these limits, in particular for NO_x in areas of Bratislava and other urban or industrial areas. Ozone, particulate matter and benzene concentration are also problematic.

This has an impact on the health of the population of these areas and on the environment. It is estimated that at least 25% of the forests of the country have been damaged by air pollutants, mainly SO_2. The Figures 11 and 12 indicate the main pollutant emitting areas and concentrations.

- **Greenhouse Gases (GHG)**

In 2003, 46.8 Mt (CO_2 equivalent) of GHG were emitted, of which 82% was carbon dioxide (CO_2). Between 1990 and 2003, CO_2 emissions dropped by 28% to 37.9 Mt, as the combined effect of industry restructuring and a sharp reduction of coal consumption which put the current emission level 32% below the 1990 level. During the same period, GDP increased by 18%. Nevertheless, the country's carbon intensity at 0.59 t CO_2/USD 1,000 of GDP at PPP, 2000 prices (OECD Europe: 0.36 t), remains one of the highest in Central Europe, despite the large use of natural gas and the high share of nuclear energy in the power mix.

In 2003, fuel combustion accounted for 93% of CO_2 emissions. Coal remains the chief fuel emitter with 15.5 Mt (45%), followed by gas (36%) and oil (19%). The energy sector accounts for 33% of total CO_2 emissions followed by industry (37%), transport (13%) and residential (17%) (see Figures 14 and 15). Although CO_2 emissions from coal combustion in power and heat generation and industry have decreased by 40% and 60% over the period 1990/2002 respectively, emissions from oil use in transport and gas use in the residential sector have increased by 75% and 109%, respectively. Altogether, these four emission sources now account for half of total CO_2 emissions.

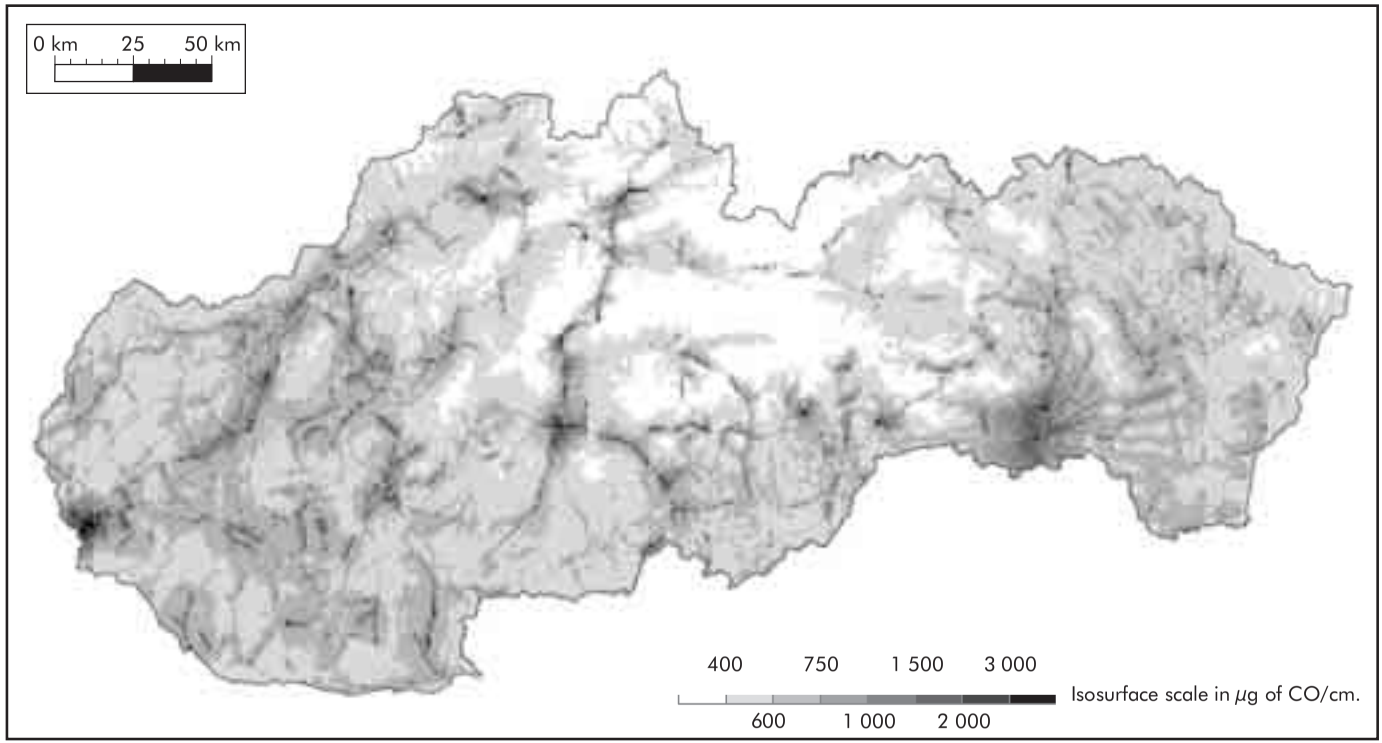
The other main GHG are methane (CH4) with 10% of GHG and N2O with 8%. Leaks during natural gas transport account for the 25% share of CH4 emissions of total, the largest share of the total being waste with 44% of total (0.22 Mt of CH_4).

Official forecasts put CO_2 emissions sinks and carbon storage at 47.4 Mt (-4.5%) by 2010, then increasing to 60 Mt by 2020 for scenario with additional measures.[11]

11. Preliminary data on projections which will be revised in the 4th National Communication on CC, submitted in December 2005.

Figure 11

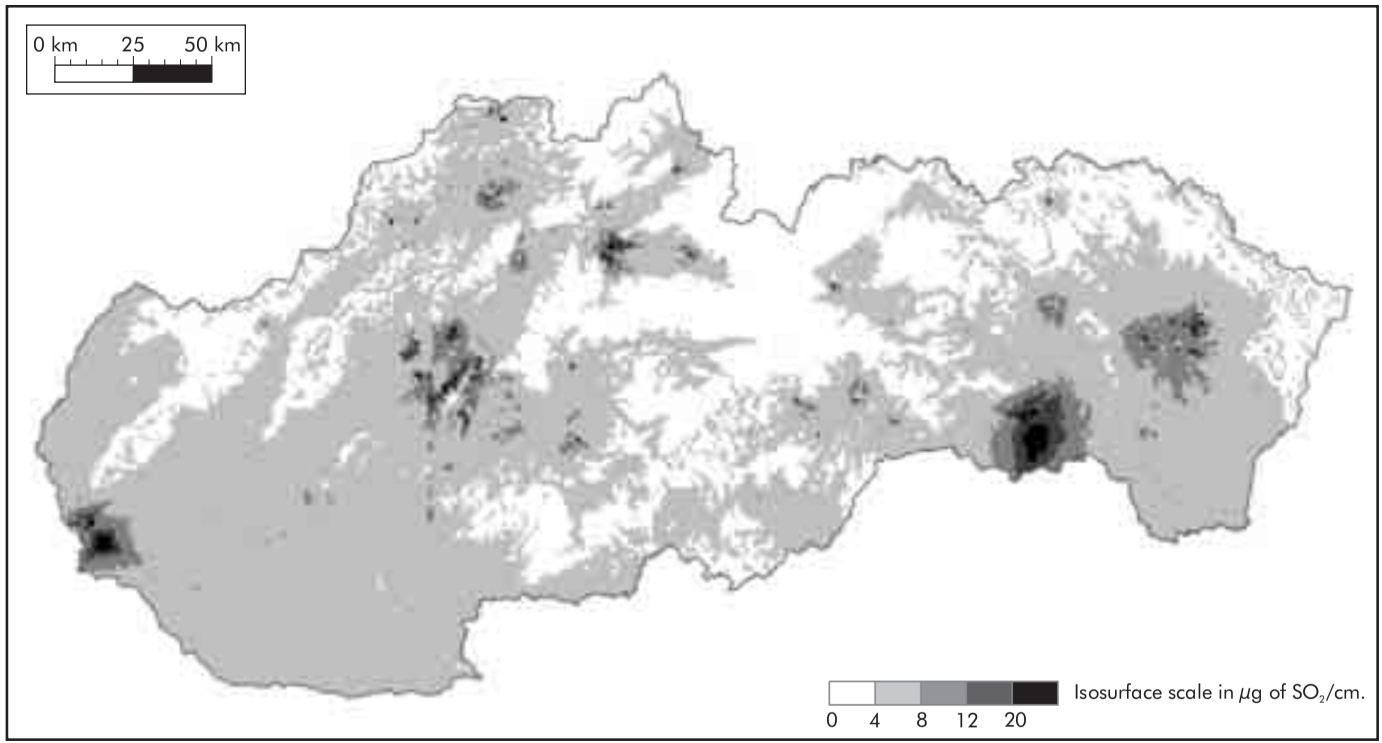
Map of Concentration of Carbon Monoxide (CO)



Notes: Maximum annual concentration based on 8 hour period at points distant by 1,000 m apart. The annual upper limit for health protection (10,000 ìg/cm) is not exceeded on Slovak territory.
Source: National Emission Inventory System (NEIS), 2003.

Figure 12

Map of Concentration of Sulphur Dioxide (SO2)

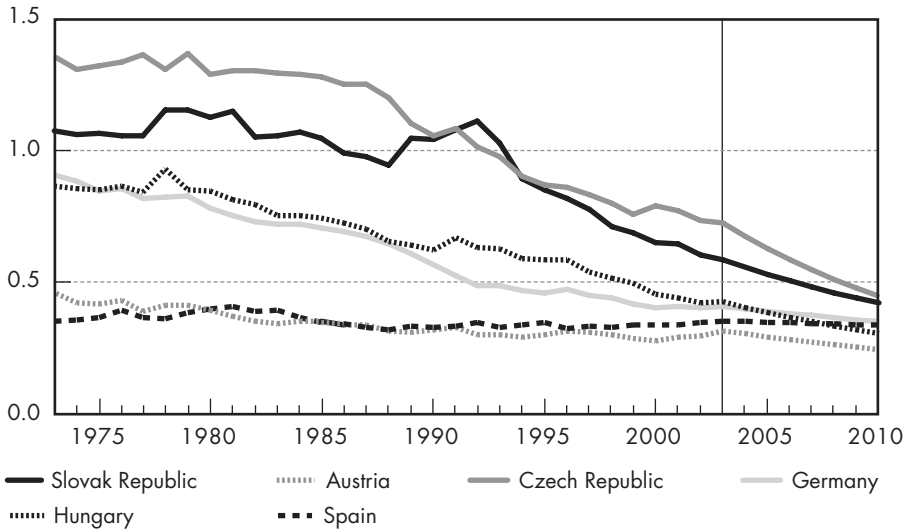


Notes: Average annual concentration based on daily measures. The annual upper limit (20 Ìg/cm) for ecosystem protection is exceeded in several urban and industrial areas. The annual upper limit for health protection (50 Ìg/cm) is not exceeded on Slovak territory.
Source: National Emission Inventory System (NEIS), 2003.

Figure 13

Energy-related CO_2 Emissions per GDP in Slovakia and in Other Selected OECD Countries, 1973 to 2010

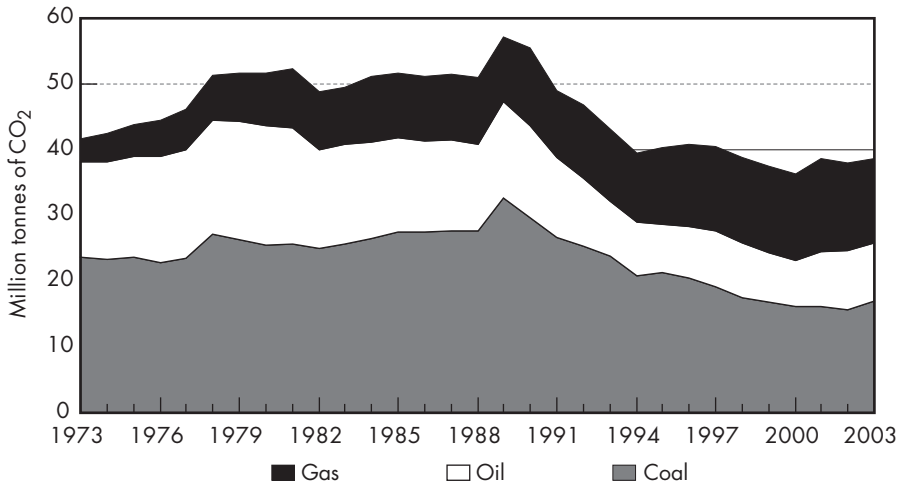
(CO_2 emissions in t. per thousand USD at 2000 prices and purchasing power parities GDP using 2000 prices and purchasing power parities)



Sources: Energy Balances of OECD Countries, *IEA/OECD Paris, 2005* National Accounts of OECD Countries, *OECD Paris, 2005 and country submissions.*

Figure 14

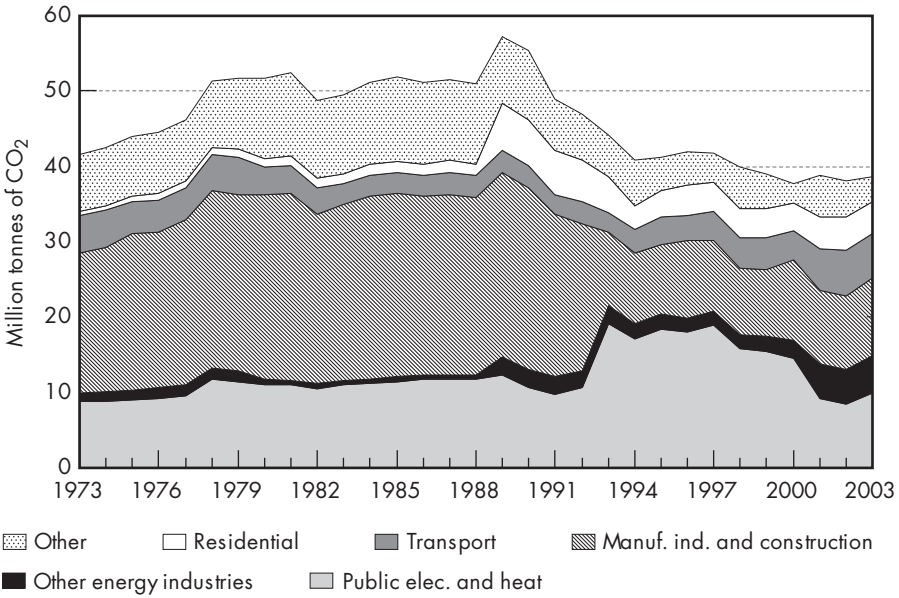
CO_2 Emissions by Fuel, 1973 to 2003*



** Estimated using the IPCC Sectoral Approach.*
Source: CO_2 Emissions from Fuel Combustion, *IEA/OECD Paris, 2005.*

Figure 15

CO_2 Emissions by Sector, 1973 to 2003*



** Estimated using the IPCC Sectoral Approach.*
Source: CO_2 Emissions from Fuel Combustion, IEA/OECD Paris, 2005.

Response Policies

● Organisation

In 1999, the Ministry of the Environment adopted the State Environmental Policy and the second National Environmental Action Programme (NEAP II), which are directed at environmental security, pollution reduction and climate change mitigation. The objectives of NEAP II are to transpose and implement the *EU acquis* on the environment, reduce pollutant and CO_2 emissions and develop a monitoring system on air pollution. In 2003, on the basis of a joint study with Switzerland and the World Bank, the Ministry adopted a strategy on GHG mitigation, which includes sectoral measures and increased use of market-based instruments.

The Ministry of the Environment is supported on policy implementation by the Environmental Agency and relies on regional offices and the Slovak Environmental Inspection (SEI) for enforcement and monitoring.

Regulation and Financing

Comprehensive legislation has been adopted, including the Clean Air Act (2002), in order to apply the relevant EU directives, notably the Large Combustion Plants Directive (LCPD). The new emission standards for LCPD, even with exemptions until 2010, have contributed to the closure of several coal and lignite-fired power and heat generators with a capacity of 914 MW (see section on demand and supply balance in the chapter on electricity). Sulphur and lead emissions from oil products, in particular automotive fuels, have been reduced significantly thanks to enforcement of the current EURO 4 standard and the phasing out of leaded gasoline.

The Environmental Fund was originally funded from state budget and environmental taxes. It supports various programmes as well as investment projects focusing on air pollutants and GHG emission reduction including energy efficiency and small renewable projects. EU pre-accession programmes such as PHARE, Instrument for Structural Policies for Pre-Accession (ISPA) and Large Scale Infrastructure Facility (LSIF) provided co-funding to improve environmental performance. Currently, EU structural funds are available to support the development of projects by public and private companies and municipalities. At present the Environmental Fund (SKK 660 million in 2004) is funded only by environmental charges and penalties.

Air Pollution Mitigation Tools

Taxes

The use of market based instruments is the preferred option to enhance the effectiveness of environmental policies. In particular, energy price increases for cost recovery have played an essential role in increasing consumers' awareness on the use of energy and its various impacts.

The Ministry of the Environment established a comprehensive emission tax system for stationary units which account for the largest portion of emissions. The "Act on charges on pollution" approved in 1998 details the individual taxes applying to two main categories of pollutants: basic (SO_2[12] , NO_x, CO, VOC) and other (150 pollutants in four classes of toxicity) (see table below). Each emitting unit is supposed to self-report its emissions for the calculation of the tax. However, under-reporting has occurred, because effective control by the Environmental Inspection appears insufficient. As a result, emission taxes and non-compliance fines dropped significantly, by 20% in 1999 to SKK 300 million.

12. SO_2: SKK 2,000/t (€ 49/t)

Table 7

Emission Charges for Air Pollutants, 2003

Pollutants	SKK/ton
Particulates	5,000
Sulphur dioxide	2,000
Nitrogen oxides	1,500
Carbon monoxide	1,000
VOC	4,000
Category 1	40,000
Category 2	20,000
Category 3	10,000
Category 4	2,000

Source: Ministry of the Environment.

SO_2 Trading

Since 2002, in order to fulfil the Slovak commitment to the Gothenberg Protocol, large SO2 emitters (above 50 MW) have been subject to an emission quota system. Until 2006, quotas allocated are higher than existing individual emissions but will be reduced by 45% by 2010. Companies can trade their emission surplus and deficit above or below their quota on a bilateral basis. However, they also appear to under-report their emissions.

● Climate Change Mitigation

The first signs of climate change may have appeared in the country with an increase of temperature by 1.1°C over the last 100 years and 0.17°C per decade since 1940, and a decrease of 5.6% in annual precipitation (in particular snow). In November 2004, a powerful storm devastated a large part of the Tatra national park.

Slovakia ratified the Kyoto Protocol in 2002 and is a party to Annex I to the UNFCCC. As an EU Member State, Slovakia, under the Kyoto Protocol, has to reduce GHG emissions 8% below the 1990 level.

Multi-purpose Policies: Energy Efficiency and Renewable Energy

Higher energy efficiency on both the supply and the demand sides has a great potential for reducing GHG emissions. The reduction of the high energy intensity relies on a programme managed by the Slovak Energy Agency (SEA)

but has neither quantitative objectives nor time frames. The country has agreed with the EU to increase the share of renewable electricity from 19% to 31% by 2010, or 4% of TPES (see chapters on energy efficiency and renewable energy).

Emissions Trading Scheme

The EU has been a pioneer in developing a scheme for GHG emission trading, the Emissions Trading Scheme (EU ETS) which has been officially active since January 2005. The Ministry of the Environment submitted the National Allocation Plan (NAP) based on the Directive 2003/87/EC to the European Commission, which, after review, requested two additional reductions in emissions of 14% and 0.6% to 30.3 Mt/y for the 2005-2007 trading period. The NAP allocates individual emission quotas to 168 installations, which account for 52.3% of total CO_2 emissions. Quotas were directly negotiated for installations emitting more than 0.5% of the country's CO_2 emissions (1.9 Mt/y), which account for 86% of total allocation. The main sectors covered are the energy sector and heavy industries (iron and steel, chemicals). The national registry is managed by Dexia Banka Slovensko and has been operational since the end of 2005. The Bratislava Commodity Exchange and other companies offer trading of allowances, which are estimated at 5-7% of total allocation to potential foreign buyers.

Slovakia is also actively preparing to take part in emissions trading under the Kyoto Protocol. Because the country is expected to remain below its Kyoto target, it is expected to be a net seller of emissions – in the form here of Assigned Amount Units (AAUs) – possibly in the range of 10% of its total target. Already, it is the first country to have concluded a pilot sale of 200,000 AAUs to a Japanese company in exchange for a fuel switching investment from coal to gas at a power plant. The government does, however, plan to use part of the emission surplus as a reserve for domestic use in case of higher emission growth.

Joint Implementation

Joint Implementation (JI) is another flexibility mechanism. Up to now, only one project developed with the Netherlands (ERUPT 4) is being implemented on gas recovery for the main landfills. The recovered methane will generate electricity from 2007, saving at least 551,200 t of CO_2 equivalent in the period 2008-2012. Projects in district heating using biomass and geothermal, and reducing methane leaks of the gas transport network, may attract other allowance buyers.

Table 8

Characteristics and Potential of Various Environmental Mitigating Measures Related to Energy (in kt)

Policy/ measures	Objective and/or activity	GHG	Instrument	Status	Organisation/ Responsible for implententation	2000	2005	2010	2015
			CO_2			258	1,365	1,372	1,342
Act 478/2002 Coll. on air protection	Reduction of air pollutant emissions	CH_4	Regulatory and economical	I	MEnv and Environmental Agencies	4	88	92	72
		N_2O				1	10	13	11
Introduction of combined cycles	Increase of energy efficiency	CO_2	Regulatory and technical	One plant	ME SEA	0	972	814	911
				Second plant planned					
	Reduction of final energy consumption				MC				
Thermal insulation	Reduction of fossil fuel and electricity consumption	CO_2	Regulatory	40% of flat buildings need new isolation	MC	0	78	803	634
Use of renewable energy sources	Reduction of fossil fuel consumption	CO_2	Regulatory and technical	Objective of 31% of renewable electricity by 2010 (2003: 19%)	ME	159	1,138	1,857	2,334
		CH_4		S	SEA	0	1	2	
		N_2O				0	6	19	3

Sources: Ministry of the Environment and IEA.
Positive values of greenhouse gas emissions correspond with reduced formation of greenhouse gases after deployment of the measure
I – Policy and measures already implemented (under criteria of the updated IPCC Guidelines 1999/7) ; S –Policy or measures adopted
ME: Ministry of Economy ; MEnv: Ministry of the Environment ; SEA: Slovak Energy Agency ; MC: Ministry of Construction and Regional Development

In the years 1998/2000, at least four Activities Implemented Jointly (AIJ) were implemented with the Netherlands, Switzerland and Norway. They covered energy efficiency improvements, gasification and biomass conversion for a total contribution of USD 2.6 million, resulting in an annual reduction of 200,000 t of CO_2.

Other Sectors

GHG emissions of other sectors, such as residential, services and transport, are growing but are outside existing regulation and international mechanisms. Measures have been only indirect, including improvement of energy efficiency and fuel substitution.

Transport has become one of the most pressing sectors in terms of GHG emissions and pollution, notably in urban areas. The use of individual vehicles has grown due to the insufficient quality of service of public transport. Additionally, GHG emissions from trucks increased by 55%. The large number of units and diversity of the transport sector make policy implementation complex as several governmental central and local bodies are to be closely co-ordinated (see chapter on energy efficiency). Nevertheless, despite the lifting of environmental restrictions on the import of used vehicles, the latter still have to comply with emission standards.

Critique

Obvious and spectacular improvements to the environmental situation have been achieved thanks to economic reforms as well as to voluntary environmental policies. Growth in air pollutant and GHG emissions is now decoupled from economic growth. The energy sector has largely contributed to these improvements, even if it remains the largest emitter. Nevertheless, emission levels remain much higher than OECD average.

Air pollution levels have spectacularly decreased both in quantities and toxicity. Nonetheless, the system monitoring air pollution has deteriorated and local pollution problems persist in populated areas. It is important that direct (measures) and indirect (calculations based on consumption) monitoring systems provide reliable information in order to assess the evolution of emissions as well as monitoring impacts of policies and measures.

The 2002 OECD Environmental Performance Review of Slovakia outlined the challenges for the country's environmental policies, including strengthening efforts to implement policies in a cost efficient manner in order to better integrate environmental considerations into other state policies and to comply with international commitments.

In this respect, NEAP I & II, reinforced by the climate change strategy, have shaped the mitigation policies of pollutants and GHG, based on market-based instruments such as the sound principle of "polluter pays". However, policies have not included precise targets nor time frames, making evaluation of progress and results difficult. Furthermore, their enforcement has been weakened by lack of control over emission declarations and reduction. Thus, it is crucial to ensure effective implementation and monitoring of the adopted policies on the basis of clear quantitative objectives and time frames.

The adoption of EU environmental standards and regulation has contributed to environmental performance and to convergence with the EU15. Nevertheless, continuous attention is needed to possible side effects on the environment.

Existing programmes have been supported by financing tools managed notably by the Environmental Fund, with the support since 2004 of EU structural funds. They now provide an opportunity to foster environmental performance through co-funding of critical investments as well as enhancing the capacities of the administration to monitor and control the entire process.

Overall, the vast majority of improvements are closely linked with a reduction of the energy intensity, which can be achieved and sustained only by a strong multi-sector energy efficiency action plan (see chapter on energy efficiency). The continuous decline of the use of coal, in particular in power and heat generation, and higher penetration of natural gas and renewable energy, will contribute to reducing air pollution and GHG emissions. The expected decommissioning of several large coal-fired plants over the next five years will amplify this trend.

Although the first years of enforcement of the tax system on pollutants have provided incentives for emitters to take measures to reduce their emissions, lax control over self-reporting by emitters has diminished the effectiveness of the measure. Although the SO_2 trading scheme has the potential to reduce emissions at favourable cost, insufficient control on declarations and trading raise concerns about its effectiveness. Further efforts are needed in the next phase from 2006 to correct initial shortfalls and fully access the benefits of the scheme.

The current taxation system of energy products includes only partially environmental externalities, in particular pollution. Policy makers should consider incorporating environmental externalities into energy and environmental taxes, in particular for sectors not covered by the pollution fee system or the EU ETS. These additional resources could support emissions reduction projects through the Environmental Fund.

Slovakia is expected to fulfil its Kyoto commitments as GHG emissions are currently 32% below the 1990 baseline. Nevertheless, this favourable situation should not prevent the government from effectively implementing the current NEAP and GHG strategy and preparing future policies, as reduction of GHG provides environmental and economic benefits. Furthermore, emissions are growing rapidly in the transport and residential sectors for which no specific mitigation tools are in place.

For the sectors covered (energy and industry), emission trading through the EU ETS has the potential to reduce CO_2 emissions in a flexible and economic way. The government should ensure that sufficient incentives (fair quotas, strict monitoring and control system backed by dissuasive sanctions) are provided to emitters to develop reduction policies to avoid penalties or sell allowances. Thus, the reduction of the volume of allowances for the largest emitters, especially in the electricity sector, should foster trading. It is crucial for effective development of the scheme to ensure a sufficient monitoring and control on compliance of emissions and trading.

For a transition period, authorised quotas will exceed emission levels. With its planned progressive reduction, a strict monitoring and control of emissions, reduction and trading would be necessary to avoid the current shortfalls of the SO_2 trading scheme. It remains to be seen if Slovakia would fully benefit from the EU ETS which would also require sufficient awareness, information and advice for Slovak operators.

As for international co-operation and joint projects, implementation has remained limited despite a substantial potential as shown in other countries of the region. The first JI project is encouraging and could be replicated in other sectors such as insulation of buildings, district heating, biomass and geothermal projects.

For sectors not covered by existing mechanisms, it is important to enhance mitigation efforts, notably through an ambitious action plan initially targeting medium to small emitters in the service sectors, freight transport and residential.

For current and future programmes, the capacities of the national and local administrations and agencies to design, develop, implement and monitor strong and flexible environmental policies is crucial to achieve the domestic and international objective of full convergence with the rest of Europe. Synergies should be further developed with other state policies, in particular energy efficiency policy, housing policy and transport policy.

Recommendations

The government of the Slovak Republic should:

- Monitor and evaluate the implementation and cost-effectiveness of the policies and measures in the National Environmental Action Programme (NEAP) and the Climate Change Strategy, using quantitative objectives and time frames.
- Continue to reduce the level of emissions of local pollution and enhance the monitoring system of local pollution.
- Ensure adequate control of emissions rights and trading, and monitor their evolution notably by reinforcing the Slovak Environmental Inspection (SEI) capacities.
- Implement ambitious action plans in sectors, in particular residential and transport which are not covered by the current pollution fee system or EU-Emission Trading Scheme (EU ETS).
- Enhance the promotion of Joint Implementation (JI) projects.
- Consider adding a CO_2 component in the emission tax and vehicle registration tax to support the Environmental Fund.

RESEARCH AND DEVELOPMENT

Key Information and Data (2003)

- **Share of R&D in GDP:** 0.30% (EU 15: 1.8%)
- **Energy R&D:** SKK 540 m (2000-2005), 0.015% of GDP (EU 15: 0.042%-1999, IEA: 0.037%)
- **Employment:** N/A

General R&D Policy and Situation

The Ministry of Education defines the national Research and Development (R&D) policy. The latest R&D policy document "State Policy in Science and Technology" was approved in 2000. Its main priorities were to ensure co-ordination with industrial policies, enhance international co-operation and increase efficiency of R&D activities.

The stated objective was to increase the share of R&D in the GDP to 1.8% in 2005 towards the EU objective of 3% to reverse a decade of constant decrease. Actually, this share was 0.35% in 2003 and 0.3% in 2004, down from 0.45% in 1993.

The Ministry of Education has a leading role in R&D coordination. This is accomplished through the Government Council for Science and Technology, which is an advisory body consisting of representatives from selected Ministries and central authorities, Slovak Academy of Sciences, R&D sectors and associations.

Energy R&D

- **Organisation**

For R&D in energy, the Ministry of Economy administers the public programme and allocates co-funding on the basis of open tenders. Implementation and co-ordination of R&D energy programmes rely on the Academy of Sciences and public institutions, mainly universities. The private sector does not yet appear to play a significant role.

Table 9

Energy R&D Projects, 2000 to 2005

R&D projects	Date of start and completion	Sector	Implementing organisation	Total budget/state funding (SKK m)
Before 2002				
Safety assessment of nuclear power plants	07/2000 12/2002	Nuclear	VUJE Trnava	163/81.5
Distributed neural system for control of distribution and consumption of energy in industry	07/2000 12/2002		Cancelled	
Development of power industry under conditions of price liberalisation and opening up of energy market	07/2000 12/2002	Energy	EGU	12/6
Optimisation of energy industry	07/2000 12/2002	Energy	VUJE Trnava	81.5/40
Modernisation and optimisation of development of heat-supply systems	07/2000 12/2002	Energy	VUPEX	35.5/18
Research of material and technology conditions in repair of classified NPP components including spun pipes	07/2000 12/2002	Energy	SE	23/11.5
2000-2005				
Scientific and research support on supervision in nuclear power industry	01/2001 03/2005	Nuclear	VUJE Trnava	16.5/16.5
Development and preparation for integration of RODOS system for emergency planning and crisis management	06/2000 11/2004	Nuclear	VUJE Trnava	18/18
Controlled ageing and service life optimisation for VVER 440 NPP units	10/2002 12/2005	Nuclear	VUJE Trnava	106/53
Production power sources and energy conversion sources Energy	07/2003 12/2005	Energy	VUJE Trnava	84/45
TOTAL				**539.5/289.5**

Source: Ministry of Education.

- **Programme and Priorities**

  The energy R&D programme "Application of Progressive Principles of Production and Transformation of Energy" adopted for the period 2000-2005, covered ten tasks (see Table 9) focusing on three main fields; nuclear energy, fossil fuels and heat.

  For the period 2000-2005, total expenses amounted to SKK 539 million of which 54% (SKK 289 million) was covered by public co-funding (between 50% to 100% of total project cost). Expenses on nuclear R&D accounted for at least 60% of total energy R&D expenses and 55% of public co-funding. For the period 2003-2005, spending on fossil fuels and renewable energy programmes is planned at SKK 20 and SKK 41 million, respectively.

- **Nuclear R&D**

  Nuclear energy accounts for the largest portion of R&D activities and has focused on safety improvements and upgrade of existing NPPs. VUJE Trnava, a privately-owned nuclear research institute has been responsible for the implementation of these research programmes.

  Participation by Slovak organisations in the EU energy R&D co-operation programmes has been increasing, in particular in EURATOM and 5 and 6th R&D Framework Programme, and to a lesser extent in ALTENER and SAVE. The 5th R&D EU Framework programme (1999-2001) provided co-funding to energy projects worth SKK 339 million. The following programme granted SKK 220 million, in which the share of environment and sustainable energy systems was 16.7% of the total. For the period 2000-2005, Slovakia and EU contributed a total of SKK 100.5 million and SKK 44.5 million (€ 1.2 million), respectively.

Critique

The future of Slovakia as a small European country depends to a large extent on its ability to acquire new knowledge, and to apply it to products and services in competitive and challenging European and global markets. This implies a significant national effort in R&D and increased participation in international co-operation and programmes.

If the general co-ordination and focus of the R&D programme on energy has improved thanks to the joint action of the Ministry of Economy and the Academy of Sciences, the total volume of activities and scope have been

significantly reduced because of the continuous decrease in government co-funding. This has led to the dropping of various programmes and the dismantling of research teams.

In addition to resource constraints, the energy R&D programme does not appear to be sufficiently linked to the national energy policy, and it lacks diversification. Although the 2000 energy policy prioritised the use of clean fuels and renewable energy and improvement of energy efficiency, components of the programme in these fields remain limited (10% of total budget) and several projects were stopped (*e.g.* DSM in industry) or not developed. Experts were allocated to other tasks or left energy R&D for other sectors.

In contrast, nuclear R&D has concentrated over 60% of available resources over the last five years on the implementation of upgrades and safety improvements to existing nuclear plants. This share is well above the net contribution of nuclear energy (8%) to primary supply.

In synchronisation with the national energy policy and sectoral action plans, it is crucial to define an energy R&D strategy and action plan by targeting technologies that can help the country achieve specific goals- in particular improvement of energy efficiency and reduction of pollutant and CO_2 emissions. Effort on energy R&D should rely on a greater national R&D effort through a significant increase of government funding in order to reach an R&D level equivalent to 1.8% of GDP. This effort would be in harmony with the Lisbon Agenda and is necessary to achieve the medium-term benefits of better R&D.

The action plan for energy R&D should identify priority sectors and niches, and allocate for at least five year of governmental co-funding coherent with the programme's objectives and tasks. The cost effectiveness and results of each project should be monitored, possibly through an independent body.

On this basis, it is important to continue to develop partnerships between public and private organisations on the identified niche markets. This partnership together with adequate governmental co-funding should increase Slovak participation in international programmes, in particular those managed by the EU. At a later stage, the most advanced projects may consider link up with IEA R&D programmes among its 40 Implementing Agreements, as several CEEC countries have already done.

Recommendations

The government of the Slovak Republic should:

- Develop an energy R&D strategy by targeting those technologies that can help the country achieve its specific energy goals, in particular improvement of energy efficiency and reduction of CO_2 and pollutant emissions.
- Consider reversing the downward trend in government spending on energy R&D and bringing it more in line with other EU and IEA countries and ensuring its cost-effectiveness.
- Investigate private/public partnerships to ensure continued energy R&D efforts by energy companies in the competitive market.
- Enhance co-operation between institutions and examine advantages for greater participation in international energy R&D programmes such as these developed by the EU and the IEA.

PART II:
ENERGY SECTOR

OIL

Key Information and Data (2003)

- **Crude oil imports:** 5.6 Mt
- **Oil products:** refinery output (6.1 Mt), exports (3.3 Mt), imports (0.8 Mt)
- **Share of oil in TPES:** 17% (net trade), 30.7% (gross)
- **Consumption:** 3.5 Mt
  Road transport (59%), industry (28%), energy sector (22%)
  Diesel (28%), gasoline (17%), fuel oil (11%)
- **Unit consumption ratios:**
  0.60 t/cap. (OECD Europe: 1.3)
  0.13 t/GDP USD 1,000 (OECD Europe: 0.06)
- **Average retail prices in € (tax content in %, 2004):**
  Gasoline (95 RON): € 0.89 (60%)
  Diesel: € 0.86 (56%)
- **Market share of Slovnaft** in wholesale market (72%) and retail market (37%)
- **Car equipment** (252 per thousand people) and mileage: 9,000 km
- **CO_2 emissions:** oil refineries (2.8 Mt) and oil combustion (8.85 Mt; 2.8% of total) inc. road transport (4.9 Mt), industry (1.8 Mt) and energy sector (1.3 Mt)
- **Employment:** Slovnaft (3,100), Transpetrol (340), independent retailers (1,400); 15% of energy sector

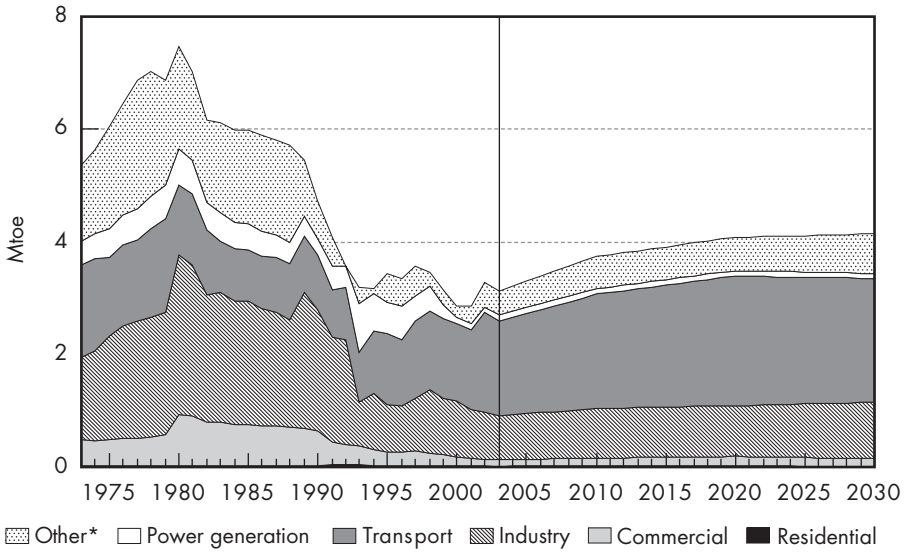
Slovnaft, a.s. (Slovnaft), the dominant Slovak oil company is the largest energy company in the country and the first to be fully privatised. While crude oil imports account for a significant share in total energy imports, the exports of oil products and transit of crude oil provide significant earnings. The development of transport by road has increased consumption of oil products by 68% since 1990.

Oil Demand: Transport Dominance

Oil accounts for 17% of the primary energy supply and 25.5% of total final consumption. The energy sector, mainly refineries and transformation (petrochemical) consumed 700 kt or 22% of total consumption in 2003. Total final domestic oil products consumption is at 2.78 Mt (2003), the same level as 1996. If the share of the petrochemicals in the total has decreased by 54% at 300 kt, transport's share has expanded to 59% at 1.6 Mt (+ 0.5 Mt) and industry's share has stabilised at 24% (760 kt).

Figure 16

Oil Supply by Sector, 1973 to 2030



** Includes other transformation and energy sector consumption.*

Sources: Energy Balances of OECD Countries, *IEA/OECD Paris, 2005 and country submission.*

Industrial consumption of oil declined due to economic and technical restructuring and fuel switching to natural gas. The consumption decline has been concentrated in the chemical industry. The rapid growth of the number of individual vehicles (1990: 160 per thousand people, 1998: 222 per thousand people; 2003: 252-EU 25: 454) and trucks (2.5 trucks/unit of GDP, 1998) has pushed consumption by the transport sector, which actually has been moderated by the relatively high price of fuels. This has encouraged the purchase of more efficient small and medium size vehicles and moderate mileage (9,000 km/year).

The breakdown between products reflects this sectoral transformation with the steady increase of automotive fuel use (+43% for gasoline at 669 kt in 2003 since 1990 and + 79% for diesel at 919 kt) at the expense of heavy fuel oil and fuel oil (-71% at 444 kt). Aviation fuel consumption is limited to 47 kt, but is growing fast (+80% since 2000) with the expansion of the Bratislava airport.

During the period 1995-2003, oil consumption intensity has decreased by 26% to 0.13 toe/USD 1,000 GDP 2000, which is 80% higher than the OECD

Europe average. The level of individual vehicle ownership is growing and should continue to converge towards the EU 15 average, with the increase of revenues (2000: 54,000 new registrations foreseen to increase by 57% before 2010[13]). Individual vehicles account for 40% of total passenger transport at the expense of public transport. Road transport has gained a dominant market share (70% for 47% in tonnage) of freight transport, while railways (20%) and water (10%) have been marginalised.

Oil Products Prices and Taxes

Since 1998, price of gasoline (RON 95) and diesel have increased by 66% and 34% to SKK 36 and SKK 34, respectively. During the same period, the inflation rate reached 56% (1998-2004). Pre-tax prices increased by 51% and 68% and tax (excise and VAT) by 78% and 17%, respectively. Taxes account for 61% and 53%, respectively.

Compared to other European OECD countries, gasoline and diesel prices in Slovakia are in the lower range (see Figures 17 and 18). Nevertheless, the lower incomes in Slovakia (vs. Western Europe) make fuels relatively more expensive (average 2004 using PPP: 95 RON: 1.7 €/l, diesel: € 1.6/l) than in Western Europe (Austria: € 0.85 and € 0.7) (see Table 1). In real terms, the price of fuels has increased 10 percentage points above the inflation rate over the last seven years, which is in line with the evolution of international oil market.

Industry Structure

Over the past decade, the Slovak oil industry has moved from state-owned monopolies and obsolete technologies to private international companies and modern infrastructures. The domestic market has been progressively integrated and opened to neighbouring markets.

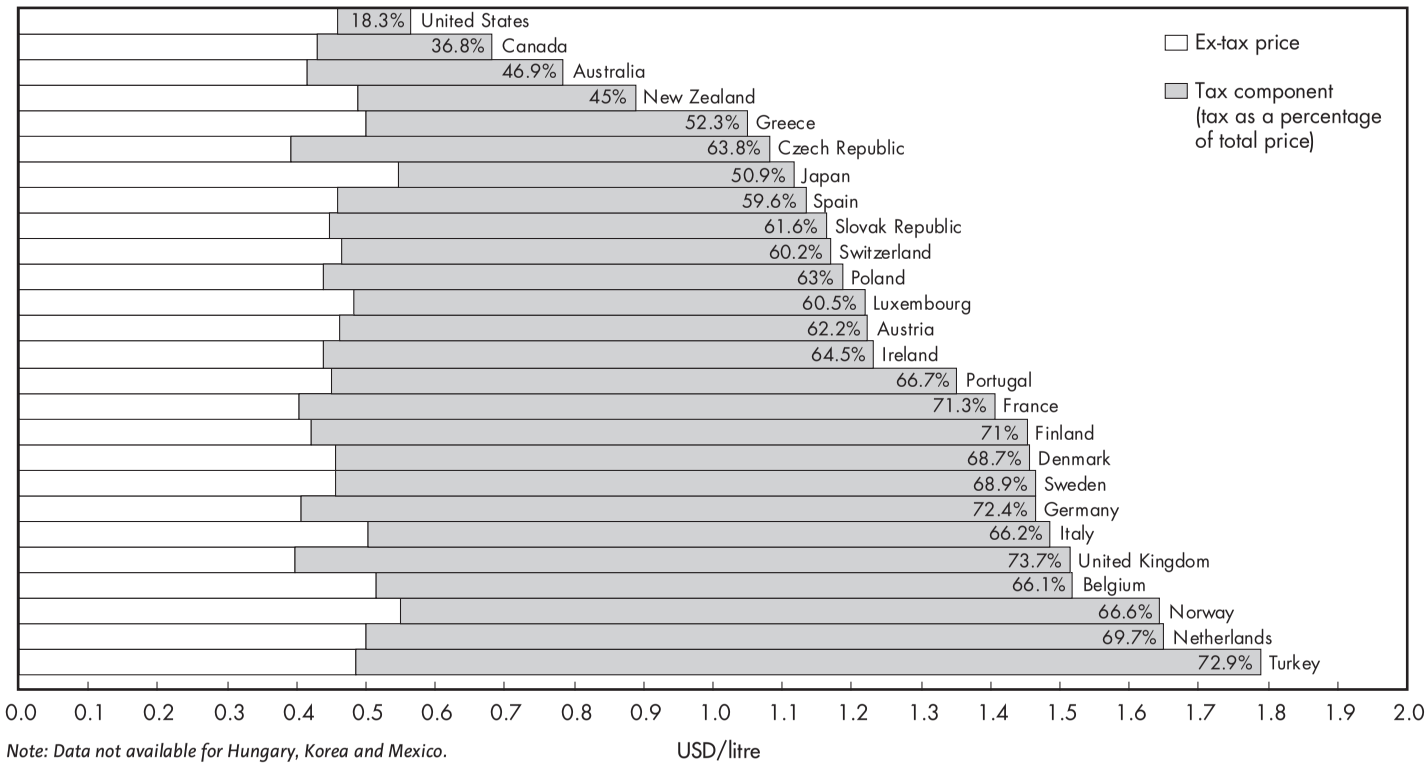
- **Crude Supply: Russian Imports Dominance**

Domestic oil reserves are estimated at 9 ml bl, mainly in the Western part of the country. Nafta Gbely, a company owned by SPP and EON/Ruhrgas, operates eight fields whose annual production of 50 kt or 2% of total supply is delivered to the Petrochema Dubová refinery.

13. *Source: Automotive Trends.*

Figure 17

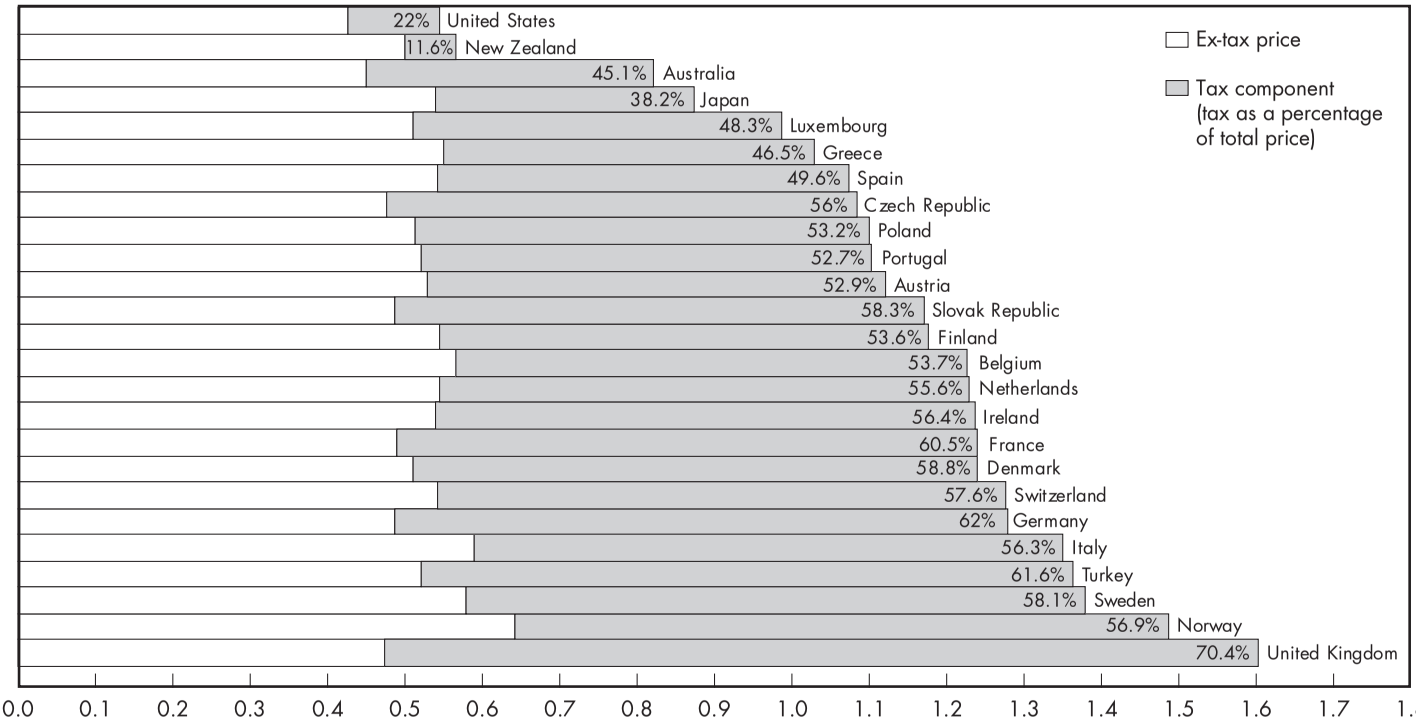
OECD Unleaded Gasoline Prices and Taxes, First Quarter 2005



Note: Data not available for Hungary, Korea and Mexico.
Source: Energy Prices and Taxes, *IEA/OECD Paris, 2005.*

Figure 18

OECD Automotive Diesel Prices and Taxes, First Quarter 2005



Note: data not available for Hungary, Korea and Mexico.

Source: Energy Prices and Taxes, *IEA/OECD Paris, 2005.*

Imports cover the remainder (5.66 Mt/y or 113 kbl/d in 2004) and are purchased from Russia on the basis of long- and short-term agreements. In one of the two existing long-term contracts, Lukoil replaced Yukos which defaulted in January 2005. The Slovak and Russian governments have signed an inter-governmental framework agreement until 2014.

- **Crude Transport: Druzbha Trunk Line**

Crude oil imports are delivered by the Transpetrol pipeline system which consists of two main pipelines. The most important is the Druzbha pipeline built in the 1960s. It starts at the Ukrainian border, delivering Russian Export Blend Crude Oil (0.6%-1.3% sulphur content) to the Slovnaft refinery before continuing to refineries in the Czech Republic. Its current capacity is 21 Mt/year. In the event of a supply disruption from Druzbha, the connection to the Adria pipeline may be the main alternative, for the import of crude from the Croatian port of Omišalj at a maximum capacity of 3.65 Mt/year.

- **Oil Refining**

The first oil refinery with 1.5 Mt/y capacity, called Apollo, was built near Bratislava at the beginning of the 20th century. It was rebuilt after the Second World War before being replaced in the 1950s by a new unit of 6 Mt/y, named Slovnaft.

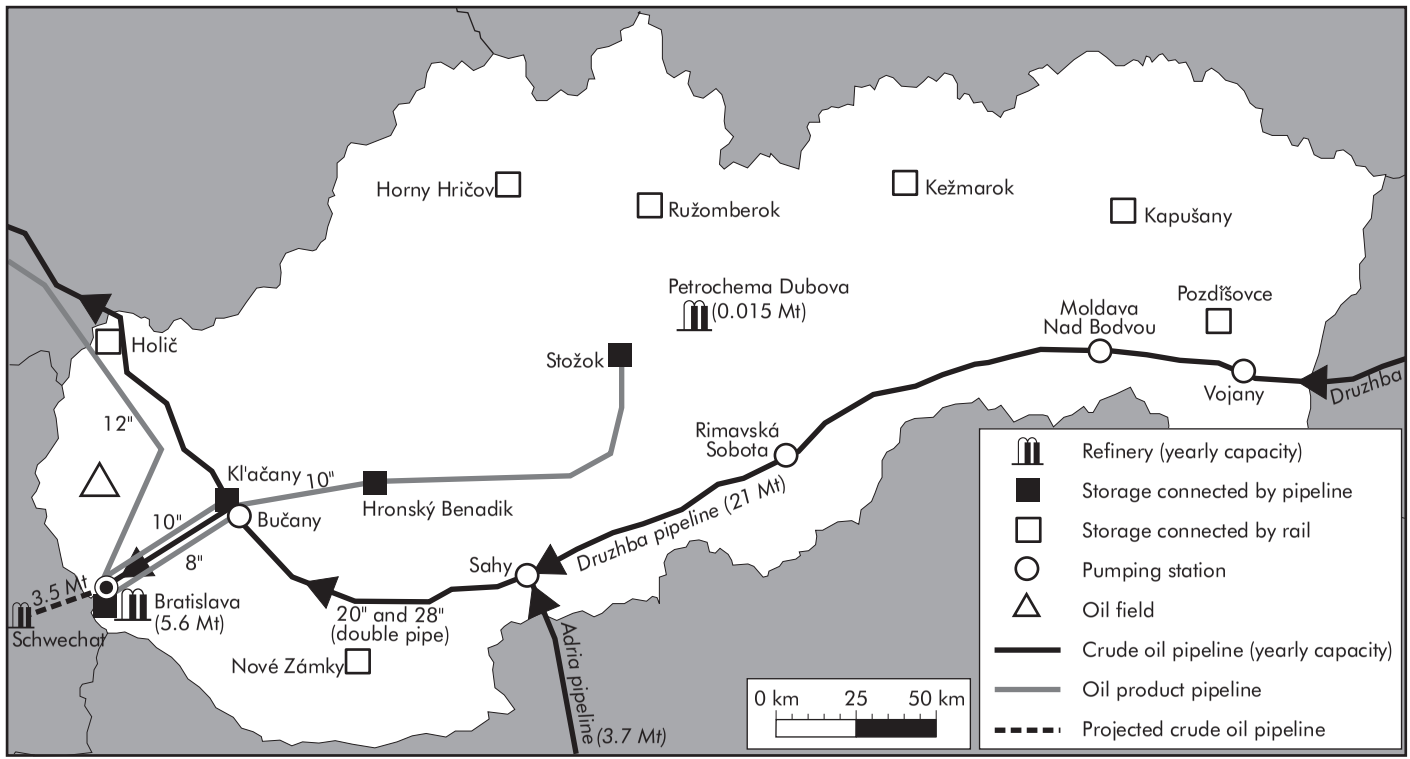
Slovnaft is the major domestic oil refining company, with additional petrochemical and retail activities. In 1995, the government sold 39% of Slovnaft's capital to Slovintegra, a company controlled by Slovnaft executives through a management buy-out. Between 2000 and 2003, MOL of Hungary, as a strategic investor, purchased this stake and others, including 10% sold by the NPF, to control 98.4% of Slovnaft. It was the first significant take-over by a strategic investor in the energy sector and the first to transfer control to a private investor.

Slovnaft is the largest energy company in Slovakia and one of the largest companies in the country in terms of turnover (SKK 67.6 billion, 86.1 in 2004) and tax contribution (10% of state revenues). It employs 3,100 staff of which 96% work in its Bratislava site headquarters and refinery. Since 2002 it has invested a total of SKK 22 billion.

Its unique Bratislava refinery has a capacity of 5.6 Mt of crude oil/year (115 kbl/d) and produces petrochemicals, automotive and jet fuels. The company has extensively modernised its refinery to improve the economic

Figure 19

Map of Oil Infrastructures



Source: IEA.

and environmental performance as well as the products delivered. In particular, the EFPA (Environmental Fuel Project Apollo) investment worth SKK 17.2 billion (1998-2001) included 17 interlinked light-products conversion and modernisation projects which increased the share of light products (automotive fuels) from 48% to 76%. After further significant investment, the refinery produces sulphur-free products only, thus complying with the EURO 4 & 5 quality fuel standards, including low-sulphur (10 ppm) diesel despite the lack of fiscal incentives. Refinery losses have been reduced to 2.6% of the total crude processed while the refinery's own consumption stands at 12%.

Compared to the initial production, total refinery output has increased by almost 25% at 6.6 Mt (2004) of which more that 54% is exported, accounting for 80% of revenues.

There is also a small independent oil refinery (150 kt/y) in Nemecká (Central Slovakia), built in 1938 and operated by Petrochema a.s. Dubová, which is owned by Alfa Trading s.r.o. It receives its crude by railway from Slovak and Czech oil fields and produces mainly petrochemicals and diesel and heating oil whose annual sales are below SKK 900 million, a mere 15,000 tonnes.

- **Alternative Fuels: Emerging Biofuel Programme**

In line with Directive 2003/30/EC on promotion of biofuels in transport, the objective is to reach a share of biofuels in domestic automotive fuels market of 2% by 2006 and of 5.75% by 2011. The Ministry of Economy and the Ministry of Agriculture have elaborated a biofuels development programme which foresees focusing on bioethanol and diester. New production capacities will have to be built or renovated. Slovnaft has already prepared facilities for blending.

The use of LPG and CNG as automotive fuels has been developed and account for 2% and 0.2% of automotive fuel consumption, respectively.

- **Storage Capacities**

Slovnaft and Transpetrol operate storage facilities of 310 kt and 430 kt capacity in total. The capacities for emergency reserves are 328 kt for oil products (ASMR 198 kt, Slovnaft 130 kt) and 206 kt for crude oil at Transpetrol.

Slovnaft operates 40,000 cm of commercial storage facilities in the country, and the privately owned and operated logistics facilities amount to 35,000-37,000 cm in 11 terminals.

Trade: Export Dominance and New Role for Imports

The Slovak oil refining industry exports 54% of its refinery output (80% in value), mainly to international oil companies operating in Central Europe. Automotive fuels account for 83% of exports. The Czech Republic is the top export market with 37%, followed by Austria, where sales of extra-low sulphur content diesel have increased. Since 1997, exports have grown to almost 60% at 3.3 Mt.

Since 1997, imports have developed and cover now 25% of the total wholesale market. They mainly originate from the Schwechat (Austria), Litvinov (Czech Republic), Plock (Poland) and Szazhalombatta (Hungary) refineries. The majority of imports are automotive fuels distributed in the retail networks of Slovnaft's competitors. Imports of products from neighbouring countries could directly supply the market and cover eventual deficits.

Oil Product Markets and Competition

The oil market in Slovakia is fully liberalised and there is no state ownership of any of the market players. The wholesale market covers the supply of industrial customers and filling stations. Slovnaft has a 70-72% market share in the Slovak wholesale automotive fuel market. The remainder is provided by imports.

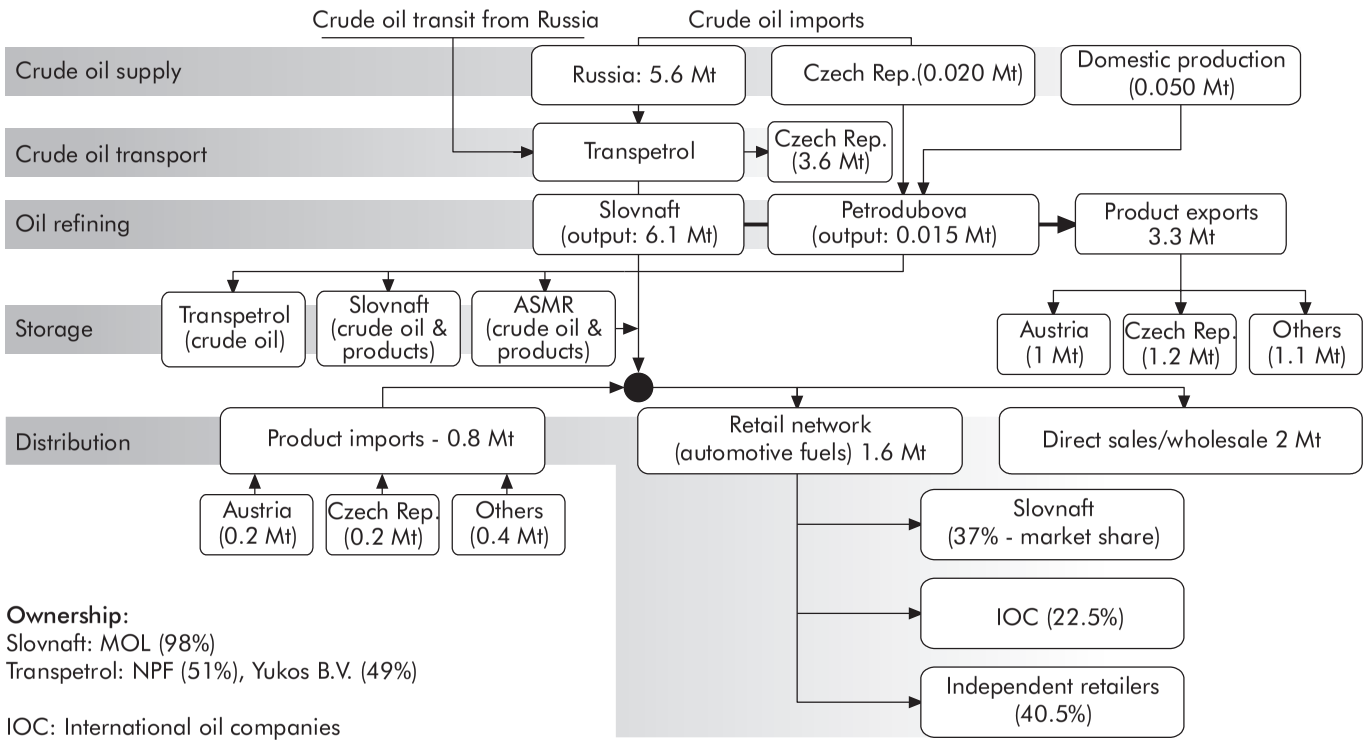
On the retail automotive fuel market, Slovnaft operates the largest retail network with 280 public filling stations in 2004 (see table below) for a market share of 37%. As a condition of the acquisition of Slovnaft by MOL in 2000, the Anti-Monopoly Office imposed on Slovnaft a maximum number of stations of 333 by 2005. The company also operates retail networks in the Czech Republic, Austria, Ukraine and Poland.

Multinational retailers, including SHELL, ESSO, OMV and AGIP, have in the second half of the 1990s developed new retail networks whose individual output is generally higher than of Slovnaft. Also smaller private independent retailers operate a large number of stations but with a declining market share (35%) despite a growing number of stations. Supermarket chains had plans to enter into the distribution of fuels from 2005. With increased competition and rationalisation, it is expected that the current number of stations (888), which appears relatively high for the size of the domestic market (1.6 Mt)[14] will be reduced in the coming years.

14. Czech consumption of automotive fuels: 5.5 Mt for 2,100 public stations.

Figure 20

Oil Flow Diagram, 2003



Ownership:
Slovnaft: MOL (98%)
Transpetrol: NPF (51%), Yukos B.V. (49%)

IOC: International oil companies

Source: IEA.

Table 10

Automotive Fuel Retail Networks, 2000 and 2004

Retail network	Number of filing stations		
	2002	2004	2004
Slovnaft	331	286	37
OMV	68	98	11
Shell		56	6.3
Aral	11	-	-
Avanti	34	-	-
MOL	17	-	-
Agip	14	15	1.7
ESSO	15	18	2
Conoco	12	13	1.5
Jurki	42	52	5.5
Independent retailers	270	350	35
TOTAL	**415**	**448**	**100**

Sources: SAPPO, Ministry of Economy and Slovnaft.

The Slovak Association of Petrol Industry and Trade (SAPPO) represents the eight largest retail companies (AGIP, ESSO, MOL, SHELL, OMV, Slovnaft, Conoco, Jurki), accounting for 80% of the sales in the retail market. The association co-operates on drafts of new legislation in order to support common requirements of members and monitors price development and consumption of automotive fuels.

● Public Enquiries

In November 2004, the Ministry of Finance launched an audit on Slovnaft prices, reviewing justified expenses to determine eventual unfair profit. In February 2005, the Ministry issued a fine of SKK 1.35 billion to Slovnaft on the basis of "unjustified expenses" for the years 2002 and 2003, unfair profits of 9.23% for 2004 by a company in a dominant position, and an error in the accounts. Slovnaft has appealed the decision indicating that the Ministry of Finance's calculations did not take into account expenses for environmental protection, modernisation of filling stations, and research and development, for a total amount to SKK 500 m for the period 2001-2003. In May 2005, the Ministry of Finance decided to suspend the fine and to review the case (in particular some of its original findings). The Ministry may consider price caps on retail fuels or profit ceilings. Slovnaft's appeal is pending.

The Anti-Monopoly Office has also launched an enquiry into possible abuse of a dominant position. Slovnaft has signed exclusive one-year contracts with independent retailers, private wholesalers, and end-users. The Anti-Monopoly Office continues its enquiry.

Crude Transit

Transpetrol is operating 515 km of pipelines for crude oil transit and national transport including the Slovak sections of the Druzbha pipeline (21 Mt/y capacity) and a branch to the Adria pipeline (3.68 Mt/y capacity), as well as storage. The Adria branch is used only occasionally to deliver Russian crude to Hungary, Croatia and Serbia or in a reversed direction from Hungary to Slovakia.

In 2002, Yukos acquired 49% of the shares of Transpetrol and management control for SKK 2.3 billion. The State keeps a 51% ownership. In 2003, the company's total turnover increased to SKK 1.6 billion with 430 employees. The volume of oil transported increased by 5% to 9.9 Mt of which 55% delivered to Slovnaft and 36% to Ceska rafinerska, the Czech refiner.

Despite the dismantling of Yukos in Russia, which led to an interruption of supplies to Slovakia, Yukos management declared its intention to keep its stake in Transpetrol. However, the Slovak and Russian governments discussed the possibility of transferring this ownership to another Russian oil company, the fast-growing Russneft, which has been acquiring other Yukos assets, and partner of the trading company Glencore. In February 2006, Russneft acquired Yukos B.V's shares for SKK 3.2 bn and requested approval by the Anti-Monopoly Office and the Ministry of Economy.

Transpetrol has been evaluating several new transit projects:

- Ukrainian-Czech section of the Druzhba mainline: an investment of USD 10 million over a period of two years could increase the capacity up to 24 Mt/y.
- Druzbha-Adria pipeline connection: this pipeline would transport Russian crude oil to the port of Omišalj in Croatia. Five countries signed a transit agreement for initial volumes of 3.5 Mt per year. Transpetrol investment of USD 4.5 million would bring the pipeline capacity after two years to 10 Mt/year. However, at this stage, the flow-reversal scheme has not received the requested authorisations, in particular that of an Environmental Impact Assessment (EIA) in Croatia. The dismantling of Yukos, the main promoter of the project, has delayed commercial agreements. There is no date for completion.
- The Bratislava-Schwechat pipeline with a 3.5 Mt/y capacity at a cost of € 35 m (SKK 1.4 billion), would transport Russian crude oil to the OMV

refinery at Schwechat. Construction of the 60 km line could start in 2007 if the project were in compliance with environmental requirements outlined by the Slovak Ministry of the Environment on the section across a natural area supplying drinking water to Bratislava. A long-term supply agreement also needs to be signed. Used with a reversal of flows, this new pipeline, which would be operated jointly by Transpetrol and OMV, could also supply non-Russian crude to Slovnaft.

- Extension of the Odessa-Brody pipeline: the proposed project to transit Caspian oil would require significant investment (USD 65 million) and is not economically feasible. Furthermore, the Odessa-Brody is currently used in reverse to export Russian oil from Odessa. The newly elected Ukrainian government announced its decision in October 2005 to use the pipeline as originally planned, but it is unclear from which date and to which markets.

Critique

In less than a decade, the Slovak oil sector has been transformed and modernised, complying now with the latest international standards in terms of process and quality of products. The oil market is at the most advanced reform stage and provides significant customer choice. Transport and storage infrastructure have also been upgraded and expanded to comply with the new environmental and market requirements.

The modernisation of the refining and retail sectors is the result of the successful partnership of Slovnaft with a strategic investor. The new strategy and large investments have driven a new dynamic and improved the performance of the company in the Slovak and Central European oil product markets. Slovnaft is now a player integrated in the MOL Group, which has promoted a regional strategy of internal and external development. With the Polish PKN Orlen, the other significant majority private player in Central Europe, the MOL Group constitutes a solid regional player, able to create value and to counterbalance dependence on a unique oil supply source and provide an alternative to the expansionary commercial strategies of Russian and international oil companies.

Taxation has been aligned to international levels, bringing prices up to the lower range of OECD Europe. In real terms, since 1998 the prices of automotive fuels have been increasing moderately (below + 1.5% per year since 1998) but account for a larger share in customer revenues. As in other OECD countries, taxes on diesel are lower than for gasoline although the combustion of diesel (without catalytic filter) emits more pollutants than gasoline. This distortion should be removed by aligning the taxes on diesel

fuel with gasoline, allowing for the fact that diesel engines consume less and emit less CO_2 than gasoline engines.

In parallel, the domestic market has been opened to imports and retail competition, attracting new players investing in new networks. This competition has enhanced the quality of products, in compliance with EURO 4/5 standards, and quality of services.

These achievements in the oil sector appear even more impressive as they contrast with previous years of stagnation, weak strategies and unclear commercial practices until 2000, when MOL, as strategic investor took over Slovnaft. Nevertheless, the rapid success of privatisation of vertically integrated and dominant companies should not obscure competition and supply security issues.

Slovnaft dominates oil refining in the country and owns and operates the largest storage and retail network, as it bought the former state owned retail network, Benzinol, in 1995. Nevertheless, the combined liberalisation of trade and retail has introduced competition to the wholesale and retail markets. Its refining capacities, designed well before the changes occurred in the 1990s, largely exceed the needs of the relatively small Slovak market. Thus, the company is a natural exporter and regional player, making more than half of its turnover on foreign markets.

The initial competitive advantages of the company on the domestic market have been reinforced by the modernisation of production and integration of a dense retail network. Thus, Slovnaft dominates the wholesale market with almost 75% market share and is the leading retailer with 37% of automotive fuel sales.

The effects on competition related to Slovnaft's vertical integration and its competitive advantages on the fuel market in the first years as a privatised company have been monitored by the Ministry of Finance until March 2005. Since then, the Antimonopoly Office has also acquired responsibility for pricing and competition, which need to be monitored more closely.

In this context, the 2004 Ministry of Finance's price audit determined that Slovnaft claimed unjustified expenses and gained unfair profits. A fine equal to 1.6% of turnover (11% of profit) was imposed on the company and then suspended. The Ministry based its initial decision on the Prices Act, which stipulates that the profit of a company in a dominant position should be based on economically justified expenses. It also indicated that Slovnaft had reduced its prices in the Czech market, where it faces tougher competition, while raising prices on the Slovak market.

Slovnaft has argued that there is no existing justified price regulation and that the Slovak market is fully competitive. It has also indicated that 60% of its profits are generated from exports and are below the international average of 13% (*e.g.* Polish PKN Orlen at 14%).

Slovnaft has also argued that the Ministry of Finance has not provided evidence of its dominant position. So the ongoing Anti-Monopoly Office investigation might clarify the situation. Preliminary elements indicate, as with other countries in the region such as Poland, that the main refiner and retailer is a market-maker in prices owing to its size and commercial vertical integration. It has control of key storage and logistics assets and exclusive contracts with independent retailers.

The limitation of exclusive supply contracts with retailers and end-users and fair access to logistics, are required to enhance competition and attract new players such as supermarkets. This market pressure would continue to promote restructuring of the retail market, reducing the number of small stations and increasing productivity, notably in the Slovnaft network. The authorities should pay attention that this concentration does not reduce customer choice, especially in rural areas. However, regulation on price control should be avoided as it is detrimental to effective competition.

Another impact of the privatisation process has been the presence of upstream interests in downstream, since Yukos, the main supplier of Slovnaft (60%) also became co-owner and operator of Transpetrol, the supply pipelines' operator. If it has reinforced links, it has also increased dependency on one supplier. The sudden fiscal enquiry and bankruptcy of Yukos have fragilised the crude supply situation of Slovnaft as well as that of Transpetrol as Yukos is the reference owner of Transpetrol.

The transfer of long-term contracts to Lukoil which in contrast to Yukos is involved downstream mainly in retail market and in partnership with Gazprom, has raised possible competition issues not only with Slovnaft but also with the Czech Unipetrol. It has also reinforced hydrocarbon import dependency on a single group linked to Gazprom, the dominant gas supplier. This would be further reinforced if Yukos' shares in Transpetrol are transferred to another Russian energy company active in the downstream and/or gas.

In this context and to avoid downstream conflict of interest with domestic and regional markets as well as reinforced dependence on a supplier, a new international and open tender for Transpetrol stake should provide conditions to attract independent investors with a long-term perspective for the company.

The development of biofuels can contribute to enhance the diversification of supply. The governmental plan sets objectives and priorities which should be

endorsed by private investors in order to effectively develop a biofuel production chain. The government should at the same time provide adequate fiscal incentives in relation to environmental benefits and ensure its competitiveness in the medium term.

Transpetrol has efficiently ensured the transport of transit of crude oil, mainly to the Czech Republic as well as preparing several additional transit projects confirming the crucial role of Slovakia in energy transit. The government should ensure that Transpetrol continues to develop new projects only with firm and confirmed commercial interests in compliance with international standards, notably environmental. Only viable and sustainable projects able to cover investment and maintenance expenses as well externalities will bring value to the country and avoid subsidies to transit.

The most advanced project is the pipeline extension to Schwechat, which should materialise if these conditions are fulfilled. The extension of the Druzbha pipeline does not appear as a priority as significant spare capacity exists (10-11 Mt or 48%-55% of total capacity). This free capacity would be enough to transit oil for the new transit projects, DruzhbAdria (3.5 Mt) and Bratislava-Schwechat (3.5 Mt), when they come into being. Prospects for Caspian oil from Odessa-Brody appear more distant as this pipeline is currently used in the other direction. Demand remains limited to one Czech refinery and current plans are to extend the pipeline from Brody to the Plock refinery in Poland then to Gdansk on the Baltic and even to Germany if oil producers and refiners' interests materialise.

Recommendations

The government of the Slovak Republic should:

- Ensure effective wholesale and retail oil product competition through open trade, access to new entrants and active monitoring of competitive conditions, based on liberal legislation and using market tools by an independent and empowered agency (Anti-Monopoly Office); price regulation should be avoided.
- Ensure fair access to oil terminals to all market players.
- Continue enhancement of fuel quality and modernisation of transport, refining and retail facilities in compliance with international standards.
- In line with the objectives, promote sufficient demand for biofuels to stimulate increased investment in production facilities.
- Ensure that the ownership and operation of oil transit does not conflict with supply diversification, market competition and its sustainability.

COAL

Key Information and Data (2003)

- **Consumption:** 9 Mt (4.55 Mtoe)
  Energy sector (43%), coke plants (21%), industry (24%), others/residential (2%)
  Steam coal (2 Mt), coking coal (2.8 Mt), lignite (4.1 Mt)
- **Share in:**
  TPES: 24.6% (OECD Europe: 17.7%)
  Net generation: 20.5% (OECD Europe: 29%) and heat: 21.5%
- **Reserves:** 100 Mt (lignite)
- **Production:** 3.1 Mt (lignite) of which from underground mines: 100%
- **Imports:** hard coal (4.7 Mt) of which coking coal (60%), lignite (1 Mt)
- **Direct subsidies:** SKK 120 m (€ 3 m)
- **CO_2 emissions from coal combustion:** 17 Mt (43.9% of total) inc. electricity and heat generation (7.1 Mt), industry (5.1 Mt) and other energy sector (3.2 Mt)
- **Employment:** mining (6,500; 2004: 5,070)

Solid fuels account for 24.6% of TPES, down from 29% in 1996; however they continue to be an important component (above 20%) of the power and heat mix. Imported coal, mainly hard coal, makes up 80% of total supply. Domestic lignite is the only major fuel produced in the country but its production is falling.

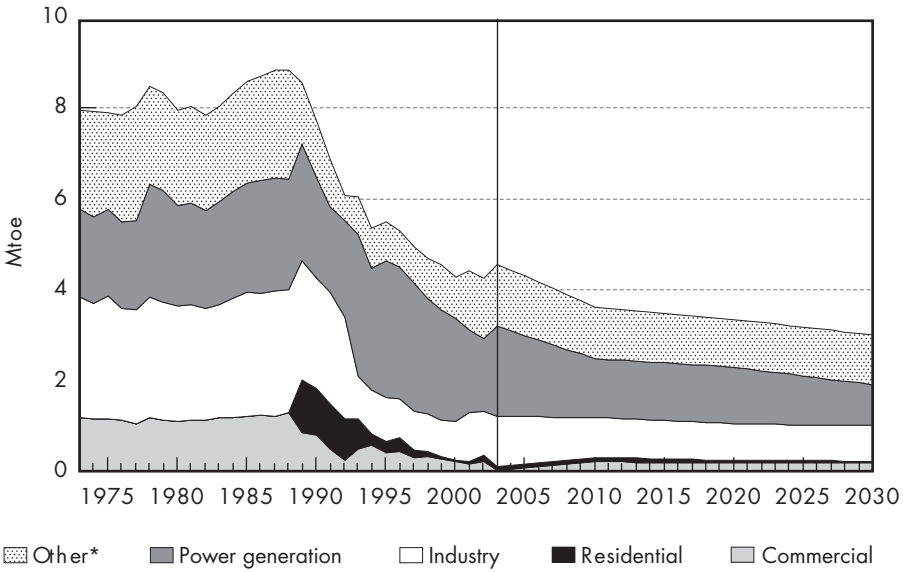
Market Features: Concentration and Decline

The coal market is largely concentrated in terms of consuming sectors and companies. In 2003, hard coal (4.9 Mt or 3 Mtoe) accounted for 80% (on an energy basis) of total coal consumption; lignite represented only 20%.

Power and heat generation are the largest coal consuming sectors with 4 Mt (2 Mtoe), which account for 20% and 22% of their output, respectively. Steam coal and lignite are principally consumed by the large units of SE (1,182 MW, 17.2% of the total power production) and by district heating plants. In 2003, coal-fired and lignite power plants generated 0.5 TWh and 0.9 TWh, respectively (1.7% and 3% of total generation). There is a project to build a new lignite-fired plant in Novaky (280 MW) proposed by Advanced Power,

Figure 21

Coal Supply by Sector, 1973 to 2030



* Includes other transformation sector and energy sector consumption.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2005 and country submission.

but no decision has been taken. Coal-fired and lignite CHPs produced 3.5 TWh and 1.5 TWh (12% and 5% of total).

Hard coal and lignite consumption decreased by 4.2% and 48.1%, respectively since 1996. The planned closure of several major power and heat generation units from 2005, producing 900 MW, for environmental or economic reasons, will further reduce coal and lignite consumption.

Compliance with SO_2 and NO_x emission limits for EU Large Combustion Plants (LCP) and Integrated Pollution Prevention and Control (IPPC) directives is the main environmental requirement for coal-burning units. Flue gas desulphurization (FGD) for SO_2 control was installed in some SE power units in Vojany and Novaky, where there is also a Fluid Bed Combustion (FBC) unit.

Steel, iron and non-ferrous metallurgical industries are the main direct users of steam and coking coal. Significant quantities of coal, mainly lignite (1 Mt in 2003), continue to be burnt by the residential and service sectors, especially in areas outside the gas network creating indoor and outdoor pollution problems.

Supply: Hard Coal Import Dominance

- **Lignite Production**

  Lignite, which is the only significant domestic fossil fuel, has been mined since the 18th century but industrially only since 20th century. Proven reserves, estimated at 100 Mt, have a low calorific value (10-17 GJ/t) and high sulphur content (1% to 2.5%). Sized lignite, with a calorific value of 16 GJ/t, is supplied to the residential sector, whilst the remaining production, mainly coal fines with an average calorific value of 10.5 GJ/t, is supplied to power plants.

  In 2004, the extraction of lignite decreased by 6.5% to 2.9 Mt accounting for less than 20% of coal supplies and 5% of TPES. Employment has decreased to 5,070 in regions that have high unemployment rates. Productivity has risen from 380 t/miner/year in 1996 to 671 t/miner/year in 2004 (see table below), but the economic and environmental burdens remain heavy.

  The rest of the lignite industry is composed of three different underground mining complexes.

  In Central Slovakia, the mining complex Hornonitrianske bane Prievidza, a.s. (HBP) is the largest lignite producer with 2.4 Mt in 2004, or 83% of total lignite production. Employment in the three mines operating dropped to 4,650, or a fall of 41% since 1996, while production dropped by 20%, indicating an increase of productivity. The nearby SE-owned Novaky A power plant buys 85% of the mine output. The rest is sold to district heating plants and on the retail market. The mine's management and employees now own 97% of HBP after National Property Fund (NPF) sold its remaining stake.

  The mine of Baňa Záhorie, located near the Western town of Holíč , produced 0.30 Mt in 2004 with staff of 320. Production and staff levels have been stable since 1996, but new extraction equipment has been installed, increasing productivity (by 122%). A nearby CHP plant and the Novaky power plant are the main buyers. The NPF sold its stake in the company, which is now owned 51% by its managers and employees and 13.5% by HBP (with the rest by individual owners).

  The mine Baňa Dolina in Southern Slovakia has been phased out since 2002. In 2004, its production shrunk to 0.22 Mt, with 380 employees compared to 0.6 Mt and 680 workers in 2001. After the first stage of downsizing, the government decided to maintain production at 0.26 Mt while meeting environmental, social and legal obligations. The mine receives subsidies for decommissioning and for redundant employees (see below). The employees own 63% of the company's capital.

Table 11

Lignite Production Sector, 2004

Mine/Company	Ownership	Production (Mt)	Employees	Production cost (SKK/t)	Productivity (t/empl./y)	Markets
Hornonitrianske BanePrievidza (HBP)	Employees: 97%	2.4	4,650	950	525	Power, heat and retail
Baňa Záhorie	Employees: 51% HBP: 13.5% Others (35.5%)	0.29	320	790	910	Power and heat
Baňa Dolina	Employees: 63% ORSIA: 33.8%	0.22	380	850	579	Power
TOTAL (average)		**2.91**	**5,070**	**(925)**	**(671)**	

Source: Ministry of Economy.

- **Coal Imports**

  All hard coal is imported and covers 80% of coal supply. Steam coal is imported from the Czech Republic, Russia, Ukraine and Poland, and is largely used for power generation in SE power plants, mainly Vojany. The US Steel factory in Kosice is the major importer of coking coal (2.8 Mt), mainly from the Czech Republic, Russia and Poland.

  Around 1 Mt of lignite is imported from the Czech Republic for the Novaky power plants, covering 20% of lignite consumption.

  Imports are liberalised as licences are issued automatically without quotas. Russian imports contribute to reimbursing outstanding Russian debt.

Costs and Prices

Domestic lignite production costs are high (925 SKK /t) because mining is underground and faces geological difficulties. HBP mine has the highest cost of production at 950 SKK/t, which is 21% higher than the imported Czech lignite extracted from open-cast mines.

Hard coal import prices track world coal prices at around 40 USD/t for steam coal and 60 USD/t for coking coal in 2003.

Coal prices have been liberalised and generally based on long-term supply contracts. SE contracts with the domestic lignite mines have been guaranteed for a minimum period in the privatisation contract of SE.

Coal Policy and Subsidies

The government's coal policy values domestic lignite production in terms of security of energy supply and provision of employment in regions plagued by high unemployment. It has continuously restructured remaining lignite mines in accordance with EU rules, leading to their modernisation and acquisition by the employees. The Ministry of Economy's White Paper on Coal (2004) anticipated a lignite production for 2010 of 2.65 Mt, of which 2.3 Mt is produced by HBP and 0.3 Mt by Baňa Záhorie. Extraction at Baňa Dolina mine is due to stop in 2007.

Direct state subsidies for sized residential lignite (up to 35% of total price) stopped in 2003. Remaining subsidies are provided exclusively for the phasing-out of the Baňa Dolina mine in accordance with EU regulation (1407/2002/EC). They decreased by 30% between 2001 and 2003 at SKK 120 million (or SKK 52/t). In March 2005, the EC agreed to exempt HBP from the payment of fines of SKK 14 m for delays in paying social contributions. In January 2006, it also authorised a public aid of SKK 525 million for HBP's investment for the period 2005-2010.

Lignite mines also receive indirect subsidies from buyers, notably SE, which have agreed to purchase domestic lignite at a price higher than Czech imports.

Critique

Economic reforms, restructuring and environmental regulation have reduced coal consumption in the energy sector. This trend is expected to accelerate in the next five years with the gradual enforcement of EU environmental emission standards and climate change policies, notably the ETS. The high carbon intensity and pollutant content of coal, notably lignite is a manifest burden.

The lignite policy aims at ensuring economic equilibrium for the sector, and highlights its contribution to energy security and employment. However, the contribution of domestic lignite in terms of security of supply appears limited (6% of total electricity). Furthermore, electricity supply relies on large existing domestic overcapacity and substantial import capacities (see chapter on electricity). The role of lignite is expected to decrease further due to the planned closure of coal fired power and heat units by 2010. Coal consumption by the residential and service sectors, which accounts for a marginal share of their heating needs, is also expected to decline with housing modernisation.

The direct subsidies for the phasing-out of the Baňa Dolina mine have been modest and will continue at least until its closure in 2007. The costs of underground mining of lignite are higher than Czech imports, however. The question is whether the underground mining of lignite can be economically viable. Furthermore, the reduction of lignite consumption from 2005, in particular by the Novaky power plant, may generate an oversupply of lignite, creating additional problems for the two distant and smaller mines. It is important to continue the phasing out of uneconomic mines and provide sufficient social compensations and professional training for employees who may go to sectors in expansion. These sectors include biomass, which can partially replace coal in power and heat plants. SE has studied this option, already developed notably in Hungary, for unit A of Novaky.

The indirect subsidies paid by SE to the domestic mines, by purchasing their production at higher prices instead of cheaper imports, distort competition between suppliers and fuels. The new majority owner of SE may ask for a renegotiation of these contracts after the expiry of its contractual obligations.

Imports provide the bulk of coal supply, outlining the need to maintain the geographical diversification of supply and competitive purchase conditions. Hard coal consumption will depend on the steel market, which is apparently driven by the new car manufacturing plants. Compliance with EU environmental standards for the use of coal, especially in power and heat plants, and coking plants, is expected to be of increasing importance.

Overall, under increasing regulatory and economic constraints and inter-fuel competition, the sustainability and future of coal use and lignite production in Slovakia call for further adaptations and the investment in cleaner technologies.

Recommendations

The government of the Slovak Republic should:

- Continue sector restructuring and closure of non-economical mines in compliance with EU competition, social and environmental rules.
- Allocate adequate support for the employees during the mine closure process and explore alternatives such as natural gas and biomass conversion of power and heat plants.
- Ensure that imports can compete on a fair basis.
- Ensure that large to medium-size coal users comply with the EU and domestic environmental standards.

NATURAL GAS

Key Information and Data (2003)

- **Total consumption:** 6.9 bcm (4.1 Mtoe): residential (29%), industry (25%), power and heat generation (24.5%)
- **Share in:**
  TPES: 32% (OECD Europe: 22.7%); TFC: 35% (OECD Europe: 22.7%)
  Generation: 8% (OECD Europe: 17.4%) and heat: 74%
- **Gas reserves:** 15 bcm; production: 0.2 bcm
- **Imports:** Russia (6.8 bcm, 98% of supply)
- **Gas network coverage:** 93% of population
- **Prices €/cm** (2000-2005 evolution, tax content):
  Industry: 0.19 (+ 125%; 0%)
  Residential: 0.21 (+ 140%; 16%)
- **Declared market opening** (in % of total sales): 33% (since 2004);
  effective switching rate: 0%
- **Transit volumes:** 68 bcm (2004: 78 bcm)
- **CO_2 emissions from gas combustion:** 12.7 Mt (32.9% of total) inc. residential (3.7 Mt), industry (3.3 Mt) and electricity and heat generation (2.7 Mt)
- **Employment:** SPP (5,500), Nafta Gbely (663)

Slovakia's extensive gas distribution network covers most of the country and ensures a major transit role for Europe. Natural gas has the largest share in the energy mix. SPP, the gas company, is the second largest energy company in the country.

Demand and Supply Balance

Demand

In 2003, primary consumption of gas was 7.1 bcm, accounting for 32% of TPES. It decreased in 2004 by 8.5% as the result of continuous price increases, which have encouraged energy efficiency improvements.

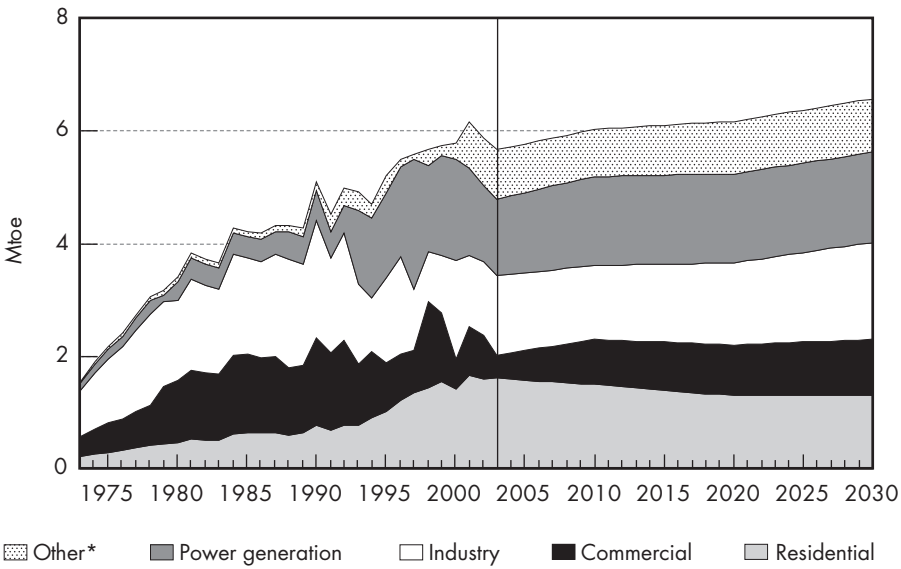
The use of gas in the energy sector is at a level similar to the OECD Europe average (60%) but much lower for Slovak power generation, which is predominately nuclear. PPC, the sole gas-fired combined cycle plant, accounts for only 4% of total electricity generation. In contrast, gas is the most used fuel (74%) for heat generation in CHP units and district heating boilers with a total

consumption of 1.5 bcm or 23% of total consumption. Gas is also used in oil refining (0.20 bcm) and transport of gas (0.57 bcm) (see table below).

Thanks to a gas network covering 76% of municipalities and 93% of the population, gas accounts for 35% of TFC. It is consumed mainly by residential (2 bcm, or 28.5% of TFC and accounting for 57% of total residential energy consumption), industrial customers (1.7 bcm, 24%) and commercial and public users (0.4 bcm). The largest consumers are the fertiliser plant Duslo Šala, U.S. Steel Košice and SPP for gas transit and transmission.

Figure 22

Natural Gas Supply by Sector, 1973 to 2030



** Includes other transformation and energy sector consumption and transport.*

Sources: Energy Balances of OECD Countries, *IEA/OECD Paris, 2005 and country submission.*

Almost three-quarters of the gas is used for heating. In addition, the use of compressed natural gas (CNG) has been developed, mainly for urban buses but the distribution network remains limited.

Due to the pricing policy developed since 2001 by the government and subsequently the regulator, demand for gas is expected to increase moderately over the next ten years.

Table 12

Natural Gas Demand, 1995 to 2003 and Forecast 2010 (in bcm)

	1995	2000	2003	Forecast 2010
Energy sector/Transformation	2.65	2.85	2.45	2
Oil refining	0.15	0.15	0.20	
Power generation inc. CHP	0.4	0.6	0.85	
Heat generation	1.5	1.6	0.85	
Gas transport	0.6	0.50	0.55	
Final sectors/final consumption	3.9	4.3	4.45	
Industry	1.9	2.0	1.75	2.4
Inc. fertiliser (non-energy use)	N/A	N/A	0.6	
Residential	1.3	1.7	2	2
Services	0.5	0.5	0.4	0.5
Other (inc. losses)	0.2	0.1	0.3	
TOTAL CONSUMPTION	**6.55**	**7.15**	**6.9**	**6.9**

Sources: Country submission and IEA estimates.

Owing to the dominant role of heating in consumption, gas demand jumps in the colder months, peaking at 46.5 mcm/day (monthly consumption in January 2002: 1.1 bcm).

Forecasts for 2010 indicate a total consumption to 6.9 bcm and 7 bcm for 2020, maintaining the share of gas in TPES at 30-33% for both horizons.

• Supply

SPP ensures the negotiation of supply contracts. Domestic gas reserves and production by Nafta Gbely from two fields located in the Western and Eastern parts of the country are marginal, with 0.2 bcm or 2% of supply in 2003.

Imports cover 98% of the total supplied. Up to 2004, Gazprom in Russia was the only supplier through a long-term "take or pay" contract (6.8 bcm in 2003, 5 bcm in 2004), signed in 1997, valid until 2008 between SPP and Gazexport, an affiliate of Gazprom.

SPP also signed short-term contracts to cover peak load with Slovrusgas (a Slovak 50/50 joint venture between SPP and Gazprom). Slovrusgas has been in liquidation since early 2005.

Alternative supplies from Norway or the Netherlands were considered in the second half of the 1990s but did not materialise. Since 2003, the gas hub of Baumgarten at the Slovak-Austrian border has developed gas trading, including Norwegian gas. In the medium term, it may receive new supplies from the Caspian region and the Middle East possibly through the Nabucco project or LNG from the Adriatic.

In 2004, the country received 1.9 bcm of gas (27% of supply) from Turkmenistan via Russia and Ukraine and presumably delivered to Slovrusgaz by Eural Trans Gas (ETG), an offshore trading company created in 2002 in Hungary.

Industry Structure and Ownership

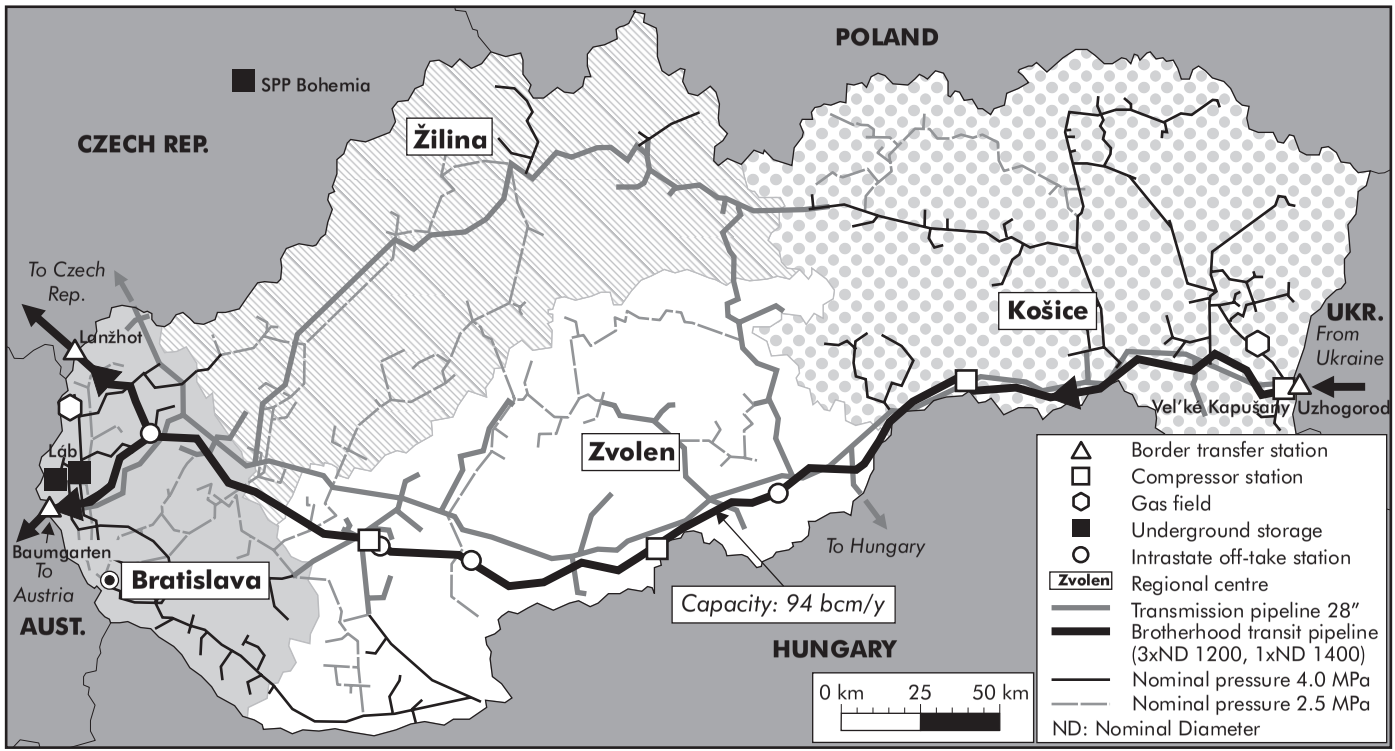
Slovensky Plynarensky Priemysel (SPP) was created in 1990 as a state-owned monopoly integrating most of the functions of the gas sector. SPP has become a joint stock company (SPP, a.s.) in 2002. It directly supplies, transports and distributes gas for domestic and foreign clients. SPP's subsidiaries are in charge of domestic production and storage.

With the gasification of the country and the development of gas transit, SPP has grown and is now one of the pillars of the Slovak energy sector. Its revenues increased to SKK 80.7 billion in 2004 for a net profit of SKK 21.6 billion (a 26.7% return), thus accounting for a major share of State revenues through taxes, dividends and occasional exceptional contributions to the State budget.

Since 2004, SPP has embarked on a major company restructuring and has established three major divisions; trade, transmission network and distribution. This helped reduce operating costs by 7% between 2002 and 2004. The next step will result in a legal unbundling of two activities through the creation of two separate companies, SPP Transmission and SPP Distribution, both 100% SPP-owned, due in July 2006. The transmission assets will remain owned by SPP itself. The Gas Directive also requests accounting and functional (independent organisation and decision-making) unbundling of transmission system operator (TSO) and distribution system operator (DSO) (with some exemptions possible for distribution).

Figure 23

Map of Natural Gas Infrastructures



Sources: IEA and SPP.

- **Transmission and Distribution**

The Distribution Division of SPP owns and operates domestic transmission and distribution networks as well as dispatching functions.

The length of the distribution network is 30,500 km, supplying 1.44 million clients, making Slovakia one of the more gasified countries in the EU with 93% of the population covered. Since 2000, the network has become more dense with additional 3,600 km of pipes. In some areas, the distribution network needs to be completed. The total maximum capacities in the country of the transmission and distribution grids are 315 mcm/day and 50 mcm/day, respectively. Distribution losses are estimated at 2% of distributed gas.

- **Storage**

Total gas storage capacity for the requirements of Slovakia amount to 2.1 bcm and are ensured by Nafta Gbely (1.2 bcm) and Pozagas (0.3 bcm), respectively owned by SPP/E.ON-Ruhrgas, and SPP/Gaz de France (see Figure 24). SPP and E.ON-Ruhrgas also hold SPP Bohemia (0.6 bcm), which operates a gas storage facility in the Czech Republic.

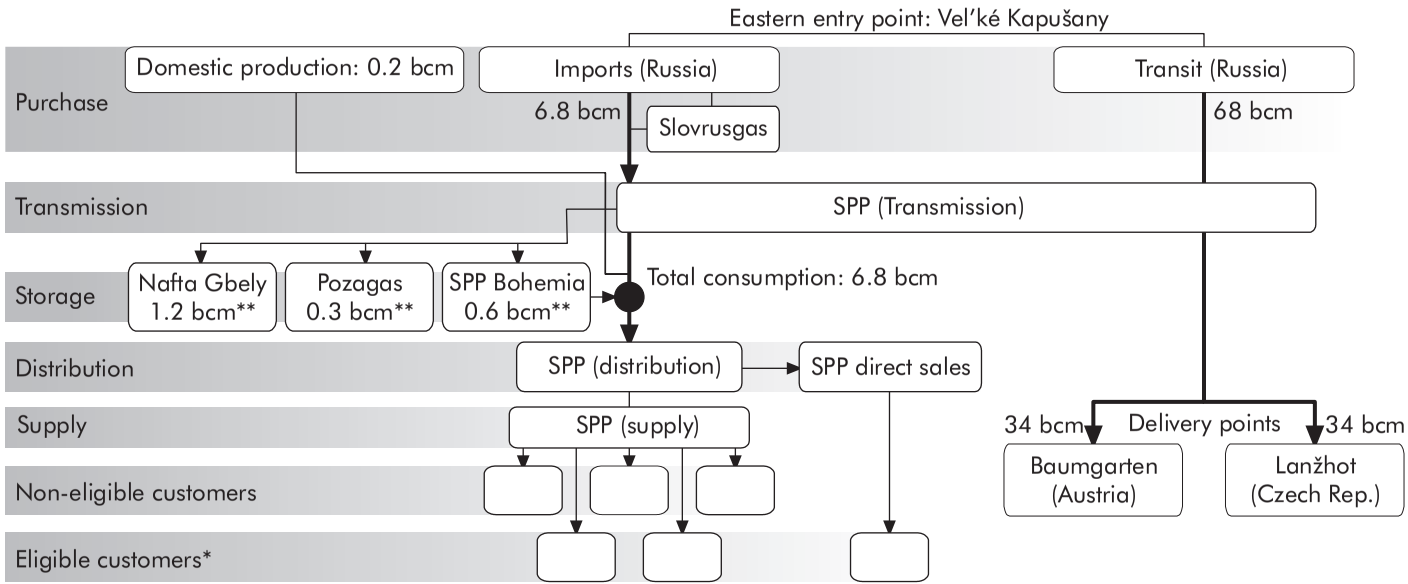
- **Transit**

Slovakia is the main point of entry of Russian gas to the EU. The international gas transit pipeline has an annual transport capacity of 94 bcm and consists of four/five separate lines and four pumping stations for a total of 1.1 GW of installed capacity. The Ukrainian gas company provides gas storage facilities to the Brotherhood pipeline which transits gas from Siberia through the Ukraine and then Slovakia. The entry point at the Ukrainian border at Uzhogorod and Slovakia has a capacity of 12 mcm/hour, the highest in Europe. Delivery points are located at the Czech border (Lanžhot) for deliveries to Germany and France (34 bcm in 2003) and at the Austrian border (Baumgarten) for deliveries to South Europe and Switzerland (34 bcm).

In 2004, international transit volumes to other EU countries increased by 14% to 78 bcm, accounting for 16% of EU 15 gas supply (or 30% of supplies for countries receiving Russian gas). Transit volumes peaked at almost 85 bcm in 1999 before decreasing to 68 bcm in 2003 (see Figure 25) as the result of the commissioning of another pipeline bringing Russian gas through Belarus and Poland (Yamal 1) until Germany. Volumes going through Ukraine and Slovakia could reach 100 bcm in 2010 depending on market developments and other transit routes, in particular the North-European gas pipeline (NEGP). The full commissioning of a fifth pipeline in Slovakia can increase the total transit capacity to 120-130 bcm.

Figure 24

Natural Gas Flow Diagram, 2003



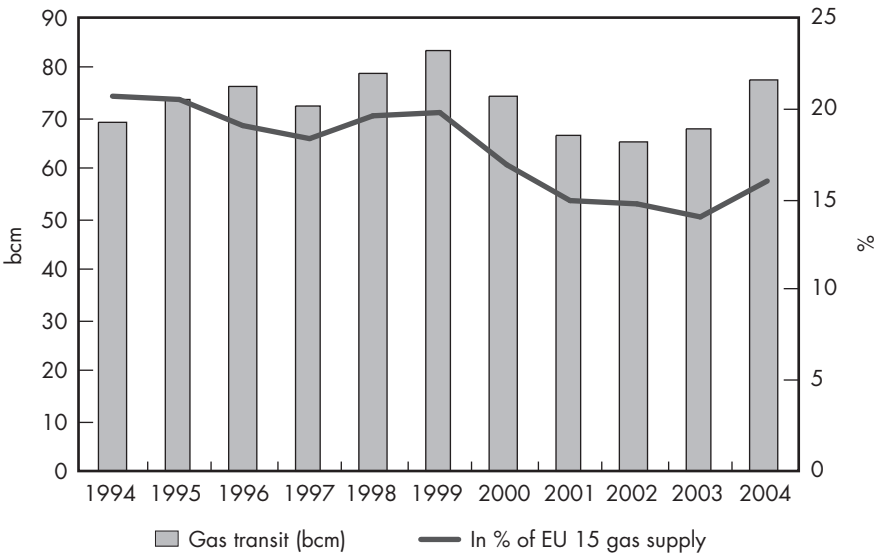
Ownership:
Slovrusgas: Gazprom (50%), SPP (50%)
SPP: NPF (51%), E.ON and GdF (49%)
NaftaGbely: SPP (55.9%), E.ON (40.3%), others (3.8%)
Pozagas: SPP (35%), Nafta Gbely (35%), GdF (30%)
SPP Bohemia: SPP (50%), Europgas/E.ON (50%)

* Since 1.01.2005 for all non-household customers. For all customers: 1.07.2007
** Capacities

Sources: IEA and SPP.

Figure 25

International Natural Gas Transit and Share in EU 15 Gas Supply, 1994 to 2004



Sources: IEA and SPP.

The stability and efficiency of this east-west gas flow through Slovakia to the south and west of Europe is of crucial importance for European security of gas supply. SPP has been operating transit pipelines since 1973, for a cumulative volume of over 1,700 bcm without a single interruption. For the first two days of January 2006, Russian gas volumes dropped by around one third because Gazprom cut off all deliveries to Ukraine.

The main users of the transit line have been Gazexport (70% of volumes), Wintershall (10%) and Transgas (10%) on the basis of long-term ship-or-pay contracts. Transit fees are paid to SPP in cash and account now for one third of SPP revenues and most operating profits down from 60% in 2000 when they accounted for 90% of profits. The long-term contract with Gazexport is valid until 2008 and guarantees for SPP minimum transit volumes of 55/60 bcm.

Since 2004, URSO has acquired the responsibility of monitoring transit tariffs and fair access to the system under regulated third party access (r TPA).

- **Privatisation**

  In March 2002, the Slovak Government disposed of 49% of SPP to two foreign strategic investors, Ruhrgas and Gaz de France, which together formed a company, Slovak Gas Holding B.V. (Netherlands). The consortium also acquired management responsibility of SPP.

  For the sale of 49% of its shares in SPP, the State received SKK 110 billion (USD 2.7 billion), accounting for 180% of its revenues in 2002 or 10.7% of the country's GDP. The government has declared its intention to retain its 51% share in SPP, a strategic company for the country and one of the largest providers of revenue to the State budget.

  The consortium offered Gazprom, the dominant gas supplier, an option valid until end-2004, to purchase 16.3% of its SPP shares. However, Gazprom did not use its option, officially confirming in June 2005 that it would not acquire any shares in SPP.

Regulation

- **Tariff System**

  In 2003, the import price at the Ukrainian border was around USD 120/tcm on the Gazexport contract, and probably around USD 100/tcm for the Turkmen gas . Since that time, prices have increased to around USD 190/tcm in the last quarter of 2005 as a result of the indexation to oil prices.

  In the 1990s, Slovak natural gas prices for households used to be the lowest in the region thanks to the transfer of gas[15] transit revenues (World Bank estimates at USD 170 million/y). In 2000, the average gas price for households and large customers was SKK 4.6 per cm (USD 0.09), although the import price at the border (without domestic transport and distribution cost) was SKK 6.1 (USD 0.12) per cm. If the industrial tariff was at 72% of the average OECD Europe, the household tariff represented only 18% of this average and half of the Czech tariff. This created price distortions as household customers have lower tariffs than large district heating plants. As a result, residential users increased their gas consumption by almost 50% between 1995 and 1998.

  Since 2000, the structure and level of gas prices in Slovakia have changed significantly. The reform price has aimed to phase out the cross-subsidisation

15. POGC in Poland was said to have paid a similar price for its ETG contract (Platts, Energy in East Europe, 2004).

of household prices through the transit fee. Between 2000 and mid-2005, prices have increased, in particular for residential (+140%) and small and medium consumers (+157%). As a result, final gas consumption has declined by 12% from its peak level of 5.4 bcm in 2001, indicating its relative price elasticity. URSO decided on a 20.3% increase of the household prices from 1st October 2005 and 5.8% from January 2006 in order to reflect the continuous increase of prices of imported gas, which are contractually linked to oil prices. URSO has not set new prices for large industrial customers as an indexation is already in place for those consuming more than 60,000 cubic metres per year.

For some of the largest customers including the fertiliser plant of Duslo Šala, the effective price is lower than the published tariff and is based on long-term contracts.

Table 13

Average Natural Gas Sale Prices (without VAT) by Consumer Group, 2000 to 2005

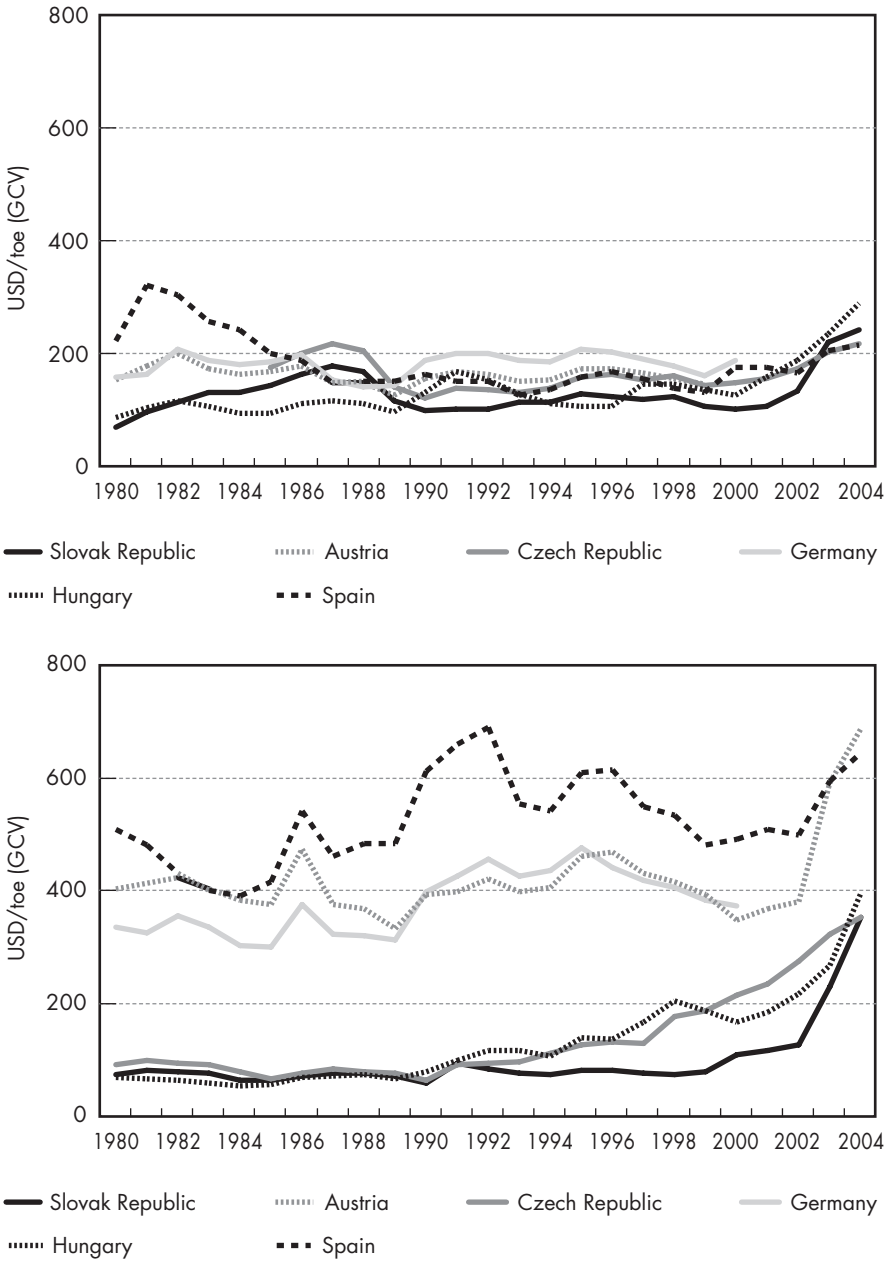
Consumer group	Consumption level (in cm)	2000	2004	2005	2000/ 2005
			SKK/cm	%	
Residential	0-1.700	4.0	8.6	9.6	+140%
Small and medium consumers	1.700-60.000	3.3	7.7	8.5	+157%
Large consumers	6.500-15 million (eligibility limit) and above	3.5	6.8	7.6	+117%
Average	-	**3.7**	**7.5**	**8.4**	**+124%**

Source: URSO.
Note: 19% VAT rate applies on residential price; prices on 1st January.

URSO regulates tariffs for infrastructure use, based on regulated third party access (rTPA) for transmission and distribution. For transmission, which includes transit since 2005, URSO publishes an entry-exit tariff and for distribution there is a post-stamp tariff. Tariff levels aim at providing sufficient resources for adequate maintenance and investment. For storage, conditions of access remain under negotiated third party access (nTPA) between parties (possible new entrants and SPP) on a case by case basis. Existing transit contracts continue to be based on the initial agreements.

Figure 26

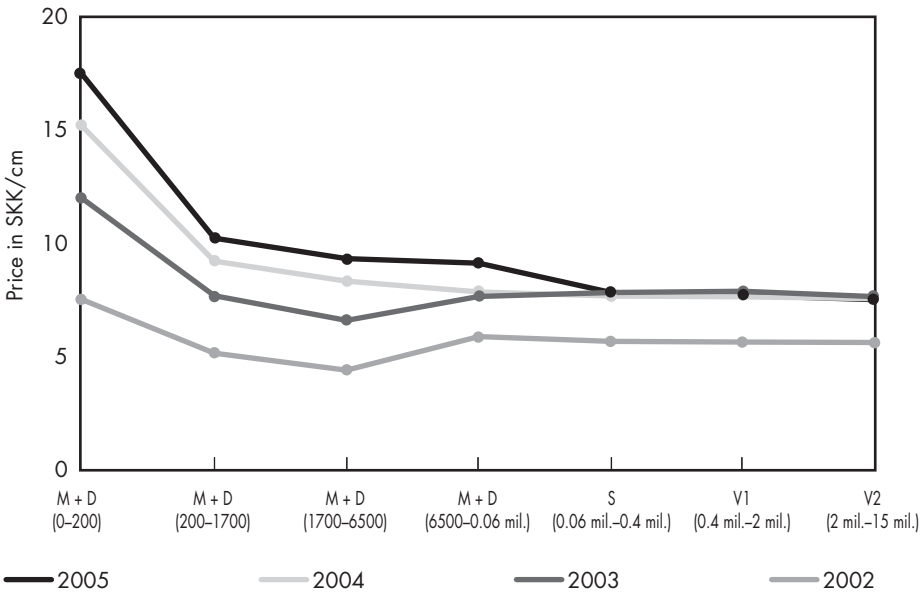
Natural Gas Prices in Slovakia and in Other Selected OECD Countries, 1980 to 2004; Industry Sector and Household sector



Source: Energy Prices and Taxes, *IEA/OECD Paris, 2005.*

Figure 27

Natural Gas Prices per Tariff Category, 2002 to 2005



Source: URSO.

Legend: MD1, MD2, MD3, MD4: small and medium-sized customers; S, V-1, V-2: large customers.

Note: The process of regulation in the years from 2003 to 2005 phased out cross-subsidies between individual categories of consumers and adjusted a distorted curve showing the dependence of the amount of gas consumption on unit gas sales price, while taking into account the principle "the larger the gas consumption, the smaller the unit gas price".

● Market Opening to Competition

The Slovak Government has been implementing gradual gas market liberalisation since December 2001. The first stage of market opening was 1 July 2002 when consumers using a minimum of 25 million cm were made eligible. This was followed by a further opening in January 2003 for consumers using more than 15 million cm. Slovakia's energy legislation of October 2004 is designed to execute the EU gas directive 2003/55/EC, as amended. All non-household customers became eligible as of 1 January 2005, and a 100% market opening is scheduled for 1 July 2007. By the end of 2005, however, no customers among the 45 largest (those using more than 15 million cm and accounting for 33% of sales) had yet switched suppliers.

The new legislation which sets the schedule for the legal unbundling of SPP reinforces the power and independence of the regulator and requires the

adoption of gas market rules. The new gas market rules adopted in March 2005 will be in force from January 2006 and will determine the rules of operation including for:

- Access to the transmission and distribution network and to the storage;
- Gas transmission including the entry and exit points to and from the Czech, Austrian and Ukrainian transmission gas systems, and gas distribution defining types of contracts (annual, long-term and short-term contracts with fixed or interruptible transmission capacity), conditions related to exceeding daily capacity, gas nomination and publication of free transmission capacities;
- Supply of gas and gas delivery to households including household protection;
- Determining the method for handling the network and distribution network overloads;
- Gas storage including conditions for gas market participants; and
- Network physical and commercial balancing defined by zone and regime.

In the event of the failure of natural gas to reach final consumers, the supply is ensured by the distribution network operator, the supplier of last resort.

Critique

Market reforms, in particular end-use price rebalancing and partial privatisation, have extensively modified the gas sector, enhancing modernisation and consolidating the transit system. New challenges include an effective opening of the market in the face of a dominant external supplier and a domestic integrated incumbent.

Domestic demand is expected to increase moderately, particularly for residential users. There is potential for growth, notably because of substitution from coal and oil for environmental reasons, and from electrical heating (see chapter on energy efficiency). However, the extension of the distribution network can bring only marginal additional volumes as it already covers the major part of the country.

● Industry Structure and Ownership

Long-term contracts with the main gas supplier of the EU are a guarantee for EU security of supply. However, these contracts have to be compatible with the competition rules of the EU Treaty.

In the forthcoming new supply contract effective after 2008, to be negotiated with Gazexport/Gazprom, the question of abandoning the destination clauses will be crucial following agreements for Austria and Italy made in 2003 and E.ON recently. This would allow eventual re-export or re-sale of gas to other companies fostering access to supply for new distributors. Direct contracting with Gazexport between the Czech Transgas and Gazexport avoids using a third party, reducing costs and enhancing market transparency.

In its expansion and control strategy along the entire gas supply chain, Gazprom has been using diverse ways, including direct and indirect acquisitions of downstream assets. Gazprom agreed with the Gaz de France/Ruhrgas consortium, which acquired 49% of SPP as well as management control, to acquire an option of 16.3% of SPP. The direct involvement of the dominant supplier in downstream and transit activities appears no longer to be an area of concern since the Moscow-based company decided, in the context of its decision to go ahead with the North-European gas pipeline (NEGP) project, not to take up its option.

Gazprom has been planning to expand into the oil sector, initially through a merger (later abandoned) with Rosneft, before acquiring 76% of Sibneft, the 4th Russian oil company in September 2005. Also, in March 2005, Gazprom signed a long-term agreement with Lukoil.

Risks related to anti-competitive practices or abuse of dominant positions include the curtailment of supply, price-fixing, and other forms of market control. Coupled with this, Gazprom's expansion strategy could pose commercial risks, considering the existing level of debt, poor economic performance and need for huge future investments. Furthermore, Gazprom's decision to suspend gas supply to Ukraine during the gas dispute resulted in a significant reduction of transit volumes and supplies to Slovakia in January 2006, highlighting the vulnerability of importing countries, which is nevertheless less significant than the revenue dependence of export and transit countries.

Given the large share of gas in the Slovak energy mix, effective diversification of supply is of real importance. Securing alternative sources of supply is a welcome move as it will enhance both security of supply and competition at the supply level. However, the conditions of the 2003 Turkmen gas supply deal do raise concerns as the scope of diversification is limited, the pipeline and trading scheme being under Gazprom control. The use of third parties, besides being offshore-based, raises issues of market transparency, security of supply, as well as of the net benefits for the country and SPP.

Gazprom has directly or indirectly used offshore companies to control supplies and penetrate markets. Gazprom successively contracted two

offshore companies to transit large volumes of gas from Turkmenistan to Ukraine under opaque conditions. In December 2002, Gazprom signed a first contract with Eural Trans Gas (ETG), an obscure company registered in Hungary. In 2003 and 2004, ETG transited 36 bcm to Ukraine and re-exported up to 8 bcm to Europe, mainly to Germany and Poland as well as to Slovakia (1.9 bcm in 2004 or 27% of total imports), generating at least USD 500 million in profits to unknown beneficiaries. Since January 2005, ETG has been replaced by RosUkrEnergo (RUE), a joint venture between Gazprom and the Austrian bank, Raffeisen. In June 2005, the Ukrainian authorities launched into investigation on both trading companies and announced that the current contract with RUE would not be renewed.

Gas supply diversification has already been implemented by the Czech Republic in the second half of the 1990s by importing 30% of its gas supply from Norway. In the medium term, various options have been envisaged, including the Nabucco project to supply Caspian and Middle-East gas at the Baumgarten gas hub, on the Slovak border. In this case, the existing transit system could be partially used by reversing the flow from Baumgarten to Slovakia.

It is important for the operator and the regulator to ensure sufficient maintenance and investment for the extended network, particularly in rural areas, in the context of market opening. Particular focus is needed on transmission capacity as peak load demand (46.5 mcm/day) approaches the maximum load capacity of 50 mcm/day.

It seems there is sufficient storage capacity to cope with existing peak load demand during the heating season. Both access tariffs to transmission and storage should be sufficient to cover maintenance and new investment costs. These regulated tariffs should correspond to effective economic realities and should not provide undue advantages for the incumbent.

It is imperative to continue to ensure the high reliability and safety, competitiveness and efficiency of the transit system considering its importance not only for SPP's revenues but also for European gas supply (16% of supply) and exporters (around 80% of Gazprom's exports to Europe and 75% of its total revenues in 2003).

Gazprom has announced its intention to build a first line of the North-European gas pipeline (NEGP) with a capacity of 27.5 bcm/y despite economic and technical uncertainties, in particular its total cost (est. € 5-6 billion) compared to available spare transit (Brotherhood line: 10-15 bcm/y, Yamal 1: 12 bcm) and opportunities for expansion (Brotherhood: 20-30 bcm, Yamal 2: 32 bcm). It would be preferable to avoid a situation similar to the Blue Stream offshore pipeline which was built in 2003 between Russia and Turkey at a cost

of € 3 billion but which has remained scarcely utilised (2003: 12% in of the 16 bcm/y capacity, 2004: 20%).

If the NEGP is built and utilised, Gazprom may reduce volumes transiting Ukraine and Slovakia for Germany and France after 2010 but probably would maintain the level of 40 bcm for the Austrian and Italian markets. Estimates for the next decade indicate a reduction of 25 to 35% in volume, higher than the fluctuations of the last five years (-19% between 1999 and 2002 followed by +17% until 2004). In a scenario of expanding demand on the other hand, volumes due through the NEGP (est. 10-27 bcm) and eventually Yamal 2 (est. 32 bcm) would include extra exports. In this case, volumes in transit through Ukraine and Slovakia would increase by 20 to 40% at 100-130 bcm.

Nevertheless, risks of a persistent drop in volumes and transit fees over the medium term have emerged and may have a major impact for SPP as it is an important source of its revenues (33%). Thus, the decision to expand the SPP transit pipeline may be postponed until contracted volumes are confirmed as fact.

The privatisation of 49% of SPP capital together with the passing of managerial control to strategic investors has contributed to the modernisation of the company, notably by increasing further productivity and efficiency. Nevertheless, if inappropriately managed, the privatisation of a company like SPP may have an impact on gas competition in Slovakia and the rest of the EU.

The persistence of a vertically integrated monopoly structure under private ownership might prevent an effective opening of the Slovak gas market (see below). At the regional level, SPP may not be able to develop activities, notably trading, in neighbouring markets where its strategic owners operate subsidiaries, except in the Czech Republic where RWE acquired 97% of the gas monopoly company. Thus, the initial large privatisation revenues from the partial sale of SPP may be offset by the constraints in accessing the benefits of an open and competitive domestic market and of SPP's evolution into a regional player.

At the EU level, control of a major European gas supply route by two large players may have an impact on competition, especially if access is regulated under nTPA. The operator advances operational constraints for negotiated access. The regulator has an important role to play to guarantee a non-discriminatory access to the transit line.

Regulation

The authorities have accomplished impressive achievements in price reforms, particularly in the phase-out of cross-subsidies from transit revenues to households. Nevertheless, it appears that there is still room for improvement, particularly with regard to price differentials between households and industrial consumers. At the same time, the recent price increases of natural gas imports caused by oil price hikes are expected to be passed on to customers under conditions to be determined by URSO. Considering the high share of gas bills in households revenues, new price increases should be associated with an energy efficiency program (*e.g.* isolation, regulation and appliance upgrades), in particular for low-income families.

As an EU accession country and since May 2004 as an EU Member, Slovakia has sought to apply the relevant directives on gas markets to adapt contractual conditions. The authorities, in particular URSO, face the challenge of attracting sizeable competitors in a relatively small market in a context of the dominating monopoly structure of SPP. Additional delay in the initial plan to unbundle SPP into two entities will further postpone the first stage of market opening.

Although large customers have the possibility of switching suppliers, this has not yet taken place in practice as there has been no real alternatives to SPP, a vertically integrated company. SPP remains the only supplier of gas to the Slovak market. This concentration may prevent competition from developing in the sector. Furthermore, even dramatically increased, regulated prices may yet be lower and less volatile than (future) liberalised prices, especially in the wake of fluctuations of oil prices which are the reference for gas prices. Switching to a new supplier would appear risky for eligible customers who might prefer price renegotiations with SPP.

For new entrants, the immediate challenge would be to access gas supply because SPP currently controls imports and trade. Other OECD countries (*e.g.* Italy, Spain, Hungary) have developed gas release programmes to provide secured supplies to new competitors. URSO and the Competition Office should closely monitor developments and prevent distortions to competition in order to achieve a liquid, credible and robust liberalised market of a critical size.

In addition, for access to networks and storage owned by SPP and its subsidiaries, nTPA and legal unbundling may not be sufficient to ensure fair access to facilities for future competitors. The EU Gas Directive requires an effective accounting and functional unbundling of SPP Transmission and SPP distribution. In order to establish a competitive structure in the gas sector as has been achieved in the electricity sector, separation of monopoly activities

from competitive activities may be necessary. It is, together with the need to diversify gas supplies in the medium term, a condition for fair access to networks for gas supplied by new operators to eligible customers. Beyond the EU Directive requirements, several European OECD countries established separate and fully state-owned gas transmission companies: National Grid plc (Transco) in the UK, Nederlandse Gasunie in the Netherlands and Gaz-System in Poland.

As is the case for electricity, other barriers include the lack of awareness by customers, the complexity of switching supplier and the regulation of all network prices. The management of transmission and storage capacities and cross-border trade must also be co-ordinated. It is important that these issues be discussed with all interested parties including at the regional level, in particular other regulators and TSOs in the EU mini-forum for Central Europe. The development of cross-border trade and gas hubs can, if effectively monitored, enhance competition and supply diversification. Competition, transparency and security of supply can be made compatible.

Persistent limitations on opening the gas market would impact on competitive conditions in the Slovak electricity market as well as the heat market. Similarly, restrictions on access to the transit pipeline would impact the EU's internal gas market.

Recommendations

The government of the Slovak Republic should:

- Consider ways to diversify supplies, including regional initiatives, and ensure sufficient gas storage.
- Evaluate whether the long-term contracts that exist in this sector are compatible with EU and Slovak competition rules.
- Evaluate the consequences for competition and diversification of the presence of integrated companies, both upstream and downstream; ensure commercial transparency of supply and import contracts.
- Continue to develop competition in the gas sector in a manner compatible with the objectives of security of supply and new investments.
- Implement the legal unbundling of SPP as soon as possible in order to improve transparency and non-discrimination in the sector.
- Ensure that newcomers have fair access to gas supply transmission, storage and distribution facilities.
- Ensure a fair and transparent entry and exit tariff system for access to the transport network including at international points.

NUCLEAR ENERGY

Key Information and Data (2003)

- **Number of plants (3) and reactors (6) in operation**
- **Share in TPES:** 25% (with net production: 8%) and power mix: 57% (OECD Europe: 14% and 30%)
- **Installed capacity:** 2,640 MW (33% of total capacity)
- **Electricity generation:** 17.9 TWh (gross), 16.4 TWh (net)
- **Plant efficiency:** 29%

Since 2003, more than half of all the electricity in Slovakia has been produced by nuclear power generation, constituting the output of six reactors (model VVER 440). Two of them are going to shut down for decommissioning, respectively in 2006 and 2008. The sector was entering the privatisation process in early 2005 through the disposal of 66% of Slovenské Elektrárne, a.s. (SE), the electricity company that owns and operates nuclear assets.

Main Features

● Historical Overview

During the 1970s and the 1980s, a large nuclear energy programme was pursued in the former Czechoslovakia, based on Soviet-design reactor types. The first nuclear power plant (NPP) in Slovakia entered service in 1972 in Jaslovské Bohunice (NPP A1), about 70 kilometres from Bratislava. It had a prototype HWGC reactor (heavy water moderated gas cooled reactor) of the type KS 150, with a capacity of about 144 MW. After a series of accidents, this NPP was put out of service in 1977, and it has been under decommissioning since 1995.

On the same site of Bohunice, in 1978 and 1980, two reactors VVER[16] 440 type 230 series built by Atomenergoexport (AEE) of Russia were connected to the grid[17] (NPP V-1), followed by two other reactors VVER 440/213 in 1984 and 1985 (NPP V-2) built by the Czech constructor Skoda. All plants were designed by Energoproject Prague.

16. *The VVER is a Pressuried Water Reactor (PWR) of Soviet design.*
17. *Nuclear reactors first go critical, then are connected to the grid and usually commissioned via a trial operation, before being brought into commercial operation.*

On the site of Mochovce, about 120 kilometres east of Bratislava in District Levice, the construction of a new NPP with two new reactors (EMO 1&2) of the same VVER 440/213 type, began in 1983, followed two years later by another NPP with two similar units (EMO 3&4). However, due to lack of funds following the collapse of the communist regime in 1989, the works on these four new reactors were halted respectively in 1991 (EMO 1&2) and 1994 (EMO 3&4). In the mid-1990s, after that EBRD declined to provide a loan for the completion of the first two units (EMO 1&2), the Slovak government decided to resume their construction, which were at that time respectively 90% and 75% complete. In 1995, the works were restarted with a safety upgrade to the original design, consisting of integrating a Western instrumentation and control (I&C) system for a total cost of about € 875 million (SKK 35 billion).[18] EMO unit 1 entered commercial operation in 1998 and EMO unit 2 in 2000.

In 2000, the government indicated that it will not provide a State guarantee for the completion of EMO 3&4. In 2001, the management of units 3 and 4 from Mochovce NPP was separated and a new subsidiary SE-EMO 3&4 (see below) was established handling units left uncompleted since 1994, when they were each about 30-40% complete.

● Current Situation

The Slovak nuclear reactors and their current status are reported in the table[19] below.

SE, the state-owned electricity company, currently operates all Slovak nuclear power plants through its branches SE-EBO, operating Bohunice V-1 and Bohunice V-2 NPPs, and SE-EMO, operating units 1 and 2 (EMO 1&2) of Mochovce NPP. The total installed capacity of the running NPPs is 2,640 MW, or 32.7% of the country's total installed capacity. In 2003, these six reactors generated 17.9 TWh of electricity, equivalent to 57. % of the national gross production up from 44.6% in 1997 (when four reactors were operational). This electricity is mainly used to cover demand base load (around 45%).

SE reported an average generation cost in the year 2003 for nuclear power of € 35/MWh (SKK 1,400/MWh), V-1 having the lowest generation cost of € 27/MWh (SKK 1,080/MWh). In addition to power generation, heat is produced by Bohunice V-2 and Mochovce (EMO 1&2) NPPs. In 2003, these

18. *The chapter includes both currencies.*

19. *The schedules for the end of decommissioning were recently reassessed by DECOM Slovakia, s.r.o. to optimize the dismantling of building, SNIDF expenditures and the handling of radioactive waste.*

Table 14

Nuclear Power Reactors, April 2005

Units	Type	Capacity (MW)		Status	Commercial date	Planned shut-down	Planned end of decommissioning
		Net	Gross				
Bohunice A1	HWGC	(110)	(144)	Decommissioning	1972	1979	2037
Bohunice V-1, unit 1	WWER 440/230	408	440	Operational	1980	2006	2025
Bohunice V-1, unit 2	WWER 440/230	408	440	Operational	1981	2008	2025
Bohunice V-2, unit 3	WWER 440/213	408	440	Operational	1985	2025	2043
Bohunice V-2, unit 4	WWER 440/213	408	440	Operational	1985	2025	2043
Mochovce, unit 1	WWER 440/213	405	440	Operational	1998	2038	...
Mochovce, unit 2	WWER 440/213	405	440	Operational	2000	2040	...
Mochovce, unit 3	WWER 440/213	...	(440)	Construction halted	...	...	...
Mochovce, unit 4	WWER 440/213	...	(440)	Construction halted	...	...	...
TOTAL-operational	**WWER**	**2,442**	**2,640**	**Operational**	**...**	**...**	**...**

Source: IAEA.

two nuclear power plants produced 48 ktoe of energy in the form of exchangeable heat, or 3.6% of the domestic gross heat production.

Institutional Aspects and Legislation

- **Institutional Framework**

  Regulation of nuclear energy falls under the responsibility of the Nuclear Regulatory Authority (UJD) for nuclear safety, and the Office of Public Health (under Ministry of Health) for radiation protection. UJD supervises all phases of radioactive waste management at nuclear installations and final phases of institutional radioactive waste[20] management. The pre-conditioning phases of institutional radioactive waste management are supervised by the Ministry of Health. The Ministry of Economy ensures the overall monitoring of the nuclear sector and provides authorisation for transport of radioactive materials (see Figure 28).

  The Ministry of Interior is responsible for security and protection of the public and of public property. In the event of nuclear and radiation release accidents, it is also responsible for organising aid to the public.

  The Ministry of Labour, Social Affairs and Family (MPSVR) is a state authority for occupational health, safety and labour inspection. The inspectorate checks for compliance with safety for equipment categorised as "classified".

- **Legislation: the New Atomic Act (2004)**

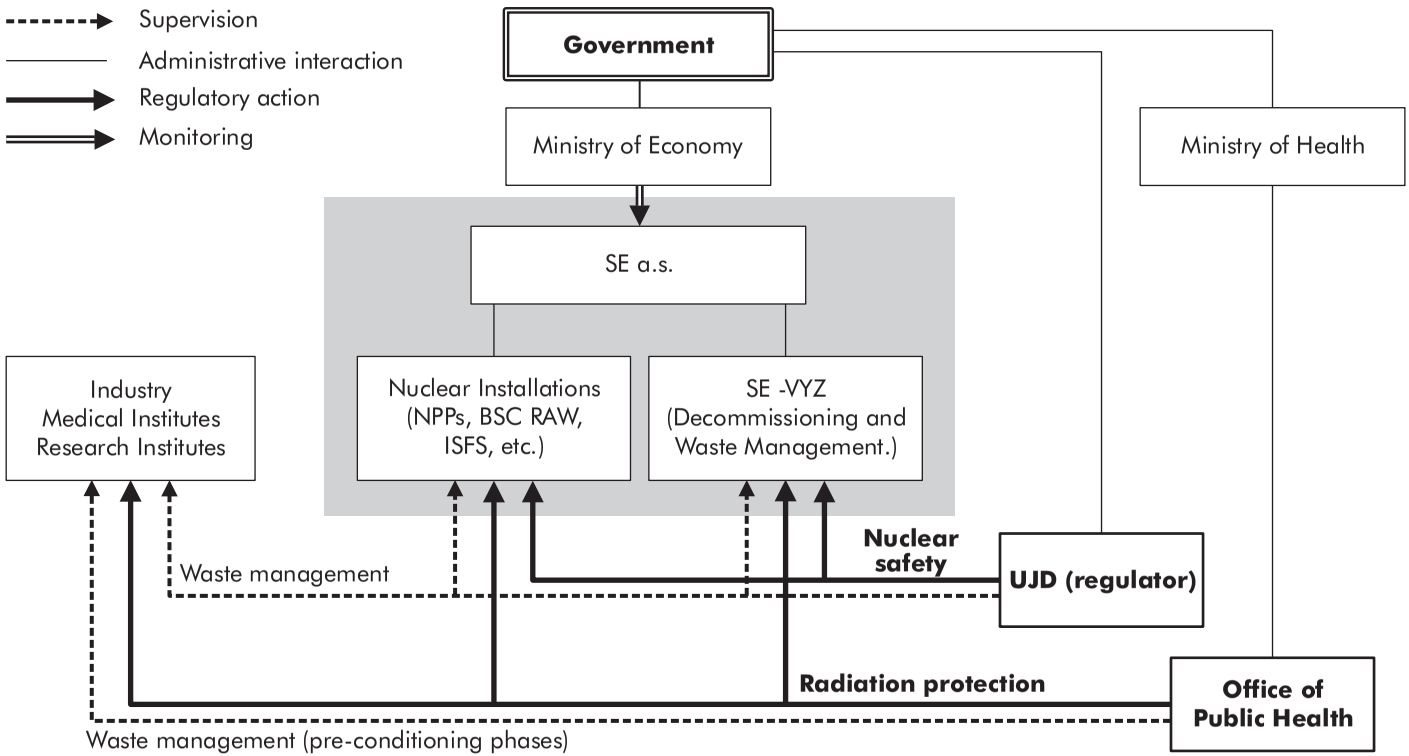
  A new Atomic Act was adopted by the National Council (parliament) in September 2004 and entered into force in December 2004, with the exception of certain provisions due to come into force on 1 January 2007. Although it repeals and replaces the Act 130/98 Coll. on peaceful use of nuclear energy (Atomic Act), which constituted the central regulation for nuclear safety and radioactive waste management, it maintains the original approach, structure and content of the previous legislation.

  The new Atomic Act, like the previous one, does not cover radiological protection. In addition to the provisions for the implementation of EU legislation into national law, this act makes the following most important modifications:

20. *Generated by non-nuclear installations (e.g. hospitals, research centres).*

Figure 28

Nuclear Energy Institutional Framework, January 2005



Source: IEA.

- Cancellation of authorisation – UJD will no longer license and regulate supply activities. Its safety supervisory activities will focus henceforth on the operators of nuclear installations and their quality assurance systems;
- Competency transfer – UJD is to become a specialised nuclear installation construction authority, with the exception of land planning and expropriation proceedings. The licensing regime for the different stages of service life of a nuclear installation has been strengthened;
- Establishment of the National Agency for the Disposal of Radioactive Waste - this agency will report to the Ministry of Economy (these provisions shall enter into force only on 1 January 2007);
- Physical protection - more stringent verification of the qualifications required for persons entering a nuclear installation;
- Civil liability for nuclear damage - liability limits were raised to € 75 million for nuclear installations and € 50 million for transport activities.

Safety Aspects

Regulatory Framework

The Nuclear Regulatory Authority (UJD) is the body responsible for the enforcement of nuclear safety regulation. UJD was established as the successor of the former Czechoslovak Atomic Energy Commission in 1993. It is a central state authority, independent from ministries, that reports directly to the Government and is headed by a government-appointed chairman. According to the new Atomic Act, its main responsibilities include:

- State supervision of nuclear safety of nuclear facilities including supervision of radioactive waste and spent fuel management;
- Safeguards and safety guidelines;
- Evaluation and control of emergency plans;
- Fulfilment of obligations from international treaties in nuclear safety and safeguards;
- Licensing authority for construction of nuclear facilities.

UJD employs more than 80 staff and has a total state budget of € 1.8 million (SKK 71 million). In Finland, where the installed nuclear capacity is comparable (about 2,600 MW), including two VVER-440 reactors, STUK, the Radiation and Nuclear Safety Authority has got joint responsibilities for radiation protection and it employs 300 staff for a budget of € 26.5 million (SKK 1,060 million).

- **Bohunice NPPs**

A major safety upgrade was performed on both units of NPP V-1 through the implementation of the programs "Small Reconstruction", during 1991-1993, and "Gradual Reconstruction", during 1994-1999. These programs were based on both probabilistic and deterministic objectives, and their results were described in the safety analysis report: "NPP V-1 Safety Report after Gradual Upgrading", prepared by the Nuclear Power Plant Research Institute Trnava, Inc., (VUJE Trnava, Inc.[21]). The total cost of the programs has been estimated around € 250 million (SKK 10 billion).

Similarly to that of NPP V-1 units, the approach towards the safety review of NPP V-2 has been based on international safety standards and guidelines, accounting for the relevant national regulations and recommendations. At present, a long-term safety upgrade program is carried out at NPP V-2 known as "NPP V-2 Units Modernization and Safety Upgrading Program". The focus is on safety systems, security enhancement and increase of the installed capacity by 62 MW (or +7%) by 2010. Through the implementation of this program, NPP V-2 units 3 and 4 are expected to operate about 40 years.

In addition to the analyses for upgrading NPP V-2, the focus shifted over 2001-2004 to severe accident analyses as a follow-up of some PHARE projects. Specifically focused on the management of VVER 440/213 containment atmosphere, an analytic project had been developed in 2002-2003 in co-operation with VUJE Trnava, Inc. in support for the development of Severe Accident Management Guidelines (SAMGs) at NPP V-2 and NPP Mochovce. The project results were directly used to develop and optimize SAMGs.

- **Mochovce NPP (EMO 1&2)**

EMO units 1 and 2 are reactors VVER 440/213 of the same type operated at Jaslovské Bohunice but modified to comply with the growing requirements concerning improved safety of VVER units and to account for geological peculiarities of the Mochovce site. The key differences include replacement of the original control system by the corresponding equipment made by SIEMENS, requirements concerning seismic upgrading of the NPP and adjustments of primary and secondary circuit systems as suggested by the experience on the same type of NPPs. A modernization and safety upgrading program similar to the one implemented at NPP V-2 is planned to be undertaken for EMO 1&2 and to be finalized by 2012, increasing the installed

21. VUJE Trnava, Inc. is the main technical support company to SE and works as well for the regulatory body (UJD).

capacity by 62 MW (or 7%) and extending also for these units the operational life to about 40 years.

The situation in the area of beyond design basis accidents (BDBAs) and severe accidents (SAs) is similar to that at Bohunice NPP V-2 units, the difference being that for NPP Mochovce a PHARE study was prepared in the first half of 2001.[22]

Waste and Decommissioning

- **Waste Management**

The 1998 Atomic Act defines radioactive waste as non-useable materials in gaseous, liquid or solid form, which may not be released into the environment because of its content of radionuclides or because of contamination by radionuclides. The import of radioactive waste is prohibited. In Slovakia, radioactive waste is generated by both electricity production (radioactive waste from NPPs) and utilisation of radioactive sources in industry, medicine and research (institutional radioactive waste).

The classification of radioactive waste is reported in the table below according to the scheme proposed by the International Atomic Energy Agency (IAEA) in 1994.

The 1998 Atomic Act also defines the radioactive waste management as the pre-treatment, treatment, conditioning, storage, transport and disposal of radioactive waste from nuclear installations and the pre-treatment, treatment, conditioning, and transport to disposal sites of institutional radioactive waste. These phases in waste management are represented in Figure 29, which refers to the case of waste from NPP and shows the basic facilities required to close the back-end of the nuclear fuel cycle (NFC). The NFC represented is of the open type, where the spent nuclear fuel (SNF) is disposed without reprocessing as it is required in the strategy of the government. The company "Decommissioning of Nuclear Installations and Spent Fuel and Rad-waste Management (SE-VYZ)", which was established by SE in 1996, is responsible for nuclear waste management.

The general strategy for radioactive waste management established by the Slovak government is based on the following steps:

22. *Study titled: ¨Applicability of PHARE 4.2.7 a/93 Project Results to EMO Units 1 & 2 and Analyses for SAMG¨.*

Table 15

IAEA Radioactive Waste Classification

Waste classes	Example of wastes	Typical characteristics	Disposal options
Exempt waste (EW)	Most demolished material from decommissioning (*e.g.* concrete, valves and pipes)	Activity below or at the level that can be cleared from regulatory control	No radiological restrictions
Low and intermediate level waste (LILW)	Contaminated and activated material from NPP operations	Activity higher then clearance level and residual heat release lower than 2 kW/cm	Near surface or geological disposal facility
• Short lived waste (LILW-SL)	Filters, protective clothes, liquids from decontamination	Nuclides half-life ≤ 30 years with average alpha activity lower than 400 Bq/g	
• Long lived waste (LILW-LL)	Dismantled internal structures of reactor core	Nuclides half-life > 30 years with average alpha activity higher than 400 Bq/g	Geological disposal facility
High level waste (HLW)	Liquid and solidified waste from SNF (spent nuclear fuel) reprocessing, SNF	Residual heat release equal or higher to 2 kW/cm	Geological disposal facility

Source: IAEA.

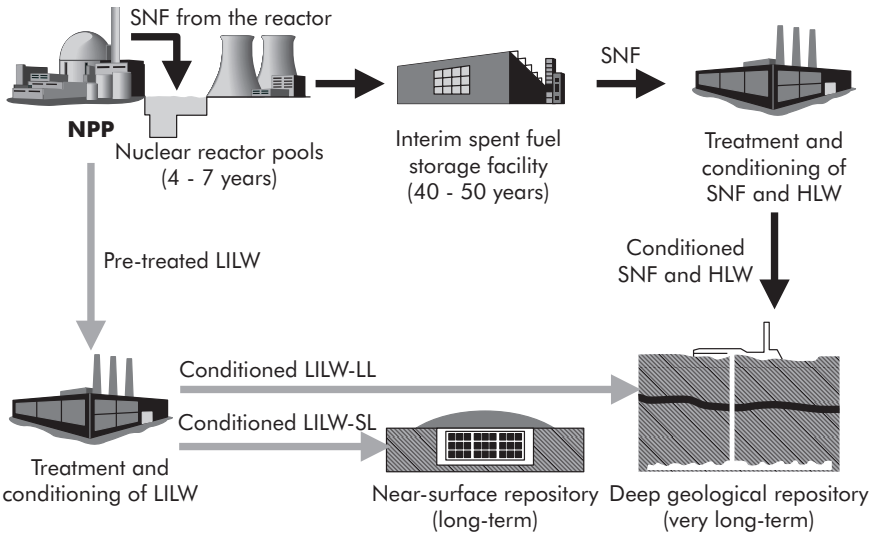
- Processing of radioactive waste into the form suitable for disposal or long-term storage;
- Near surface disposal of low level and intermediate level waste (LILW) and long-term storage of waste unacceptable for near surface disposal; and
- Development and research of a deep geological repository for final disposal of high level waste (HLW) and spent nuclear fuel (SNF).[23]

This strategy is in accordance with the IAEA Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management that was ratified by Slovakia as one of the first states to do so in October 1998. The convention's basic requirements were included in the 1998 Atomic Act. According to this law, and in line with previous legislation, the producer of radioactive waste is responsible for its safe management from point of origin to its handover at the disposal facility.

23. *Spent Nuclear Fuel (SNF) is radioactive waste that belongs to the class of HLW. It is separately mentioned for its importance and characteristics of management.*
24. *RAW, or radwaste in the nuclear literature stands for radioactive waste.*

Figure 29

Management of Radioactive Waste from NPP and Back-End of the Open Fuel Cycle



LILW: Low and intermediate level waste.
HLW: High level waste.
SNF: Spent nuclear fuel.
Source: IEA.

Table 16

Volumes of Radioactive Wastes

Waste classes	Already stored (t)	Estimated future production (t)
Exempt waste (EW)	150	3.500
Low and intermediate		
level waste (LILW)	20.060	147.900
• Short lived waste (LILW-SL)	20.000	144.260
• Long lived waste (LILW-LL)	60	3.640
High level waste (HLW)*	1.048	1.452

** Mostly spent nuclear fuel.*
Source: Ministry of Economy.

- **Low and Intermediate Level Waste (LILW)**

  The low and intermediate level waste (LILW) is treated at Bohunice site in the "Technologies for treatment and conditioning of RAW"[24] facility, which consists mainly of:

  - Two bitumen plants, each with 120 litre/hour capacity, for concentrates (mostly liquids) from operational NPPs and from NPP A1; and
  - The Bohunice conditioning centre (BSC RAW), for final radioactive waste conditioning (through incineration, evaporation, fragmentation, high-pressure compaction and cementation).

  Treated and conditioned low and intermediate level waste is then fixed by cementation into fibre-concrete containers (FCCs), which are transported on the road to the radioactive waste national repository for permanent storage. Combined transport by railway is under consideration for the future.

  The national repository of radioactive waste is a near-surface repository for the disposal of solid and solidified LILWs generated during the operation of nuclear installations and other institutions producing radioactive wastes. It is located about 2 km northwest of the Mochovce NPP site and its current capacity is 7,200 FCCs, corresponding to a total volume of 22,320 cm, or approximately 31,000 tonnes.[25] A total of 576 FCCs were held at the repository as of the end of 2003. The repository allows for a five times capacity expansion.

- **Spent Nuclear Fuel (SNF) and High Level Waste (HLW)**

  In terms of the nuclear fuel cycle, fuel has been traditionally provided by TVEL in Russia. The fuel cycle period, corresponding to the operational life of fuel in the reactor (*i.e.* the time by which the fuel is replaced in the reactor), will increase from 4 to 5 years from 2006, which will reduce the volume of spent nuclear fuel and consequently its direct and storage costs.

  The spent nuclear fuel (SNF) is stored directly within the nuclear reactor pools for a period of four to seven years. Then it is stored in a medium-term (40-50 years) storage facility known as interim spent fuel storage facility (ISFSF) on the site of Bohunice NPPs.

  ISFSF at the Bohunice site is a wet-type interim storage facility that has been upgraded at a cost of € 70 million (SKK 2.8 billion). The main purpose of the upgrade is the capacity increase from 804 tonnes to 1,694 tonnes of heavy

24. RAW, or radwaste in the nuclear literature stands for radioactive waste.

25. Recalculed value from the average weights of FCCs in empty and filled state.

metal (tHM)[26], which is being gradually realised by replacing the original T-12 spent fuel containers by K-48 compact containers (hence without modifying the facility structure). This operation is carried out through an automatic process and will be completed by 2007. The final capacity of ISFSF at Bohunice site at the end of the upgrading process will be sufficient to store all spent nuclear fuel produced by the Bohunice NPPs (V-1 and V-2 units) and by Mochovce NPP (EMO 1&2) through their operational life.

On the Mochovce site a new dry-type interim storage facility had been planned whose estimated investment cost was about € 22.5 million (SKK 900 million). The implementation of the facility plan was initially intended by 2007 but it has been postponed to 2017 due to lack of funds.

It has been estimated that Bohunice NPPs (V-1 and V-2 units) and Mochovce NPP (EMO 1&2) will produce during their entire operational lifetime 2,500 (already 1,048 t produced) tonnes of spent nuclear fuel and 3,700 tonnes of radioactive waste, mainly LILW-LL (including waste generated by NPP A1). Their activity levels and nuclides' half-life will be unacceptable for the RU RAW Mochovce near-surface repository (*i.e.* with higher values than LILW-SL) and therefore will have to be stored in the future deep geological disposal.

The deep geological disposal is supposed to be the best solution for spent fuel, and high level waste (HLW) for the back-end of the nuclear fuel cycle. For economic reasons, no reprocessing of irradiated fuel has been decided upon. Since 1997, the search for a site for such disposal has been conducted by DECOM Slovakia within the Slovak Deep Geological Repository Programme. Initially the government had considered the possibility of creating a deep geological repository by 2037 for an estimated cost of about € 2 billion (SKK 79 billion). At present, no decision has yet been taken. Proposal for the solution for spent fuel and radioactive waste (deep geological repository, regional repository, disposal abroad) are expected to be officially submitted by 2007. SR will proceed in compliance with EU legislation and policy.

● Decommissioning

The Atomic Act of 2004, and previous legislation will replace the nuclear facility operator responsible for safe management of the spent fuel and decommissioning[27] of the reactors. To this purpose, SE-VYZ (a SE subsidiary)

26. *SNF is conventionally measured in tHM (tonnes of heavy metal) to reflect is material composition.*
27. *The decommissioning is defined as the safe removal from service of nuclear facilities and the related reduction of residual radioactivity or risk to a level enabling their use for the purpose of another nuclear facility or for unrestricted use (site release) and termination of license.*

is in charge of decommissioning nuclear installations, and management of spent fuel and nuclear waste.

SE-VYZ took responsibility for the decommissioning of Bohunice A1 NPP whose stage I should end in 2007. Stage II is scheduled to be finalised in 2037 for an ultimate decommissioning in 2050.

In the course of the negotiations for the EU membership, the Slovak government and the European Commission (EC) agreed on the early shutdown of the two reactors of Bohunice V-1 NPP by the end of 2006 (unit 1) and by the end of 2008 (unit 2) respectively. The two NPP V-1 reactors account for almost 10% of the total installed capacity. This disposition is included in the Accession Treaty signed with the EU Member states. While the deadline for closure of these units was fixed, no deadline was decided for their decommissioning although the government has planned a subsequent decommissioning. According to it, from 2007, the decommissioning of the first reactor of Bohunice V-1 NPP is expected to start, followed by the second unit in 2009 for ultimate decommissioning in 2025. It will be carried out under the Directive on environmental impact assessment (EIA), as amended, which now includes rules on public participation and trans-boundary consultations.

The direct costs, without taking inflation into account, of decommissioning of units of NPP V-1 have been estimated at € 1.35 billion (SKK 54 billion) (given by the sum of the first four rows of Table 17), and € 3 billion (SKK 120 billion) including inflation up to 2095 on the costs due to the back end of the fuel cycle. The government has estimated the induced (indirect) costs (or investments) of early decommissioning at € 3.6 billion (SKK 144 billion) or 55% of total cost, mainly for investment in electricity generation (€ 1.3 billion), transmission (€ 265 m) and imports (€ 1.8 billion) in the period of 2007-2013 and uncontributed funds to the SNIDF (€ 176 m). Total costs of decommissioning of NPP V-1 are set by the sum of direct and induced costs and represent a sum of € 4.1 billion (SKK 164 billion) for the period 2004-2013 and an additional € 0.57 billion (SKK 23 billion) up to 2025. After 2025 and up to 2095 remaining induced costs will be due to the share of V-1 in the back-end of the fuel cycle mainly for the deep geological repository for an estimated amount, including inflation, of € 2.0 billion (SKK 79 billion). As a result, the total estimated costs of NPP V-1 decommissioning, including the back-end of the fuel cycle, are equal to € 6.6 billion (SKK 260 billion).

The methodology used for estimating the direct costs of decommissioning has been based on:

Table 17

Breakdown of Projected Costs for the Decommissioning of NPP V-1, 2004 to 2095 (in € m)

Category	2004 - 2013	2014 - 2025	2026 - 2095	Total
Pre-decommissioning	139			139
Operation and maintenance	221			221
Decommissioning	79	321		400
Back-end of the fuel cycle (for the period 2026 – 2095, mainly for the deep geological repository)	15	51	527	593
Contribution not paid to the SNIDF	132	44		176
Social impacts	48	5		53
Enhancement of effectiveness of thermal power plants	101			101
Substitution by non-nuclear projects	1,146			1,146
Investment in transmission system	264			264
Imports of electricity	1,523			1,523
Total:	**3,668**	**421**	**527**	**4,616**
Annual inflation rate [%]	2.15-3.3	2.15	2.15	2.15
Total costs including inflation	**4,089**	**568**	**1,976**	**6,633**

Sources: Ministry of Economy and SE.

• **NPP A1** – analysis made by DECOM Slovakia and reported in: "Decommissioning of NPP A1 in Radiological Safe Status". The analysis also uses estimates from the preparation of decommissioning of NPP V-1 and relevant IAEA documents.

• **NPP V-1** – the Conceptual Decommissioning plan developed by DECOM Slovakia. The criteria used for elaborating this document are mainly based on experiences from similar studies of DECOM Slovakia on the decommissioning of other WWER 440 (Dukovany NPP (CZ), Kozloduy NPP (BG), Paks NPP (HUN)), international industry experience of DECOM (Greifswald NPP, Kozloduy NPP, IAEA) and relevant IAEA documents.

The program of the pre-decommissioning phase includes the preparation of facilities for intermediate storage and long-term disposal (at RU RAW) of

radioactive waste resulting from the decommissioning process (*i.e.* LILW-SL). The interim storage of RAW at the Bohunice site has been preliminarily estimated to cost about € 27.5 million (SKK 1.1 billion) and the capacity enlargement of RU RAW Mochovce national repository around € 14.8 million (SKK 591 million). Both of these costs have been included in the cost estimates for NPP A1 and NPP V-1 decommissioning.

In Table 18, a resumé of the main costs of the nuclear sector is presented, referring to costs recently borne or planned in respect of the nuclear sector planned developments and relative needs under a waste management perspective.

Table 18

*Resumé of the Main Costs Borne and Planned for Nuclear Generation, Waste Management and Decommissioning**

Operation	Status	Cost in million of € (billion of SKK)	Funded by
Bohunice NPP V-1 Total Safety Upgrade	Finalized	€ 250 m (SKK 10 bn)	SE
Completion of Mochovce EMO 1&2	Finalized	€ 875 m (SKK 35 bn)	SE/State budget
ISFSF Upgrade	Finalized	€ 70 m (SKK 2.8 bn)	SNIDF
Decommissioning of NPP A1	Ongoing	€ 300 m (SKK 12 bn)	SNIDF
Decommissioning of NPP V-1	Planned	€ 1,500 m (SKK 60 bn)**	SNIDF / BIDSF[a]
Net capacity increase of V-2 and EMO 1&2	Planned	€ 76 m (SKK 3.04 bn)	SE
Completion of EMO 3&4	Planned	€ 1,675 m (SKK 67 bn)*	SE
Construction of Dry Interim Storage Facility	Not endorsed	€ 22 m (SKK 0.9 bn)	SNIDF
Construction of Deep Geological Repository	Not endorsed	€ 1,980 m (SKK 79bn)	SNIDF, BIDSF and State Funds
Total		**€ 6,748 m (SKK 270 bn)**	

* *Since the end of 1990s.*
** *Direct cost only*
[a] *See paragraph below*
Sources: Ministry of Economy and SNIDF.

Financing System: State and International Funds

The expenses for waste and spent nuclear fuel management (including storage and disposal) and decommissioning of nuclear installations are to be covered by the State Fund for the Decommissioning of Nuclear Power Generating Facilities and for Spent Fuel and Radioactive Wastes Treatment (SNIDF), established in 1995 (according to Act No. 254/1994, amended by Acts No. 78/2000 and No. 560/2001). The fund is managed and under the responsibility of the Ministry of Economy.

According to legislation, the owner of the nuclear power plants (at present SE) shall annually pay to the SNIDF 6.8% of the electricity revenues from the NPPs and € 8,750 (SKK 350,000) for each installed MW of nuclear capacity.[28] These levies are then passed on to all electricity invoices. In addition, state subsidies have been contributing to SNIDF in relation to the decommissioning of NPP A1. In 2004, the government proposed and discussed substituting the current contributions, possibly by a new global levy but a decision is not expected before 2007.

However, in early 2005, a complaint against Slovakia was made to the EC Directorate-General for Competition by NGOs alleging that a plan to levy all electricity consumers in order to fund decommissioning of nuclear installations would be unlawful under EC rules on state aid. In June 2005, the EC responded that the State aid in favour of the decommissioning of NPPs set up by the Slovak government does not distort competition but will investigate the new levy plan when decided by the Slovak government.

Until 2003, the accumulated funds in SNIDF reached a total of € 272.5 million (SKK 10.9 billion) and € 150 million (SKK 6 billion) were disbursed. As of June 2004, the fund was at SKK 11.05 billion with covered disbursements at SKK 7.6 billion. Total funds are expected to reach SKK 7.5 billion and SKK 4.4 billion, and disbursements SKK 20.9 billion and SKK 16.3 billion in 2010 and 2015, respectively.

The European Bank for Reconstruction and Development (EBRD) manages the Bohunice International Decommissioning Support Fund (BIDSF) that is aimed to finance or co-finance activities within NPP V-1 pre-decommissioning phase and related needs. BIDSF is expected to provide € 0.9 billion for the direct decommissioning (or a co-funding of 31%), € 0.2 billion for the deep geological repository (or a co-funding of 11%) and

28. 2003 collection: SKK 2.2 bn.

€ 1.7 billion for the indirect expenses, mainly in electricity generation (€ 0.6 billion) and imports (€ 0.7 billion) (or a co-funding of 48%). The total expected BIDSF funding for the entire period stands at € 2.7 billion or over 40% of total estimated cost. The SNIDF is expected to provide the rest of the funding for the direct expenses of decommissioning.

The EU allocated to the BIDSF € 90 million up to 2003, then committed to contribute € 90 million for the period 2004-2006. The proposed EU Council Regulation sets € 237 million for the period from 2007 to 2013. In respect to the recent re-evaluation to € 6.6 billion (SKK 265 billion) for the total cost of decommissioning of V-1 NPP, the Slovak government is asking the EC to increase its co-funding by € 465 million (SKK 11.6 billion) to the level of € 702 m. In November 2005, the European Parliament passed a resolution to increase EU funding to € 400 million. The EU Council is expected to take a final decision in the first half of 2006. Other contributors, including Switzerland provided € 11.1 m (SKK 444 million).

Privatisation and Liberalisation

In 2003, the government launched an open international tender for the sale of 66% of Slovenské Elektrárne, a.s (SE). Enel S.p.A. (ENEL) was selected as the final bidder, and the proposed transaction has been cleared under the EU merger regulation. The privatisation contract is being finalised for a transfer of ownership in early 2006 (see chapter on electricity).

The government decided to include in SE's privatisation the nuclear assets to operate after 2006/2008 (V-2 and EMO 1&2) and to transfer under a new state-owned company (GOVCO) the reactors in current decommissioning (NPP A1 unit) or to be decommissioned (NPP V-1 units). This means that SE-VYZ, radioactive waste management and related nuclear facilities will remain under direct state control and totally separated from SE.

The government clearly favours the completion of EMO 3&4 (gross capacity of 880 MW), whose civil engineering was 70% completed and the nuclear island[29] 30%. ENEL, the new majority owner of SE submitted an investment plan for the next five years in August 2005. A feasibility study examining the design of the reactors and the plant requirements is expected to be carried out by ENEL within 12 months from the conclusion of the privatisation. Building permits have been released for the completion of Mochovce 3 and 4 and no

29. *Nuclear reactor and primary system.*

further pre-screening has been required by the Ministry of Environment under the subsequent law on environmental impact assessments (EIA). SE estimated the cost to complete the two reactors at € 1.125 billion (SKK 45 billion) with a payback period of 18 years. ENEL re-evaluated the completion cost at € 1.6 billion (SKK 64 billion) in its investment plan for SE, which was submitted to the government in August 2005.

The privatisation of SE is taking place in the context of electricity market liberalisation in Slovakia and its neighbouring EU Member States. Non-household customers (*i.e.* including producers, transmission and distribution undertakings and wholesale customers) in Slovakia have been free to choose their electricity supplier as of 1 January 2005, and this right will be extended to all customers (*i.e.* 100% market opening) by 1 July 2007.

Critique

Nuclear power generation provides the bulk of the country's electricity needs and will remain the primary source in the years to come. The use of nuclear energy over more than 30 years and above all the recent major programs of safety upgrading, have enhanced experience in the field and kept overall knowledge updated with international technical and safety standards. However, the sector has entered in a phase of substantial changes with market liberalisation, the privatisation process, the decommissioning of NPP V-1 at Bohunice and the potential completion of EMO 3&4 at Mochovce.

The financial and human resources of UJD, the nuclear safety regulator, appear quite limited with respect to its current responsibilities covering regulation of the operation and maintenance of the current six reactors, storage facilities and the decommissioning of one reactor. The monitoring of nuclear facilities (generation and waste storage) under private management in a context of a liberalised market, the shutdown and decommissioning of two reactors and the possible construction of two new reactors, call for a substantial and adequate quantitative and qualitative increase of UJD resources.

The call for tenders by UJD to select companies providing technical consultancy on nuclear safety should check for and verify a clear separation (at the functional or management level) between staff working for SE and those for UJD. The separation is aimed at avoiding possible conflicts of interest among experts working for both the regulator and the regulated company. For instance, such a separation should be effective at VUJE Trnava

Inc. if it carries out studies for UJD and SE. Alternatively, independent and adequately recognised organisations should be considered for provision of nuclear safety support to UJD.

The decision to select a site and build the long-term deep geological repository to store radioactive waste unacceptable for near surface disposal can be taken only after a clear resolution by the government on the policy for closing the back end of the nuclear fuel cycle. This policy has to consider the problem of the treatment and conditioning of the spent nuclear fuel and HLW, as at present facilities for this purpose do not exist in Slovakia. The time required for the construction of a deep geological repository might induce the government to take initiatives on such policy. A regional approach has been envisaged, which could reduce the cost for each country. Acceptance by the local population of high level radioactive waste in the very long term represents a challenge and calls for efforts on transparency and open discussion.

The combined decommissioning of three reactors in Bohunice, the upgrade and investment in spent fuel and HLW management and interim storage facilities, as well as the investment in a long-term deep geological repository will require a substantial increase in expenditure to undertake them. It remains to be seen whether the SNIDF nuclear fund, which has been accruing only since 1995, will be sufficient to cover all needs. In fact, the sum of non-finalised nuclear costs relying on the SNIDF amounts to € 3.7 billion (SKK 148 billion), although the SNIDF is expected to reach only € 775 million (SKK 31 billion) by 2010 with disbursements of € 300 million (SKK 12 billion) for the ongoing NPP A1 decommissioning still to be accounted for.

The initial estimates of decommissioning costs at around 10% of the estimated value of the plant appear to have been underestimated since conservative estimations based on international experience with decommissioning indicate its effective cost to range from 50 to 100% of the value of the plant. Already, the government has reassessed the cost (without the long-term repository waste storage) for NPP V-1 decommissioning at € 0.92 billion (instead of € 0.75 billion), or the equivalent of the construction cost of a new coal-fired power plant (€ 1,050/kW). Waste management and indirect costs inflated the total cost to € 6.6 billion, far above the SNIDF resources.

Thus, the Bohunice International Decommissioning Support Fund (BIDSF) is expected to cover a substantial part (40%) of the NPP V-1 decommissioning costs. So, it is important to ensure a transparent and independent process in the evaluation and assessment of decommissioning operations for a correct co-funding appraisal from the BIDSF. The expected expenses of the EBRD fund to cover indirect expenses, mainly electricity generation, and imports are

expected to amount to € 1.8 billion, accounting for the larger part of the indirect expenses (85%) and 23% of its total expenses. However, it seems that the available (€ 191 m) and committed resources by the various donors for the BIDSF may be insufficient to cover the expected co-funding of direct expenses (€ 0.9 billion), which will have in addition to be complemented by the SNIDF to fund the estimated total direct costs (€ 3.0 billion). This deficit could be reduced if supply- and demand-side projects to be identified by a least cost study are prioritised before the expenses specifically planned for generation and imports. In a point of fact, investing in energy efficiency in the energy sector and in end-user sectors should be much more cost effective and longer lasting.

A recent governmental report on long-term deep geological repository indicated that the SNIDF with the current funding may be able to fund only 39% (29% according to the figures above) of total planned expenses. So the government's plan for a new levy from all customers may have to be adjusted to take into account the new estimations for V-1 and also other units. Nevertheless, the project of levy has been challenged at the EC by some NGOs claiming non-compliance with EU state aid rules, an accusation that will be investigated.

The share of liabilities between the state and the new owner have rendered the privatisation of SE's nuclear assets more complex. It will be the first privatisation of nuclear assets in Europe since the privatisation in 1996 of British Energy plc (BE), which operated eight nuclear power plants (for a total capacity of 9,820 MW). In 2002, the level of long-term liabilities and non-avoidable costs combined with the fall in wholesale electricity prices led BE into virtual bankruptcy, obliging the British government to temporarily provide up to € 600 million in financial assistance and take responsibility of liabilities for at least € 5 billion. Attention will be required so that a similar scenario does not develop in Slovakia.

The example of BE reveals the inelasticity of the cost structure in nuclear power plants, characterised by very high unavoidable costs and low avoidable costs.[30] As regards the former, nuclear decommissioning liabilities are unrelated to output, except in respect to their timing, which is based on the scheduling of station closures. Moreover, spent fuel management costs (including storage and final disposal) are also unavoidable for fuel that has already been loaded into the reactor. On the other hand, avoidable operating

30. That is, those costs that can be avoiled by ceasing to generate or by shutting down stations.

costs of nuclear plants fall below the average of other power plants (see the generation section in the chapter on electricity).

In the framework of competitive electricity markets, such a cost structure should outline the importance for nuclear generators of either having a retail customer business that provides a natural hedge against wholesale price volatility or having sufficient funds to meet unavoidable costs. Both lead to the passing on of nuclear costs and levies to the final consumers in order to hedge nuclear power in a growing, competitive environment. The retail customer business has the great advantage of stimulating demand responsiveness, but it enhances monopolistic behaviours in the presence of market dominance as it is the case here.

Further to its estimated own cost of € 1.6 billion (SKK 64 billion), completion of the construction of Mochovce EMO 3&4 should take into consideration the consequent need for bringing into being the dry-type interim storage facility at Mochovce, whose estimated cost had been around € 22.5 million (SKK 900 million) or further enhancing the capacity of ISFSF at Bohunice, whose previous upgrading had cost about € 70 million (SKK 2.8 billion), as well as of that of the repository project (€ 2 billion SKK 79 billion). These additional expenses and other related waste management expenses will further prolong the payback period. This led the government in its 2000 Energy Policy to conclude that the project, as a generator of new waste and decommissioning expenses, suffered from low economic viability and was therefore risky. Hence, the government decided not to provide funding or a State guarantee for the completion of EMO 3&4. In the mid-1990s, the EBRD justified its decision not to provide loans for the completion of EMO 1&2 on economic grounds.

Further to the agreement with the government on the completion of Mochovce EMO 3&4 within its investment plan for SE, ENEL as forthcoming majority owner of SE, will undertake a cost/benefit analysis of the project in the framework of a liberalised and increasingly competitive electricity market. Priority in this analysis should be given to the highest available nuclear safety standards as required by international regulations and recommendations (*e.g.* use of safety-advanced Instrumentation and Control (I&C) system) considering that ENEL does not possess direct nuclear safety experience on the VVER-type reactor even if SE does have this experience.

The completion plan, accepted by ENEL, would have to comply with Slovak laws on integration of permits and possibly on environmental impact assessment. These laws should be amended no later than 25 June 2005 in compliance with Directive 2003/35/EC on public participation.

Recommendations

The government of the Slovak Republic should:

- Continue to ensure the independence and power of the Nuclear Regulatory Authority (UJD), and harmonise the current quality management system with existing and future international standards, taking into account future challenges in the nuclear sector.
- Provide adequate resources to UJD, possibly through licensing fees, in order to maintain, recruit and retain high-level nuclear safety professionals and to involve independent technical support organisations.
- Follow the highest available safety standards by closely monitoring the level of safety and security of all nuclear facilities in the new context of private ownership and liberalisation of the electricity market.
- Make efforts to diversify nuclear fuels supply.
- Ensure that the costs of decommissioning and waste management and storage, including the long term, are covered by the operator, and that the nuclear account is adequately funded and managed.
- In accordance with previous commitments, prepare the shut-down and decommissioning of the two units of Bohunice V-1 NPP, applying the highest available safety and radiation standards; continue timely decommissioning of A1 Bohunice.
- Ensure that the new SE majority owner performs a feasibility study on the completion of EMO 3&4 at Mochovce that will comply with the highest available safety standards and ensure that its commissioning will be carried out under open market conditions, limiting the impact of stranded costs.

RENEWABLE ENERGY

Key Information and Data (2003)

- **Share in:**
  TPES: 3.4% (OECD Europe: 6.9%)
  Power mix: 16.5% (OECD Europe: 16.9%)
- **Hydropower** (1.6% of TPES), biomass (1.8%)
- **Economic potential:** 4% of TPES
- **Employment:** N/A

The current contribution of renewable energy to the energy supply is marginal (3.4%), except for large hydropower in the power mix. Other renewable energy sources (RES), notably biomass also have valuable potential that is diversely developed.

Developments and Current Situation: The Hydropower Domination

The first hydropower plant was commissioned in 1886 in Košice, followed by 22 small plants. Larger plants, mainly of "run-of-river" type were built in the 1930s and then in the 1950s and 1960s mainly on the Váh River in the Western part of the country. Two pump storage plants were commissioned in the 1980s. In addition, 200 small hydropower plants are operated.

The Gabčíkovo plant on the Danube, commissioned in 1992, was the latest large hydropower plant. It was decided on by the Czechoslovak and Hungarian governments in 1977 but work was suspended in 1989 and restarted only on the Slovak side. The plant has raised controversies for its impact on the fragile eco-system of the Danube and for its economics. The plant has been under international arbitration with Hungary since 1993 on environmental grounds.

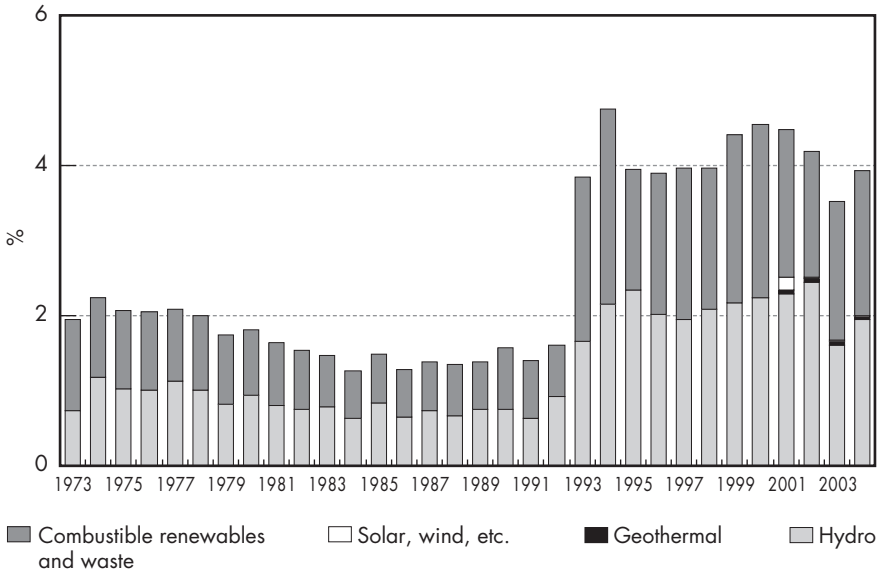
The use of other renewable energy sources (RES) has been modest except for thermal solar in the 1980s, but the technology used lacked performance and reliability.

Currently, the use of RES is rather diverse, but modest. If renewable energy sources account for only 3.4% of TPES (370 ktoe), they have, thanks to

hydropower, an important share (16.5% or 3.9 TWh) in the power mix. Large hydropower plants account for almost 2,440 MW of installed capacity (35% of country's total electric capacity), small hydropower plants 350 MW, biomass 20 MW, solar thermal 40 MWt, geothermal 130 MWt and wind power 5 MW. Hydropower is logically the dominant RES producer, with a 90% share, far above biomass (6%).

Figure 30

*Renewable Energy as a Percentage of Total Primary Energy Supply, 1973 to 2004**



** Estimates.*

Source: Energy Balances of OECD Countries, *IEA/OECD Paris, 2005.*

Potential and Barriers: Challenges Ahead

Total technical potential for RES has been estimated at 2 Mtoe and the remaining economic potential at 1.23 Mtoe (or 6.4% of TPES), of which 50% for biomass, 16% for geothermal, 13% for hydropower, 8% for solar water heaters and 2% for wind (see Table 19). The potential for large hydropower projects has already been largely met (almost 70%).

A 2004 government report on RES perspectives developed three scenarios for renewable electricity in 2010; a stable share at 19% of electricity generated (or +0.5 TWh), an increased share at 21% (+ 1.25 TWh) or 24.6% (+2.2 TWh).

Table 19

2003 Renewable Energy Production, Potential and Objectives for 2010

	Installed capacity (MW)	Total production (Electricity-GWh/ Heat-ktoe)	Potential utilised (%)	Remaining economic potential (TWh/ktoe)	Target 2010 (TWh/ktoe)
Large hydropower	2,440*	3,700 GWh	66	1,040 GWh	4,950 GWh
Small hydropower	350	250 GWh	24	790 GWh	350 GWh
Biomass	21	84 GWh/16 ktoe	12	1,300 GWh/500 ktoe	350 GWh/500 ktoe
Biogas		2 GWh/1 ktoe	1	500 GWh/100 ktoe	50 GWh/48 ktoe
Geothermal	131	3.5 ktoe	0.5	200 ktoe	24 ktoe
Solar thermal	40**	2 ktoe	0.1	100 ktoe	6 ktoe
Wind power	3	2 GWh	0.1	200 GWh	200 GWh
Liquid biofuels	–	0***	N/A	N/A	120 ktoe
TOTAL		**4,038 GWh/22.5 ktoe (370 ktoe)**	**51**	**3,830 GWh/900 ktoe (1,230 ktoe)**	**5,900 GWh/698 ktoe (1,180 ktoe)**

** Including 919 MW of pumped/storage.*

*** Energy production on the basis of 350 kWh/sq. m./y.*

**** 2004 production of biodiesel: 15,000 t.*

Sources: Ministry of Economy, Renewable Energy Action Plan (REAP), IEA and EUROBSERVER'ER.

The 2010 targets appear below the Renewable Energy Action Plan (REAP) 2012 targets for non-large hydro at 12.8/19.1 PJ (0.3/0.45 Mtoe).

Multiple barriers have largely prevented effective exploitation of the RES potential outside large hydropower due to:

- Lack of policy framework and co-ordinated strategy and institutions;
- Economics, and the large electricity overcapacity controlled by a dominant company, centralisation of production not favouring decentralised generation, higher RES investment costs despite the inability of classic, rival energy-generation systems to defray the costs of all externalities;
- Fragmented regulation, lack of incentives, notably low and non-guaranteed purchase tariffs, limited tax breaks (property, profit, VAT) for investment and direct use;
- Limited or inadequate financing; no specific fund or revolving fund for RES;
- RES industry with just a few project developers because of the very long payback periods (20 years for a recent wind project), small industry and installers; lack of trained staff and critical numbers to ensure credibility.

Policy and Regulation: under Development

Lifting the share of RES in order to increase security of supply and to reduce GHG and pollutant emissions has always been an objective of the 2000 policy. The objective at that time was to reach 4% of TPES in 2005, which could not have been met (estimate, 2004: 3.5%). In the accession treaty to the EU, the Slovak government agreed to significantly increase the share of RES in the power mix from 19% to 31%, equivalent to 9.3 TWh, of the electricity generated by 2010. Nonetheless, the government has stated its intention to ask the European Commission for a renegotiation of the objective. A possible new objective might be to reach at least 5.9 TWh (+0.5 TWh) generated from RES by 2010, that is 19% of the electricity generated, corresponding to the low scenario of the 2004 government report on RES.

As for energy efficiency, a study and a Renewable Energy Action Plan (REAP) were developed with the World Bank for the Ministry of Economy in 2002. A set of integrated measures at policy, institutional, regulatory and technical levels was proposed to foster the most promising RES over the period 2002-2012. The estimated annual cost of the REAP was SKK 86-175 million until 2012, or a total at SKK 1.5 billion for ten years for an expected reduction of energy imports by SKK 2.5 billion/y (under 2002 prices, this would be much higher with the current energy prices).

The REAP guidelines were not approved by the government but partially used in the 2003 framework "Programme in support of energy conservation and utilisation of renewable energy resources", which assigned the Slovak Energy Agency (SEA) to implement it. The Programme included the usable RES potential and analysis of the legislative instruments and funding options. Also, an intersectoral Steering Committee to promote renewables was established, gathering related administrations and stakeholders.

In conformity with the corresponding EU Directives, the government has regularly harmonised the legislation related to access for renewable energy to networks and markets. Under the new energy act, the Ministry of Economy has discretion, but it is not obliged to impose a purchase obligation on suppliers or to require priority access and preferential connection for RES-based electricity. Producers using RES have a right of preferential transmission, distribution and supply (but not to cross-border lines) under the new act, provided that technical rules are met as well as the "business terms and conditions" approved under the Regulatory Act. Only renewable projects up to 5 MW installed capacity are exempt from the general licensing.

- **Financing: Growing Share of International Sources**

The *de minimis* scheme managed by the Ministry of Economy can provide grants up to SKK 4 million per investment project but the total budget for both RES and energy efficiency projects is limited to SKK 30 million per year. Also, the Environmental Fund can grant co-funding.

EU pre-accession funds 4th and 5th Framework programme for Research and Development and the Altener programme provided co-funding for investment projects and for market development studies and initiatives. Since 2004, EU structural funds indicate that they could be a significant source of co-funding (up to 65% of investment costs) for private investment projects. For the first tender in 2004, a total of 91 projects worth SKK 390 million were submitted. A total co-funding of SKK 249 million was made available to 73 selected projects, or an average of SKK 3 million per project.

Several small Activities Implemented Jointly (AIJ) projects on biomass were developed (see chapter on the environment). Within the flexibility mechanisms of the Kyoto Protocol, the unique JI will recover methane of the main landfills to generate electricity.

In 2002, domestic funding for RES was estimated at SKK 150 million/y and international funding at SKK 200 million, which has increased since then.

- **Institutions and Actors**

The Ministry of Economy has responsibility over the RES policy. The programme implementation and regulation enforcement are ensured by the SEA and URSO, respectively.

The Energy Centre Bratislava (ECB) has been developing market and R&D development of RES, principally in the frame of international projects. Since 2001, it organises annually the "International Slovak Biomass Forum", a reference regional conference.

Outside the power company SE, there are few developers of RES projects. Manufacturing of RES equipment is limited to one solar water heater plant and the number of installers is scarce.

Sectoral Perspective and Niche Opportunities

Although the remaining economic potential for large and medium-sized hydropower units is above 1 TWh/y, the number of possible sites is limited. Among them are Sereì (51 MW/180 GWh/y) and Nezábudská Lúčka near Strečno (22.5 MW/72 GWh/y). In addition, a major pumping-storage project in Ipel (4x150MW) has been designed by SE but is highly capital-intensive (SKK 22 billion). In addition, there is no tariff on purchases at peak demand.

Three-quarters of the economic potential for small hydropower (1-10 MW) is still available, or almost 0.8 TWh (10% of total RES potential). Around 50 new projects with a unit capacity of 1 to 3 MW have been identified, mainly on the rivers Hron and Horný Váh. These projects should comply with environmental requirements.

Wind energy potential is currently estimated at 0.6 TWh/y. Since 2004, three small wind farms for a total capacity of 5 MW have been commissioned. A further 100 MW (0.1 TWh) is planned for 2010. In neighbouring Austria, a wind farm of 415 MW has been operating since 2003 and a 45 MW plant is planned in Hungary thanks to attractive feed-in tariffs.

In its investment plan for SE, ENEL plans to build new generation capacity with 100 MW of wind power and 43 MW of hydropower.

The potential for biomass includes 500 GWh of electricity generation and 200 ktoe of heat, (1,300 GWh according to the Slovak Energy Policy) or one third of the RES potential. The principal biomass resource potential is the existing forests, which cover around 40% of the territory that can be supplemented

with the planting of fast-growing trees (poplar, willow, acacia, and aspen). The second resource is waste (1.4 Mt of wood chips and black liquor) generated by the wood processing industry. The main potential users of biomass are district heating networks and individual boilers in the service sector. A wood gasification project as a substitute for lignite is envisaged for the Nováky A power plant. The systems to collect and prepare biomass have to be further developed as does the dense Austrian biomass network, which supplies multiple local district heating plants and direct users.

Biogas can be collected from landfills, water treatment plants and from agriculture and industrial processes to generate electricity, which also removes methane, a powerful GHG. Power generation from biogas is expected to increase from 2 GWh to 50 GWh by 2010. Already, a project for the main landfills is under implementation within a Dutch JI.

Geothermal energy has been used for decades, currently in 36 sites with a capacity of 131 MWt. Exploitation of the geothermal economic potential of 200 ktoe would depend on the needs of eventual nearby users such as district heating networks, spas, warehouses and industries. The largest geothermal basin is in the Košice region where a € 50 m project is under development to supply 30% of residential heat needs for Košice from 2008.

The potential of solar thermal to supply domestic hot water to collective and individual buildings is 100 ktoe. Already, 56,750 sq. m. of solar collectors (equivalent to 40 MWth producing 2 ktoe/y) are installed, in progress of 66% since 1997 and 10% (5,000 sq. m. installed in 2004). Since 2003, the full-rate VAT applies on solar collectors. Nevertheless, the energy supply from solar collectors is expected to reach 6 ktoe /150,000 sq. m. by 2010 as the current ratio of around 10 sq. m./1,000 inhabitants is below the EU 25 average (34 sq. m./1,000 inhab.) and far behind Austria where it reaches almost 300. Germany and Austria have maintained extensive development programmes to reach the current 6,200 m sq. m. and 2,400 m sq. m., respectively.

Photovoltaic has been scarcely used to supply electricity in remote areas and specific applications, having mainly been used for electricity grid monitoring and telecommunications.

Overall, most potential and projects are for power and heat generation. Thus, the level of the tariff on purchases by the grid, fixed by the authorities, will determine the development of RES. Distribution companies and SEPS are potential direct buyers aiming at reinforcing the electricity network.

Also, tax incentives for investment and use will play a key role to foster the take-off of particular market segments. For this, project developers, using

proven techniques, would have to target niche markets in concert with regional and local economic development programmes, now supported by the EU. Increasingly, the development of a solid expertise in market and project development for RES segments, as was the case with hydropower, would be needed to perform sectoral market studies and feasibility studies for most promising projects.

Critique

The use of renewable energy is still marginal, except for large-scale hydropower. Slovak energy policies have the objective of increasing the uptake of RES above its current modest share to enhance the diversity, security of energy supply and networks, reduction of pollutants and GHG emissions, as well as investment and local development. As a domestic energy source, RES can in part compensate for the declining lignite production. The market potential for RES is modest, at 4% of TPES but is diversified and usable for centralised and decentralised generation as well as off-grid. Biomass, geothermal and solar thermal could effectively provide the required low-temperature heat under economically viable conditions.

The declared goal is to reach production of 1.2 Mtoe from RES by 2010, or 6.3% of TPES, constituting 31% of the electricity generated, as agreed with the EU. On current trends, it seems obvious that these objectives will not be reached, especially in the context of growing demand. It remains to be seen if an eventual renegotiation with the European Commission may occur, leading to a new government goal of 19% of the electricity generated in 2010.

The elimination in 2004 of the qualified purchase obligation applicable to electricity distributors that existed under the previous energy legislation lessens the likelihood of effective take-off of the renewable energy sector, particularly since no significant fiscal incentives have been developed for renewable energy projects. A revised purchase obligation, based on a cost-effective approach incorporating environmental externalities, could be re-introduced either through new legislation, based on the obligation still in place for the heat sector, or through the imposition by the Ministry of Economy of a public service obligation under the 2004 Energy Act.

Overall, the current policy priority, the support programme, and regulatory and financial incentives, appear grossly insufficient to implement the stated objectives (for exploitation of the economic potential of RES). As for the energy efficiency component of the 2003 state programme, the RES component appears to manifest structural weaknesses in terms of design and lack of

resources for implementation and monitoring. No national energy agency is responsible for programme implementation in this field. Even though the evaluation may be less complex than for wide-distribution energy efficiency projects, a detailed appraisal of impacts and cost effectiveness of the programme for RES appears to be missing. In addition, RES projects are usually small and can hardly compete with the large centralised energy systems on the domestic market and increasingly on the international electricity market. The large overcapacity in electricity and the single buyer system have largely prevented new entrants from the renewable electricity market.

Realistic and affordable quantitative objectives taking into account effective potential and the state of the markets are essential. Furthermore, it is crucial to develop a coherent and ambitious action plan, which will identify priority sectors, support undertakings and bolster institutional responsibilities. Such a plan, backed by specific legislation, would need to include close monitoring of progress and cost effectiveness. Close co-ordination with the energy efficiency action plan is important because stable or reduced energy consumption will increase the share of RES in contributing to supply.

The co-coordinated measures and actions of the RES action plan would benefit from the monitoring and facilitating role of the RES Steering Committee. The public energy agency would have a central role in implementation of the plan. URSO has an important responsibility in fixing fair purchase tariffs and access to the grid for RES.

The action plan should prioritise the use of market tools, in particular purchase obligations for renewable energy and green certificates. The gradual opening of the electricity market can provide niche markets for electricity generated from RES.

OECD countries have developed broad policies and measures to foster the development of RES within the frame of their energy and environmental policies.[31] Although fiscal, regulatory and financial incentives are recognised as determinant, they are usually set for a temporary period and their cost effectiveness needs to be ensured and monitored. RES policy should target sustainability in open and competitive markets for the various segments of the renewable energy sector.

International co-funding, such as the EU programmes for RES and for regional development ("structural funds"), and the Kyoto Protocol flexibility mechanisms, could complement domestic funding sources for viable

31. *IEA* Renewable Energy Database - Policies and Measures Database *and* Dealing with Climate Change - Policies and Measures Database *(http://www.iea.org/Textbase/subjetqueries/index.asp)*.

projects. Developing these opportunities would require continuous monitoring and support at the national (SEA) and local levels. Of particular importance is the undertaking of high-quality market studies and project feasibility studies for which public co-funding through tax rebates or grants would be crucial.

Recommendations

The government of the Slovak Republic should:

- Ensure a realistic and ambitious share of renewable energy in the energy mix, supported by an adequate action plan, resources and specific regulations; assess its effectiveness and cost-benefit.
- Consider temporary tax, regulatory and financial incentives, in particular for market and project studies, and renewable energy investment projects.
- Consider the introduction of a purchase obligation for renewable energy supply for electricity distributors.
- Prioritise the use of market tools, in particular green certificates as well as the Kyoto Protocol flexibility mechanisms.

ELECTRICITY

Key Information and Data (2003)

- **Peak demand:** 4.3 GW
- **Consumption:** 28.9 TWh (final consumption: 24.2 TWh); industry (42%), services (27%), residential (20.5%)
- **Unit ratios of consumption:** 4,481 kWh per capita; 1.078 kWh/USD 1,000 GDP (1995) – OECD Europe: 0.28
- **Installed capacity:** 8.2 GW (SE: 6.9 GW)
- **Generation (gross; mix):** 31 TWh; nuclear (57.6%), coal (20.5%), hydropower (11.2%), gas (7.7%)
- **CO_2 emissions:** 8.24 Mt (21.7% of total; inc. heat production)
- **Trade capacity and flows:** 3 GW, exports (10.8 TWh), imports (8.6 TWh)
- **Average generation efficiency:** 34% (thermal plants: 31%)
- **Network losses:** 8%
- **Prices (2004):** Industry: 6.88 €cents/kWh; Residential: 8.82 €cents/kWh
- **SE's share of wholesale market:** 90-95%
- **Market opening:** Declared: 79% (1 January 2005); effective switching rate: 0%
- **Employment:** SE (9,500), SEPS (450), distribution (ZSE: 2,000, SSE: 2,300, VSE: 2,000)

Electricity accounts for 17.5% of TFC (OECD Europe and EU 15: 18.7%) and requires 10% of the primary fuel supply (28% of electricity is generated from fossil fuels). The electricity market has been reformed and the sector thoroughly restructured. Slovenské Elektrárne (SE), the third largest energy company is to be acquired by a strategic investor.

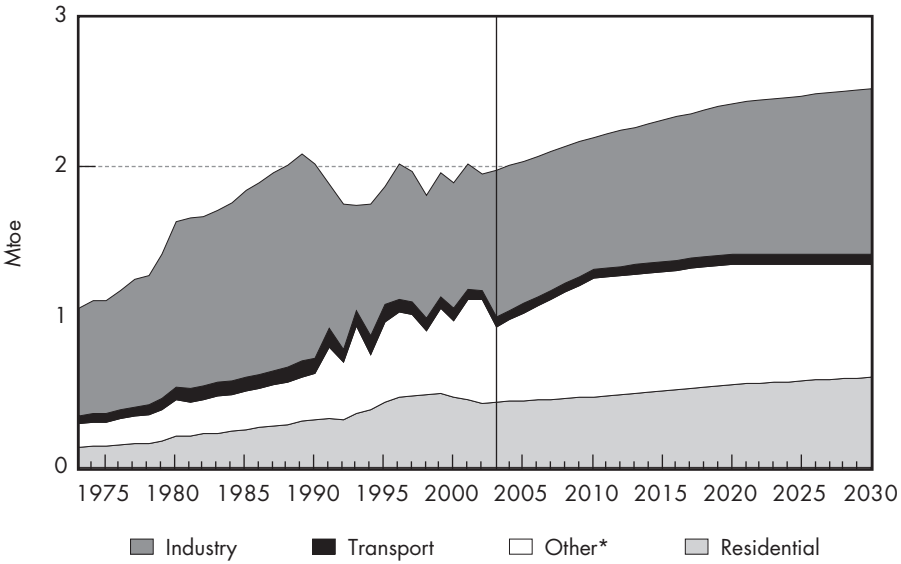
Consumption and Peak Demand: No Growth and some Distortions

Total electricity consumption was 24.2 TWh in 2003, the same as in 1989. About 42% of electricity was consumed in industry, 21% in the residential sector, 27% in the services sector, 5% in the energy sector and 3% in transport. Final consumption has remained flat since 2001 and increased only 1% between 1996 and 2003 (see Tables 20 and 21). If energy sector consumption is excluded from the electricity consumption figures, then final consumption in 2003 has decreased by 2.1% compared to 2001 and 2.2% compared to 1996.

Electricity demand growth in recent years in Slovakia is below all projections presented in the mid-1990s[32] and may be the lowest among the EU countries. A comparison of electricity demand growth rates in 2002-2003 by the UCTE places Slovakia last among the 22 member countries surveyed, up only 1.1% in 2002, well below the UCTE average increase of 3.2% for 2003.

Figure 31

Final Consumption of Electricity by Sector, 1973 to 2030



** Includes commercial, public service and agricultural sectors.*
Sources: Energy Balances of OECD Countries, *IEA/OECD Paris, 2005 and country submission.*

Electrical space and water heating account for 20% and 15% of household electricity consumption. These new uses developed in 1993 to peak in 1999 at 2.2 TWh before decreasing to 1.8 TWh in 2003, or 35% of total residential consumption. About 16% of permanent dwellings (totalling 1.7 million) use electric heaters and boilers, and this is now being stimulated by low tariffs for electrical space heating set at close to the average generation cost (see section on price regulation below), suggesting tariff distortions between uses.

32. *See IEA*, Energy Policies of the Slovak Republic, *1997 Survey, at p. 97 (describing various scenarios).*

Table 20

Electricity Supply and Demand, 1995 to 2003 (in GWh)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	1995/2003 (%)	2002/2003 (%)
Gross production	26,306	25,278	24,823	25,466	27,743	30,685	32,046	32,427	31,178	18.5	-3.9
Net production	23,009	22,357	21,648	22,502	24,816	27,323	29,609	29,937	28,715	24.8	-4.1
Imports (balance)	3,448	5,875	6,798	4,381	3,738	5,951	6,065	6,710	8,623	150.1	28.5
Exports (balance)	2,065	2,353	2,743	3,091	3,180	8,647	9,743	10,867	10,878	426.8	0.1
Used for pumped storage	438	340	295	307	336	400	262	278	262	-40.2	-5.8
Electricity supplied	23,954	25,539	25,408	23,485	25,038	24,227	25,667	25,500	26,196	9.4	2.7
Network losses	1,715	1,581	2,082	2,039	1,788	1,726	1,326*	1,108*	1,939*	13.1	75.0
Final consumption	22,239	23,958	23,326	21,446	23,250	22,501	24,341	24,435	24,257	9.1	-0.7
Energy	509	479	486	451	503	491	889*	1,675*	1,272*	149.9	-24.1
Industry	9,146	10,501	10,053	9,441	9,525	9,741	9,680	9,019	10,250*	12.1	13.6
Transport	1,379	984	1,010	1,012	903	965	767	720	726	-47.4	0.8
Residential	4,998	5,451	5,507	5,594	5,672	5,419	5,222	5,157	5,039	0.8	-2.2
Commercial and public services	5,303	5,689	5,134	4,104	5,958	5,268	7,254	7,350	6,471*	22.0	-12
Agriculture	904	854	1,136	844	689	617	529	514	499	-44.8	-2.9

** Variations attributed to change of methodology in data collection.*

Sources: IEA (1995-2000) and Statistical Office (2001-2003).

Network losses, as a percentage of final consumption, have ranged between 4.5% and 9.5% since 1996. In 2003, they reached 1.95 TWh or 8% of total consumption (0.9% for transmission and 7.1% for distribution). This places Slovakia near the average within the 21 UCTE countries.

The government has forecast electricity demand to increase from 16.6% (22.7 TWh) of Total Final Consumption (TFC) in 2002 to 17.8% (25.6 TWh) and 18.8% (30.9 TWh) of TFC by 2010 and 2020, respectively. Previous projections made in 1996 by SE of electricity demand in the range of 32-40 TWh by 2005 and 35-45 TWh by 2010 were clearly overstated.

As is the case with overall electricity consumption, peak load has not increased over the past decade. The 2005 winter peak load of 4,256 MW on 31 January 2005 was lower than the peak load in the previous five years. The 1996 peak load (4,368 MW) has only been exceeded in 2002 and 2003 (4,393 and 4,421 MW, respectively). Recent peak load (at about 4,300 MW) represents just over half of the total country installed capacity (8.2 GW) and 1.4 times of import capacities (at 3 GW in net transfer capacity).

Table 21

Evolution of Annual Electricity Peak Demand, 1996 to 2005 (in MW and GWh, with date of peak)

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005*
Date	24 Jan	18 Dec	11 Dec	1 Dec	26 Jan	13 Dec	12 Dec	9 Jan	16 Dec	31 Jan
MW	4,368	4,335	4,332	4,251	4,275	4,393	4,421	4,338	4,349	4,256
GWh	101.3	99.3	101.4	96.1	98.3	97.1	99.6	98.1	94.8	94.8

** Peak load for first half of 2005.*
Sources: SE and SEPS.

On days of peak load, the Slovak power system meets demand readily with domestic generation sources while providing substantial exports in the range of 5 to 15 GWh (and no reported imports). The sources of supply for peak days are not unlike those of other days: most of the demand is met with nuclear production (53-59%), followed by thermal (22-24%), hydro (9-15%), industrial generation (8-9%) and a small amount of pumped storage. Peak load in the summer months is usually in the range of 3.1-3.3 GW, and this is sometimes met to a small extent with imported power.

Table 22

Sources of Electricity Supply on Peak Days, 2002 to 2005

Sources of supply	12 December 2002 (%)	9 January 2003 (%)	16 December 2004 (%)	31 January 2005 (%)
Nuclear	54.6	53.3	56.9	58.9
Thermal	24.0	22.7	23.8	22.9
Hydro	12.1	14.5	9.3	9.4
Industrial	8.6	9.1	9.4	8.6
Pumped storage	0.7	0.4	0.5	0.3
	(GWh)	(GWh)	(GWh)	(GWh)
Total generation	114.5	107.3	99.8	102.4
Consumption	99.6	98.1	94.8	94.8
Exports	14.9	9.1	5.0	7.6

Source: SEPS.

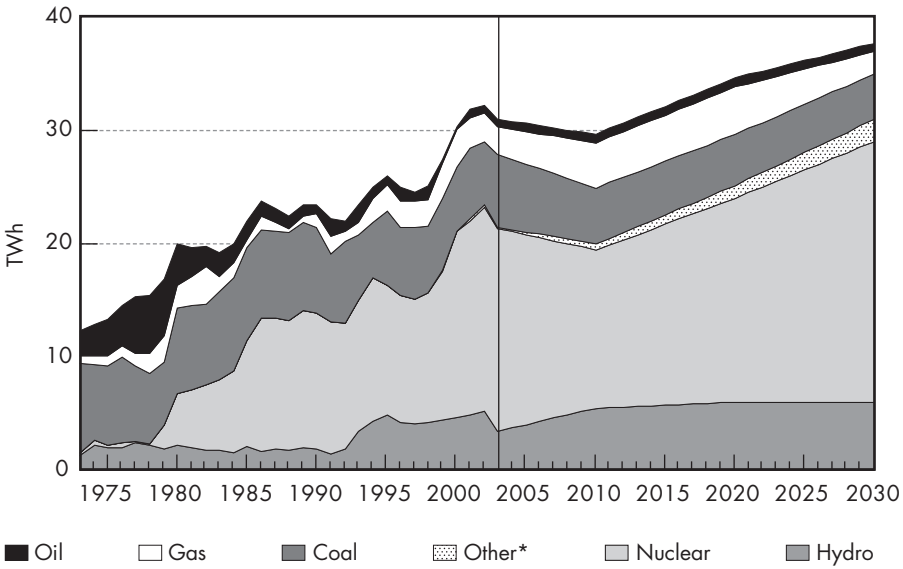
Generation: A Diversified Mix and Important Reserves, with SE as Dominant Purchaser

Total installed capacity in Slovakia at end-2003 was 8.2 GW. The capacity by fuel source is roughly balanced among nuclear (2,640 MW), thermal (3,052 MW) and hydroelectric (2,507 MW), plus 919 MW of pumped storage. As indicated above by the data on peak load, most generation on an annual basis in recent years has been nuclear (53-58 %), followed by thermal (30-35 %), and hydro (10-15 %). The development of the generation mix over the period 1973 to 2003 is set forth in Figure 32.

Almost all of the large power plants with a capacity of more than 100 MW are owned by SE (see Table 24). There are only a few independent power producers (IPPs) – private entities such as Paroplynový cyklus (PPC) in Bratislava (218 MW), commissioned in 1996. Average annual operating hours exceed 4,000 hours, with nuclear power plants at base load (6,500-7,000 hours), coal-fired plants at 2,500-4,000 hours, Gabčíkovo hydropower plant at 2,500 hours and the two hydropower pump storage plants at below 500 hours, suggesting relative underutilisation of these hydropower plants.

Figure 32

Electricity Generation by Source, 1973 to 2030



** Includes geothermal, solar, wind, combustible renewables and waste.*

Sources: Energy Balances of OECD Countries, *IEA/OECD Paris, 2005 and country submission.*

Generation assets continue to be concentrated within SE, which possesses 84% of installed capacity and accounts for 84% of total generation (26 TWh in 2003, and 25.6 TWh in 2004). Industrial self-producers generated 2.9 TWh in 2003 (9.3%), and the balance comes from independent power producers (2.2 TWh, 7%). SE's generation mix in 2004 relied for two thirds on nuclear, 18% on thermal and 15.5% on hydro.

The three distribution companies own little generation capacity and produce negligible amounts. VSE in the east has no generation capacity, taking its supply from SE. There are five large CHP plants with a combined capacity of 322 MW that connect to the distribution networks, as well as more than 170 mini-hydro plants (32 MW) and 513 MW belonging to 26 industrial self-generators. SE continues to buy generation from these independent generators and resells it to distribution companies and others (see below).

The present development of distributed generation appears to be limited. The rules have not been designed to encourage such development, and the three distribution companies have not indicated any recent initiatives or proposals for new generation installations in their areas.

Table 23

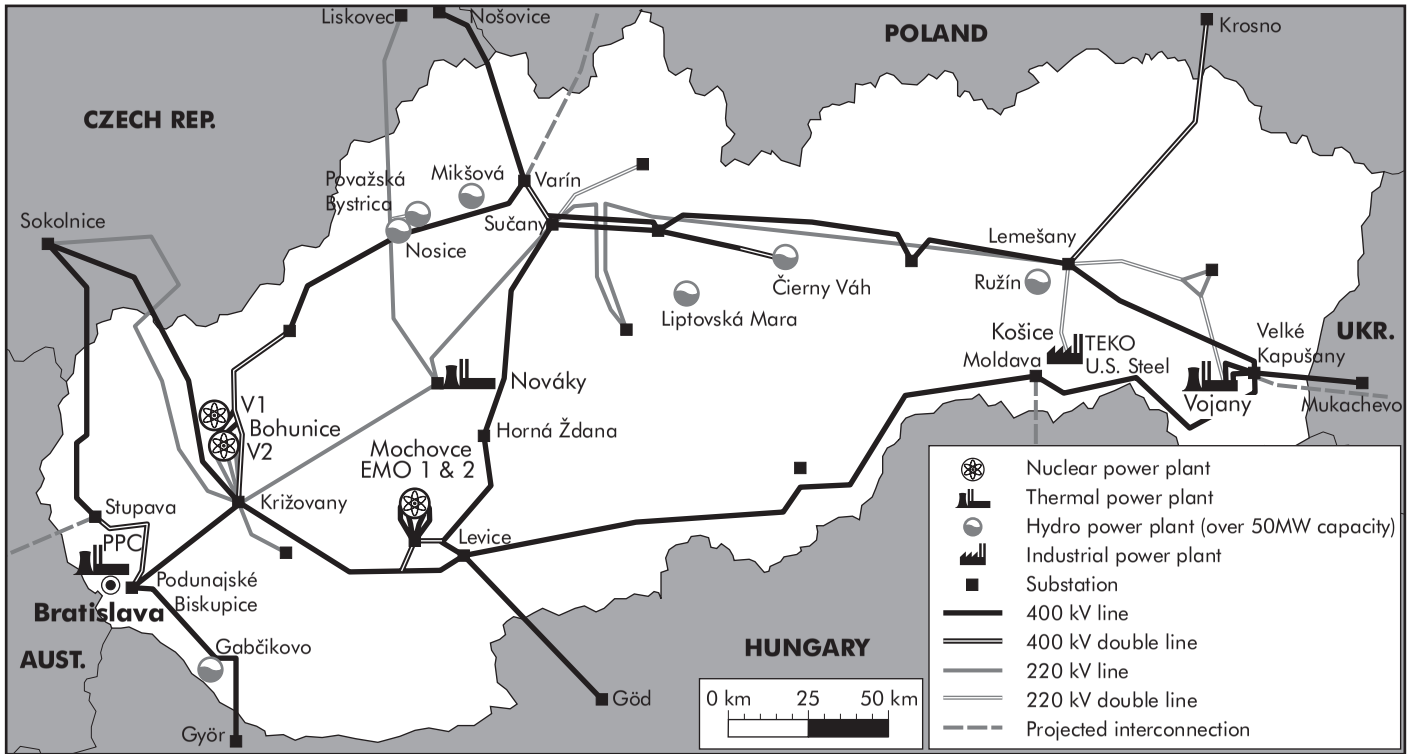
Main Electricity Generation Plants, 2003

Owner	Name	Type (Fuel)	Units × Capacity (MW)	Total capacity (MW)	Annual gross generation (TWh)	Efficiency (%)	Date of commissioning
Slovenské	Bohunice V-1	Nuclear	2 × 440	880	5.9	29	1978, 1980
Elektrárne	Bohunice V-2	Nuclear	2 × 440	880	5.7	29	1984, 1985
(SE)	Mochovce EMO 1&2	Nuclear	2 × 440	880	6.2	30	1998, 2000
	Gabčíkovo	Hydro	8 × 90	720	1.8	100	1992 –1995
	Cierny Vah	Hydro pump storage	6 × 122.40 1 × 0.76	735	0.2	100	1982
	Vojany 1	Thermal (black coal)	6 × 110	660	2.7	30	1965 –1967
	Vojany 2	Thermal (gas, fuel oil)	6 × 110	660	0.1	28	1973 –1974
	Nováky A	Thermal (brown coal)	82	82	0.2	22	1953 -1957, 1996
	Nováky B	Thermal (brown coal)	4 × 110	440	1.7	27	1964, 1976
	Liptovská Mara	Hydro pump storage	2 × 50.00 2 × 49.00	198	0.1	90	1975
PPC a.s.	PPC Bratislava	CCGT/CHP (gas)	1×218	218	1.1	88	1996
US Steel Košice	US Steel Košice	[coke-oven, blast furnace gas]	N/A	183	1.0	30	N/A
Teplárne Košice, a.s.	TEKO	CHP1 x 55 (black coal, gas)	1 x 66	121	0.4	30	N/A
Slovnaft	Slovnaft Bratislava	Oil	N/A	100	0.7	29	1994
TOTAL				**6,757 (82% of total)**	**27.8 (89.7% of total)**	**30**	

Source: SE.

Figure 33

Map of Generation Plants (by Type and Location) and Transmission Network, 2004

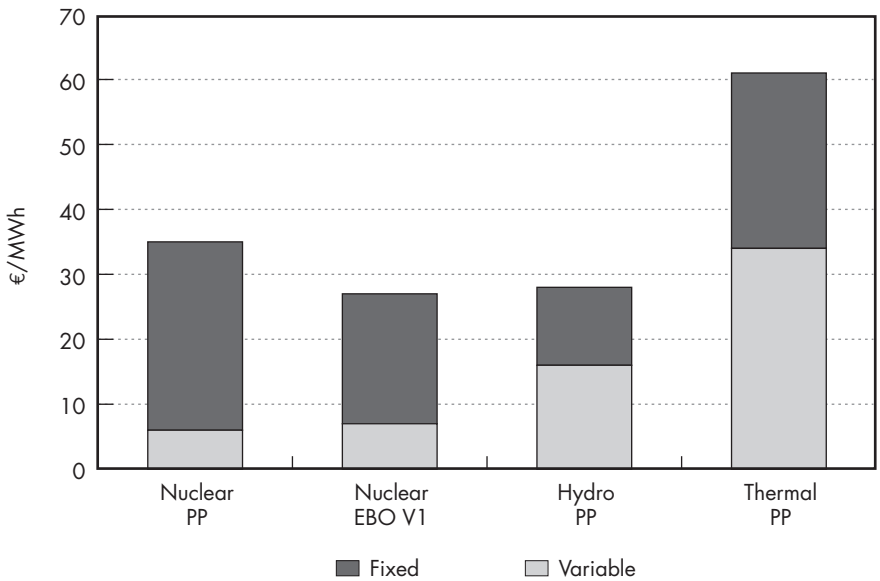


Sources: SE and SEPS.

Hydropower is the least expensive form of SE's generation. For 2003, SE's average generation cost for all its units was about 1,560 SKK/MWh or € 39/MWh with hydropower at € 28/MWh, nuclear at 35 and coal-fired thermal plants at 61 (see Figure 34).

Figure 34

Generation Costs of SE Power Plants, 2003



Note: PP: power plant.

Source: SE.

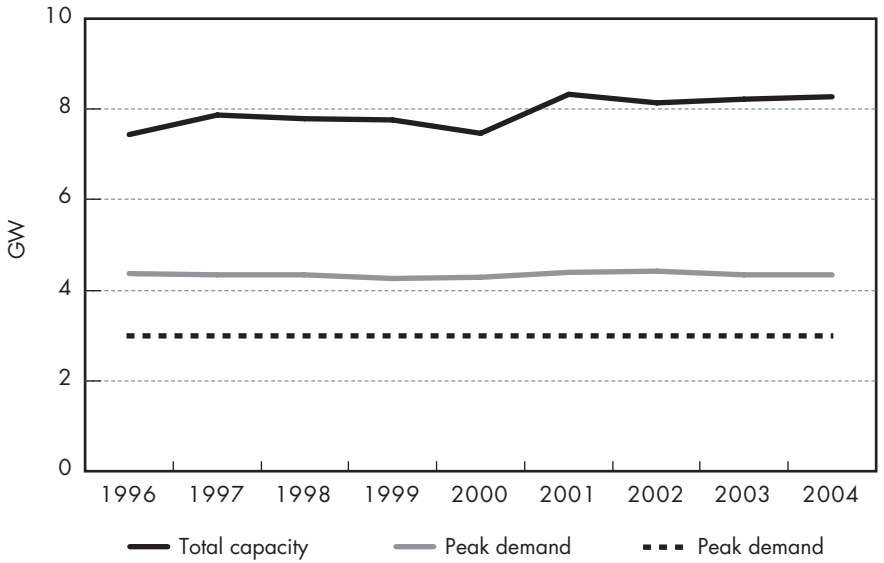
Supply and Demand Balance

Total installed generation capacity is 8.2 GW and peak load was 4.25 GW in the winter of 2005, indicating an apparent reserve margin of 93% in domestic generation. When adding a value of 3.0 GW for import capacity (see section below on transmission) to total capacity, then the reserve margin would be 164%. As a percentage of installed capacity, this import capacity is 37%, which compares favourably to most EU member states, exceeded only by Denmark, the Baltic countries, Hungary, Luxembourg and Slovenia.[33]

33. *European Commission, Fifth Benchmarking Report, SEC(2004) 1720, technical annexes.*

Figure 35

Total Capacity and Demand of Electricity, Import Capacity, 1996 to 2004



Sources: Energy Balances of OECD Countries, IEA/OECD Paris, 2005 and SEPS.

The domestic reserve margin is expected to decrease in the short-term due to the scheduled decommissioning of a series of large generation installations beginning in 2005, which will not be replaced by new capacity coming on-line. Nevertheless, demand growth has been slow recently. Roughly 1,594 MW of SE's capacity is scheduled to be closed by 2010, representing 19% of total capacity and as much as 25% of current production.

The Slovak government agreed with the EU in the late 1990s to close blocks 1 and 2 of the V-1 Jaslovské Bohunice (EBO) nuclear power plant (2 X 440 MW) in advance of their technical lifetime. The legal obligation, as set forth in both Slovak law[34] and the Accession Treaty is to close the first unit by 31 December 2006 and the second unit by 31 December 2008 and subsequently to decommission the units.

In addition, the government expects that about 200 MW of capacity owned by independent producers and district heating will be shut down between 2003 and 2010.

34. Government Regulation 801/1999.

Several other thermal plants owned by SE will also be decommissioned for environmental reasons (*i.e.* to comply with new emission limits in particular for SO2) in coming years, totalling 714 MW of SE's generation capacity (see Table 24).

Table 24

Decommissioning of Electricity Generation Capacities to 2010

Owner	Name	Type/Fuel	Description of units	Total capacity (MW)	Annual generation (TWh)	Year of decommissioning
Slovenské Elektrárne	Bohunice V-1 & V-2	Nuclear	2 × 440	880	5.2 – 6.3	2006, 2008
	Vojany 1	Thermal (hard coal)	Units 3 and 4	220	0.4 – 1.1	2006
	Vojany 2	Thermal (fuel oil)	Units 25 and 26	220	0.1 - 0.8	2006
	Nováky A	Thermal (brown coal)	TG 2 and 3	54	0.1	2005
	Nováky B	Thermal (brown coal)	Units 3 and 4	220	0.7 - 1.1	2006
	TOTAL			**1,594**	**6.5 - 9.4**	

Source: Ministry of Economy.

Important decisions on new generation capacities, which have been delayed because of the ongoing privatisation process of SE, were made in 2005. These decisions will affect the outlook and requirements for security of supply. As indicated by the UCTE in its most recent system adequacy forecast, the commissioning of 510 MW of fossil-fuel fired capacity is foreseen by 2010 and in the best estimate scenario the commissioning of 2 x 410 MW units of the Mochovce Nuclear Power Plant (EMO 3 & 4) and 188 MW of a fossil fuel power plant are considered for the year 2015.

In August 2005, ENEL submitted its investment for SE (see box below). As of early 2005, the forecast is that SE will have 6.5 GW of generation capacity operating in 2010, as compared to 6.9 GW at present, or a reduction in SE's capacity limited to 6% during this period with the completion of EMO 3 & 4 (-19% without). In total, rated capacity is expected to reach 7.6 GW in 2010. This would leave a domestic reserve margin of 1.8 times of the winter peak

(2005) and 2.3 times of the summer peak (2004), respectively. In any case, the above-mentioned significant import capacity of 3 GW is available (see section on transmission below).

Table 25

Forecast Electricity Generation Capacities of SE to 2010 (by fuel, GW)

	Nuclear	Coal	Natural gas	Hydro	Total capacity
Operating capacity	2.6	1.2	0.7	2.4	6.9
Under construction	0	0	0	0	0
Capacity authorised	0.9	0	0	0	0.9
Other planned capacity	0	0.1	0.2	0	0.3
Fuel conversion	0	0	0	0	0.0
Decommissioning	–0.9	–0.5	–0.2	0	–1.6
TOTAL	**2.6**	**0.8**	**0.7**	**2.4**	**6.5**

Source: Ministry of Economy.

Present plans for new generation capacity to be constructed during the period until 2010 include possible IPPs, such as a 385 MW CCGT project at Malženice, as proposed by Siemens and Advanced Power and authorised by the Ministry of Economy.

Total generation in Slovakia is forecast to decrease by 3.5% (or 1.1 TWh) between 2003 and 2010 but to increase 18% (or 5.45 TWh) between 2010 and 2020. The expected shortfall in domestic generation resulting from decommissioning in coming years will be met in part by an increase in the level of imports.

Transmission and Cross-border flows: Significant Capacities

The capacity of the Slovak power network is more than adequate by most standards, although there is some congestion in the southward flow on the Slovak-Hungarian border. Using the preliminary indicative values published

by ETSO for "Net Transfer Capacity" (NTC)[35], the import capacity as reported by Slovakia amounts to 3.0 GW, if considered cumulatively.[36] This value is 37% of installed capacity, well above the EU indicative target of 10% agreed in 2002 for each Member State. It could cover 70% and 90% of peak and base load, respectively. Total domestic transformation capacity is 9,010 MVA and the cross-border lines have a theoretical maximum capacity totalling 9,350 MVA (see Table 26).

The transmission entity, Slovenská elektrizačná prenosová sústava, a.s. ("SEPS"), was established in January 2002 and received a 20-year licence for electricity transit and distribution by URSO.[37] SEPS was appointed in 2002 as transmission system operator (TSO) by the Ministry of Economy, which exercises all shareholders' rights. Shortly after its formation, SEPS became a member of CENTREL, the regional group of four transmission system operators, representing an interconnected system with a combined 64 GW of generation capacity and electricity export balances ranging between 1.9 and 3.5 GW per month.[38] As TSO, SEPS is responsible, *inter alia*, for ensuring balancing and settlement of deviations, purchase and exchange of system and ancillary services, assigning transmission capacity, concluding contracts on access and connections, adopting a compensation mechanism for cross-border flows of electricity, and various planning, monitoring and reporting functions.[39] An electricity market operator is not required under Slovak law and none has been designated.

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35. *In estimating the maximum volume of generation that can be wheeled from one onterconnected system to another, the European Transmission System Operator's Association (ETSO) has agreed on common definitions on ¨transfer capacities¨ for international electricity exchanges in the EU internal energy market. These relate to the notions of Net Transfer Capacity (NTC), calculated as the difference between the Total Transfer Capacity (i.e. the maximum feasible volume) and the Transmission Reliability Margin (covering uncertainties). The resulting NTC value is to be interpreted as the expected maximum volume of generation that can be wheeled through the interface between two systems which does not lead to network constraints in either system, respecting some uncertainties about future network conditions due to imperfect information from market players and the intervention of unexpected real time events.*

36. *ETSO, Winter 2004-2005, NTC data, at peak hours on a working day. The values reported to ETSO by SEPS for import capacity (NTC) by border are, respectively: CZ to SK, 1,550 MW; PL to SK, 750 MW; HU to SK, 200 MW; and UA to SK, 500 MW, for a total of 3.0 GW. The Czech TSO, CEPS, reports a higher value of 2,330 MW for the CZ to SK transmission lines, which would mean a total import capacity (in NTC) of 3,780 GW. Using the Czech value for the Czech-Slovak border would make the sum of the NTC values, if considered cumulatively, higher than Slovakia's summer peak demand (3.1 – 3.3 GW) and close to its winter peak demand (4.2 GW in winter 2005). Slovak export capacity in NTC is nearly equal in value, at 2.95 GW. However, ETSO cautions that these values should be considered separately and are not cumulative.*

37. *For voltage level of 220 kV and above.*

38. *UCTE, System Adequacy Retrospect 2003, at 20, 40 (indicating a 4-country 3.5 GW export balance for January 2003 and 1.9 GW in August 2003 for the Czech and Slovak Republics, Poland and Hungary).*

39. *SEPS is not prohibited from engaging in electricity market activities other than transmission. However, if SEPS were to become involved in supply or generation activities, it would become subject to rules on vertically integrated undertakings and would have to undertake organisational measures that satisfy specific minimum criteria on functional independence (compliance, managerial independence, etc.), as set forth in some detail in Article 10(2) of the Electricity Directive and in Article 23 of the 2004 Energy Act.*

Table 26

Capacity of Existing and Planned Electricity Interconnections, 2003 (400 and 220 kV)

From – To	Type	Voltage (kV)	Capacity (one circuit) (MVA)
Existing			
Varin SK – Nošovice CZ	Single	400	1,386
Križovany SK – Sokolnice CZ	Single	400	1,323
Stupava SK – Sokolnice CZ	Single	400	831
Považská Bystrica SK – Lískovec CZ	Single	220	274
Senica SK – Sokolnice CZ	Single	220	326
Lemešany SK – Krosno PL	Double	2 × 400	1,662
Vel'ké Kapušany SK – Mukačevo UA	Single	400	831
Gabčíkovo SK – Györ H	Single	400	1,386
Levice SK – Göd H	Single	400	1,330
TOTAL			**9,350**
Planned			
Ukraine border – Vel'ké Kapušany SK	Double	2 ×400	1,000
Vienna AU – Stupava SK	Double	2 ×400	1,000
Byczyna PL – Varín SK	Double	2 ×400	1,000
Sajóivánka HU – Moldava/ Rimavská Sobota SK	Double	2 ×400	1,000

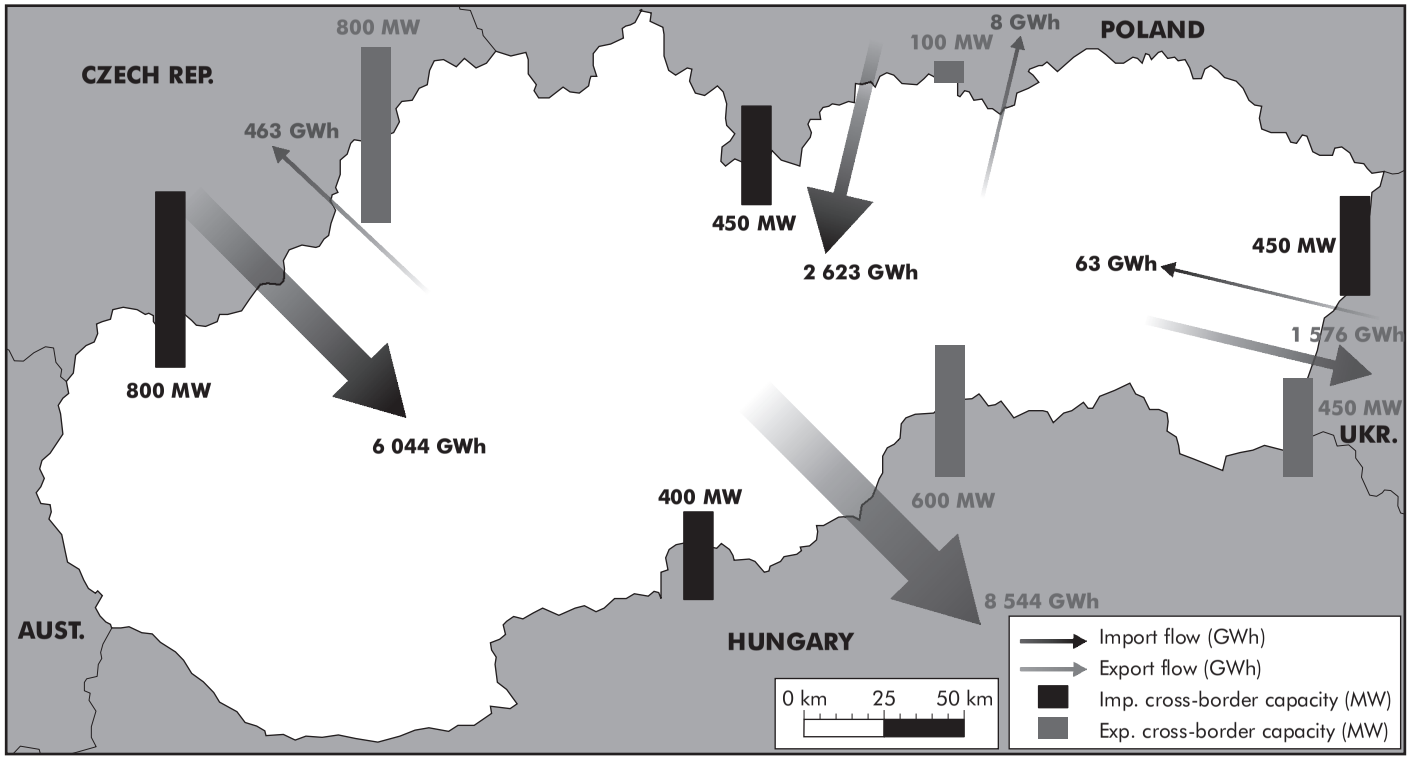
Sources: Ministry of Economy and SEPS.

Cross-border electricity exchanges on the Slovak network are substantial and reflect a general flow from north to south. In 2004, the net export of 1.86 TWh consisted of imports of 6 TWh from Czech Republic and 2.6 TWh from Poland, and exports of 8.5 TWh to Hungary and 1.5 TWh to Ukraine. Slovakia reached a balance between imports and exports of electricity in 1999. In the years 2001 and 2002, it became a significant exporter of electricity (33-36% of net generation), with a net exports of 3.7 and 4.1 TWh, respectively. This export surplus has declined somewhat in 2003 and 2004, as imports increased to 8.6 TWh in both years. The government expects a reduction of exports for the period 2006-2008 and a net import situation after 2008.

The decommissioning of generation capacity beginning in 2006 and the anticipated need to import larger electricity volumes are factors being cited by the Ministry of Economy in planning the further development of the Slovak

Figure 36

Map of Import and Export Flows (GWh) and Cross-border Capacities (MW), 2004



Source: SEPS.

transmission grid. The government has indicated that new transmission lines should be developed by SEPS, as owner of all electricity transmission facilities in the Slovak territory. No indication has been given that open tendering procedures would be used in the future to determine either the entity or the remuneration for carrying out the planned expansion of the transmission grid. However, the 2004 Energy Act provides for the possibility that the Ministry of Economy could oblige SEPS as grid operator to take measures for the development of new transmission lines as a public service obligation (PSO) under certain conditions (see section on regulation below). Feasibility studies have been completed for double 400 kV transmission lines that are in the planning phase (see Table 26).

The proposed 2 x 400 kV interconnection with Austria is a long-standing proposition that was subject to a governmental agreement dating back to 1993, but which has been hindered by public opposition and the threat of legal challenges in Austrian courts. Completion of such a line would improve security of supply for both countries, but would allow nuclear-generated power to be exported to Austria. There seems to be no political process or initiative at present to resolve this state of non-development. The proposed third interconnection with Hungary would serve to relieve congestion on the existing lines.

SEPS has been developing principles for congestion management on the interconnectors under the supervision of the regulator. Common monthly auctions of available transfer capacities (ATC) on the Czech-Slovak profile began in May 2003. These are jointly organised by SEPS and ČEPS, the Czech TSO.

The congestion situation differs by border, as the flow from north to south is pronounced, but not from east to west. The transmission lines between Slovakia and Hungary are the most congested. Auctions of the available, non-reserved capacity in the direction of Hungary generate the highest price in the annual auction. In contrast, a few profiles, such as Poland to Slovakia and Slovakia to Ukraine, have not generated any price in the 2005 annual auction.

Monthly auctions of cross-border transmission capacity for all four countries have been conducted during 2005 by the SEPS Auction Office. In the first half of 2005, the prices paid in the jointly organised auctions for the capacity on the Czech-Slovak interconnectors (the ČEPS-SEPS profile) were stable at 6-7 € cents/MWh through April.

The highest prices are paid for Slovakia to Hungary profile, which is usually the most sought after and not always available on a monthly basis (*e.g.* no

Table 27

Results of Annual Auction of Electricity Cross-border Profiles, 2005

Profile	Available transfer capacity (MW)	Offered capacity (MW)	Allocated capacity (MW)	Auction price (€/MW)
SEPS to ČEPS (Czech Rep.)	800	800	800	312
ČEPS to SEPS	800	800	785	1,664
SEPS to PSE (Poland)	100	100	90	438
PSE to SEPS	450	450	430	0
SEPS to MAVIR (Hungary)	600	250	250	48,180
MAVIR to SEPS	400	200	195	266
SEPS to WPS (Ukraine)	450	450	395	0
WPS to SEPS	450	450	425	1
TOTAL	**1.95 GW for export 2.10 GW for import**	**1.6 GW for export 1.9 GW for import**	**1.54 GW for export 1.85 GW for import**	–

Source: SEPS.

capacity has been offered in alternating months). In March 2005, traders paid € 4.04/MWh for 121 MW of capacity from Slovakia to Hungary. In contrast, capacity from Slovakia into the Ukraine is free. Prices paid for the 20 MW of capacity being offered from Poland into Slovakia were high in the January auction at € 3.68/MWh, and were between € 0.39 and 1.31/MWh in subsequent months.

Daily auctions are being developed for all four profiles, and inter-daily auctions are also envisaged. Daily auctions on the Czech-Slovak links, which used to be a single network in the past, are the most developed and use a "netting" principle. For the Ukrainian (WPS) and Polish (PSE) profiles, SEPS began daily capacity allocations on a one-sided basis (*i.e.* SEPS only).

Distribution: Advanced Process

The three distribution companies were separate units within the state-owned Slovak Power Enterprise (SEP) as of January 1977. The distribution units were

separated from SEP after 1990 as distinct state-owned enterprises. In January 2002, these were corporatised and entered into the commercial register of companies. The preparations of the distribution companies for legal and managerial unbundling have begun and should be completed no later than 1 July 2007.

Table 28

Electricity Distribution and Supply Companies, 2003

Company	Full name	Number of customers (supply points)		Sales (TWh)	Network losses (%)	Number of employees
		High voltage	Low voltage			
ZSE	Západoslovenská energetika, a.s.	4,685	980,696	7.3	8.5%	1,988
SSE	Stredoslovenská energetika, a.s.	5,023	687,332	6.3	7.2%	2,293
VSE	Východoslovenská energetika, a.s.	1,925	508,803	4.6	8.4%	1,950
SE	Slovenské elektrárne, a.s.	4	–	3.5	N/A	9,504
TOTAL	–	11,637	2.176,831	19.7	8%	15,735

Source: Ministry of Economy.

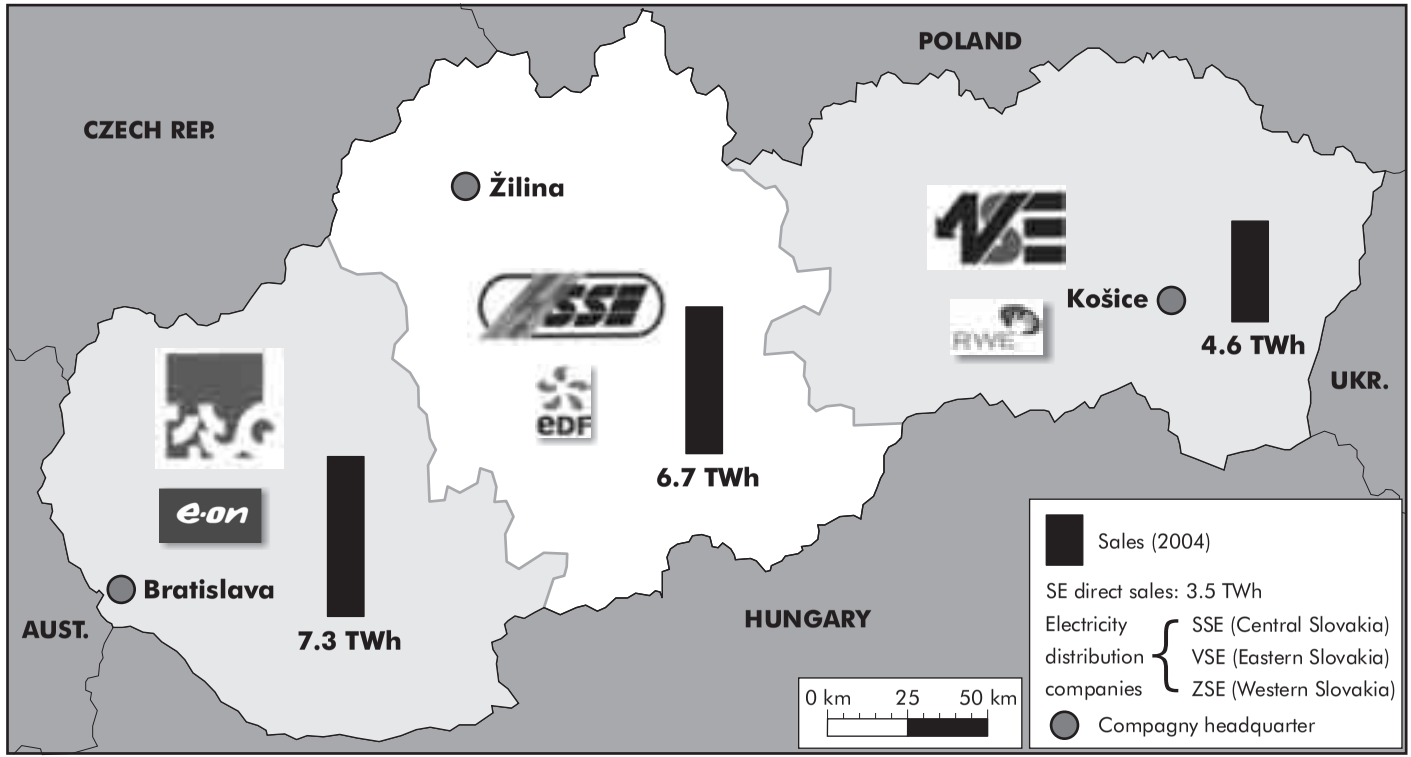
The three distribution companies purchase most of their electricity supply from SE as a consequence of the single buyer system of the past. They are not prohibited from buying from other companies or from importing. The government's policy position is that market forces should determine the level of imports. However, the historic relationship between SE and the distribution companies enables SE to more readily influence them to limit their imports, arguing that this serves to keep the costs of ancillary services low.

The eastern distribution company, VSE, which has no generation capacity of its own, takes virtually 100% of its electricity from SE. In the central region, SE has suggested to the distributor SSE that limiting imports to about 10% of demand would be a useful guideline to help maintain the cost of ancillary services at SE's generation base load profile of 2,600 MW or more. The western distribution company, ZSE, has reported generally that it has imported electricity in 2003 and 2004 and that it aims to import more power from the Czech Republic in 2005.

At present, the regulator has been developing some means to improve demand management techniques by the distribution companies, but the

Figure 37

Map of Supply Areas of the Electricity Distribution Companies



Source: Country submission.

current price control is not specifically geared in this way. Moreover, with stagnating consumption due to the steep increases in electricity prices, calls for demand management measures are not treated with urgency although they could provide least cost options to cope with the future decommissioning of generation units. The policy is apparently to monitor the progress of the proposed EU Directives on energy end-use efficiency and on safeguarding security of electricity supply and to respond accordingly.

The 2004 Energy Act provides general rules for the electricity distribution sector relating to energy efficiency, but the obligations are less consumer-oriented than in the past. Distribution system operators, upon making decisions on the development of the distribution system, must take into account the need to ensure energy efficiency of the system, such that it could provide for energy efficiency even without new additional investment into distribution facilities. Under the 1998 energy law, electricity distribution licensees were required to provide consumers with information about the possibilities of "economical utilisation of the energy supplied" as well as on prices and tariffs. However, this obligation was not carried forward to the 2004 Energy Act.

Restructuring and Privatisation: Impressive Achievements, Challenges Still Ahead

The process of restructuring and gradual privatisation of the Slovak electricity sector covers a period of about ten years (see Table 3), starting in November 1994 when Slovenské Elektrárne, a.s. was first established as a joint stock company. The company was re-entered into the commercial register as a new entity in January 2002 following its division into three separate entities, Slovenské Elektrárne, a.s. ("SE"), Slovenská elektrizačná prenosová sústava, a.s. ("SEPS"), and Tepláren Košice, a.s. ("TEKO").

The previous governmental policy against electricity privatisation, as reflected in the 1992 Act on State Strategic Interests and the 1997 energy policy statement, has been reversed in that the government is no longer seeking to maintain majority stakes in SE and the three electricity distribution companies. However, the Ministry of Economy exercises shareholder's rights over the transmission company, SEPS, and intends to keep SEPS in 100% state ownership in accordance with the Privatisation Act and related decrees.

In 2002, E.ON Energie acquired 40% of ZSE (Western Slovakia) together with the European Bank for Reconstruction and Development (EBRD) (9% of shares). Electricité de France (EdF) International and RWE purchased 49% of SSE (Central Slovakia) and VSE (Eastern Slovakia), respectively.

SE Privatisation and Investment Plan

The sale of a 66% equity stake in SE to ENEL for SKK 32.8 billion (€ 840 m) and an assumed debt of SKK 42 billion was agreed in February 2005 with an initial transfer of 6.6% of the shares and cleared under the EU merger rules in April 2005. This share purchase agreement is subject to numerous prior conditions, which include:

- The divestment of the Gabčíkovo hydroelectric plant to the state-run concern, Vodohospodárska výstavba and the agreement on how to operate it;
- The transfer of all assets and liabilities of the A1 and V-1 nuclear plants in Jaslovske Bohunice (under decommissioning or to be decommissioned) and of the nuclear waste management company, VYZ to GOVCO, a state-owned company;
- The amendment (or replacement) of the Slovak law on decommissioning of nuclear installations;
- The adoption of electricity market rules as a government regulation;
- The determination of fees applicable to hydroelectric installations for the use of water, which may impact upon the purchase price.

Following the transaction, SE would hold 5.2 GW or 64% of total installed capacity. Both parties have committed to agree on an initial strategic investment plan as well as a five-year generation investment plan by the end of June 2005 that should address the completion of the third and the fourth blocks of the Mochovce nuclear power plant by 2009, depending on a feasibility study developed by SE for these units or a comparable plant at another site. Expenditures required to complete reactors 3&4 at Mochovce were estimated roughly at SKK 45 billion, and other investments could require another SKK 80 to 120 billion.

ENEL submitted to the government its investment plan for the next five years for SE, which includes the completion of EMO 3&4 at a revised cost of SKK 64 billion, increase of net capacity of nuclear power plants V-2 (62 MW, SKK 3 billion) and EMO 1&2 (62 MW, SKK 0.04 billion), renovation of Novaky A thermal power plant (98 MW, SKK 1.3 billion), building of wind power generation (100 MW, SKK 5.7 billion) and hydropower (43 MW, SKK 5.4 billion). The government and NPF announced their agreement on this plan in October 2005. These new investments will maintain the SE's share in total generation at 85%.

The total investment cost for additional 1.3 GW of new capacity will be SKK 79.5 billion to be funded by SE as ENEL announced that SE will not pay dividends to its shareholders before 2012. The State, future minority shareholder (34%), will not finance the investment plan. The buyer has committed itself to respecting SE's existing long-term loss-making contracts with certain third parties, such as Slovalco, PPC, and Oravské Iron-Alloys (OFZ). Nevertheless, in August 2005, ENEL appears to have requested a renegotiation on its obligations for these contracts. Once all issues are settled, the NPF is scheduled to transfer the remainder of SE shares (59.4%) to ENEL early in 2006.

In the case of the three distribution companies, the Ministry of Economy is seeking to continue the privatisation process that began with sales of 49% of the three distribution companies to different strategic investors in 2002. It intends to offer for sale its remaining stakes on a gradual and individual basis to private investors and via stock exchange flotation (10%). In early 2005 a preliminary agreement was reached with EON for the sale of the state's remaining 41% stake in the western distribution company, ZSE. The transaction is expected to be finalised in 2006.

The privatisation policy in the electricity sector has also been extended to the independent power producer, Paroplynový Cyklus (PPC). In February 2004, the Slovak investor PPC Holding won a tender for the purchase of a 90% stake in the relatively small gas and steam energy producer (218 MW), at a sales price of SKK 2 billion. PPC Holding is a subsidiary of the ex-steelmaker VSŽ Kišice (in which Penta controls 89%), and its strategic partner the Swiss electricity company ATEL. This acquisition was approved by the Slovak Anti-Monopoly Office in March 2004. The remaining 10% stake is held by SE. Penta has been negotiating with SE over a possible sale of its stake, which could lead to the annulment of the power purchase agreement that requires SE to purchase electricity from PPC until 2013.

Contracting Conditions: The Single Buyer System is Progressively Receding

Under the 1998 energy law, SE was appointed by the Ministry of Economy as the single buyer for the power network. Consistent with this concept, it entered into long-term contracts with certain producers, such as PPC in Bratislava, in which SE has held a 10% share since 1996. While SE no longer officially serves as single buyer, reports indicate that SE has been

acting as single buyer since market opening in 2002. Its dominance of the domestic market is still evident in 2004, when it purchased 1.50 TWh from independent generators, including 1.1 TWh from PPC.

SE provided electricity for domestic sales in 2003 of 21.6 TWh, or 82% of electricity supplied (including network losses). SE sells power in the domestic market to the three distribution companies (17.8 TWh in 2003) and directly to four large customers (3.5 TWh in 2003). SE exported about 8.6 TWh in both 2002 and 2003, less than half of which comes from its plants (3.6 TWh in 2003). SE imported 5 TWh in 2003 out of a country total of 8.6 TWh. The three regional companies imported the remainder (3.6 TWh).

The market is changing rapidly- SE reports that imports by eligible customers were up in 2004. Some of SE's market influence over the distribution companies may be diminishing; in 2004 it sold 18% less power to the distribution companies (14.6 TWh). This loss was offset in part by selling 11% more to its direct customers (3.9 TWh). For 2005, SE forecasts that total electricity sales should reach 23.7 TWh.

SE's direct sales to its high-voltage customers, such as aluminium, steel or ferro-alloy producers (OFZ-Oravské Iron-Alloys), may be structured to stimulate energy intensive activity. In the case of the aluminium producer, Slovalco, SE's long-term supply agreement (until 2013/2017) reportedly sets an exceptionally low price of SKK 0.8 (€ 0.02) per kWh. Such sales have significantly affected load growth and consumption figures in the past.[40] In 2004, SE sold 3.9 TWh to its direct customers, an increase of 11% in 2003 (3.5 TWh) and representing more than one third of industrial consumption.

SEPS is required to purchase the necessary support services through bilateral contracts, and transmission/distribution services are provided under contract in accordance with regulated prices. In 2003, SE was the only provider of support services to SEPS, with sales amounting to SKK 8 billion, representing 17% of SE's revenues. The regulator capped SE's share of the support services market in 2004, and new players have reportedly gained a small share (5%) of this market. For 2005, as in previous years, the conclusion of an agreement between SE and SEPS on provision of support services has entailed delay and contentious negotiations. The introduction of market mechanisms for these services, probably in the form of auctions, is addressed by electricity market rules adopted in March 2005.

The distribution companies and final consumers directly connected to the transmission grid are charged fees by SEPS for balancing services, and these

40. *IEA*, Energy Policies of the Slovak Republic, *1997 Survey, at p. 96.*

fees are regulated under price regulatory decrees issued by URSO. For the high voltage customers, this market is not functioning as intended in all cases. SE and SEPS have not been able to agree on remuneration for balancing services provided by SEPS as relating to SE's power supply to direct customers under long-term agreements concluded prior to the restructuring. These long-term agreements, such as SE's supply agreement with the aluminium smelter, Slovalco, do not address such services and have not yet been renegotiated to update them to the new market context. In 2003, URSO held discussions with the companies in attempting to resolve the issue, but concluded that this would require the intervention of the Ministry of Economy.

Governmental Oversight and Regulation

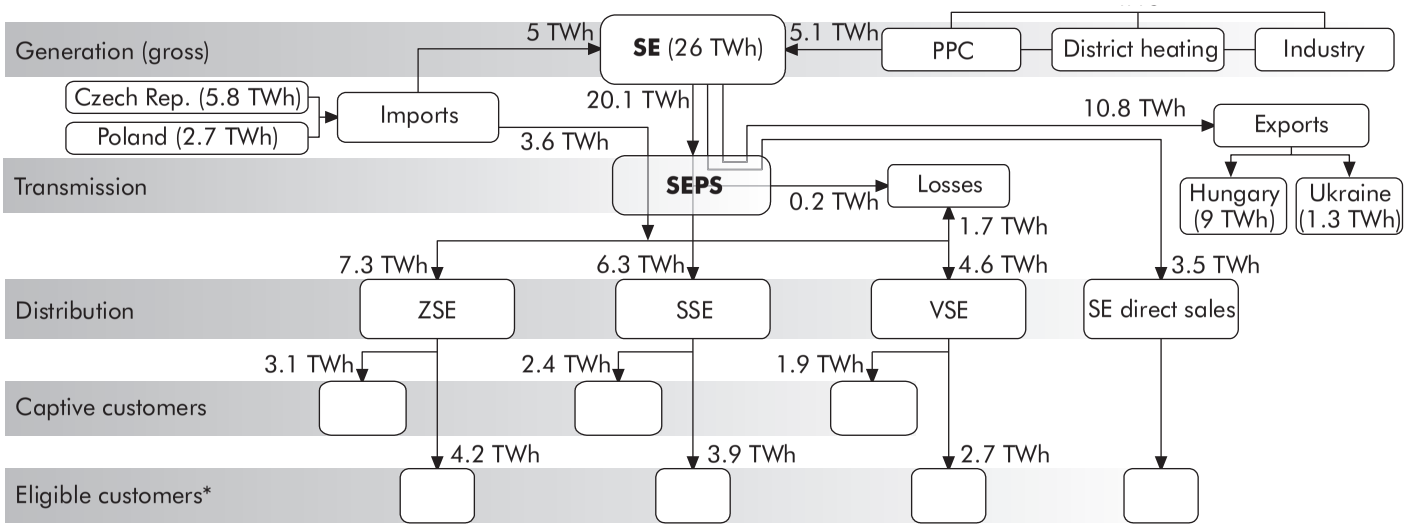
Under the 2004 energy legislation, the state has less discretion than before in the regulation of the electricity sector, in large part due to the new responsibilities charged to the regulator. Nevertheless, efforts have been made in drafting the current legislation to retain some scope for governmental discretion and possible intervention in the electricity sector. Examples of this in the 2004 Energy Act are the mechanisms for imposition of public service obligations, the rules on possible tendering procedures, and Ministerial consents for new energy facilities.

- **Ministry of Economy**

Under its public service obligations (PSOs), the Ministry of Economy decides whether to impose "obligations in the general economic interest" according to the 2004 Energy Act. This section allows the Ministry to impose PSOs on electricity undertakings with respect to the security, regularity, quality, price or energy efficiency of electricity supplies, or in order to ensure the use of renewables, cogeneration or domestic coal for electricity generation. Obligations on preferential access, connection, transmission, distribution or supply for such sources of generation can also be imposed. In addition, the Ministry can resolve issues on the provision of system and ancillary services to SEPS through the imposition of a public service obligation (PSO) on electricity producers with capacity of more than 75 MW. The Ministry is also empowered to apply these obligations either as tariff or non-tariff measures, through the provision of economic incentives, or through prohibitions against engaging in specified conduct or activity. Nevertheless, the Ministry claims that it is not authorised to deal with issues of financing or price policy in this context. Thus, if the Ministry imposed a PSO to ensure delivery of regulated services, such as system or ancillary services, it seems more likely that compensation parameters would be defined by URSO than by the Ministry.

Figure 38

Electricity Flow Diagram, 2003



Ownership:
SE: NPF (100%, 34% from 2006)
SEPS: NPF (100%)
CSE: NPF (51%), EON (40%), EBRD (9%)
SSE: NPF (51%), EdF (49%)
VSE: NPF (51%), RWE (49%)
PPC: PPC Holding/Penta (90%), SE (10%)

IPPs: Independent Power Producers

* Since 1.01.2005 for all non-household customers. For all customers: 1.07.2007

Source: IEA.

The Ministry retains substantial authority over electricity undertakings in its power to impose an obligation on an electricity facility operator to tender for energy efficient technologies, reduction of electricity consumption, or new generation capacity. The Energy Act states that URSO shall "organise and control the tender" and presumably the regulator would engage in consultations to define properly the tender criteria. In line with the Electricity Directive, the Act includes some sequencing rules. These rules on the tendering procedure are new to Slovakia and are not fully developed.

Other powers assigned to the Ministry of Economy affecting electricity undertakings include rules on states of emergency in the power sector, and a possible decision requiring generation licensees to maintain fuel stocks. These Ministerial decrees were being finalised in 2005.

● Regulation

Market Opening: First Steps

The 2004 Energy Act provides that as of 1 January 2005, all "non-household customers" (*i.e.* including producers, transmission and distribution undertakings and wholesale customers) are free to choose their electricity supplier. This right reaches all customers (*i.e.* 100% market opening) by 1 July 2007, as required by the Electricity Directive. Under current regulation, 43.5% of the total electricity price (generated "active power") is non-regulated (open to competition). The rest, generation system fees (20%), transmission fees (6.5%) and distribution fees (30%) are regulated by URSO.

However, eligible customers have not yet switched to different suppliers. Although URSO is responsible for monitoring of customer-switching, it does not have detailed data at present.

Table 29

Electricity Market Opening, 2002 to 2007

Date	Customer eligibility criteria	Size of open market (TWh)	% of market opening	% of effective supplier switching
1 January 2002	100 GWh	7.5	31%	
1 January 2003	40 GWh	9.6	40%	0%
1 January 2004	20 GWh	10	42%	0%
1 January 2005	All non-households	19	79%	0%
1 July 2007	All customers	25	100%	–

Sources: Ministry of Economy and European Commission.

Distribution companies can compete for large industrial customers outside their traditional areas. Competition may function better in the western part of the country from 2002, according to the regulator than in the central and eastern regions. This has been attributed in large part to the different respective border profiles: whereas Bratislava is close to large population centres and has substantial cross-border transmission capacities and trading, the border areas of Poland and Hungary in the eastern part of Slovakia include less industry and feature lower levels of consumption. The development of cross-border trade in western Slovakia may also be facilitated by the strong market position of E.ON, which holds majority shares in the distribution companies in the Czech Republic (JME, JCE) and in Hungary (EDASZ, DEDASZ) to the north and south of ZSE's. In its management of ZSE, E.ON will be seeking to optimise further and to import more power from the Czech producer and supplier, ČEZ.

Prices and Price Regulation

Electricity prices for residential customers rose by 9% between 2000 and 2003. A doubling in residential prices occurred between mid-2002 and mid-2004. At the end of 2004, the average electricity price for industrial consumers was SKK 2.75/kWh (6.88 €cents/kWh), well above the EU average. Prices for residential consumers were SKK 3.53 /kWh (8.82 €cents/kWh) and will be increased by URSO by 5 % in January 2006.

Electricity distribution companies operate under a price control system that applies a regulatory period of four years (*i.e.* from 2003 through 2006). During the regulatory period, the distribution companies must submit proposed tariffs to URSO for confirmation by a certain date in year N-1 for the year N.

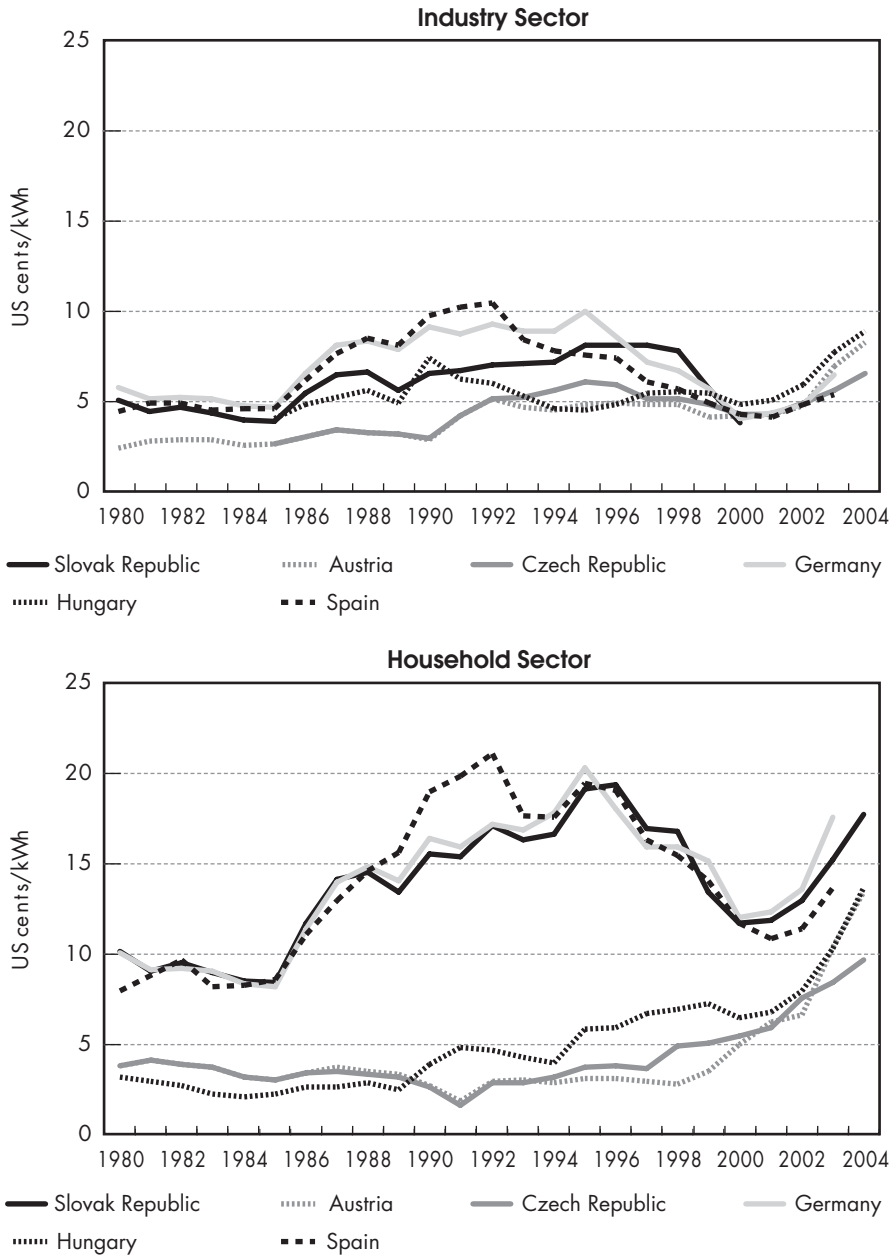
Electricity tariffs for end-users for the year 2005 have been approved under the Regulatory Act (prior to amendment), which allows URSO to set maximum prices or tariffs as well as tariff conditions. For example, in November 2004 the regulator approved the tariffs and tariff conditions of the electricity distribution company, VSE, for 2005.

These tariff conditions offer a choice of rates designed to promote electrical heating at a tariff as low as 1.55 SKK/kWh (around 2 SKK/kWh with the fixed charge) for residential (see Table 31), which is at the same level as SE's generation costs. This suggests distortions in favour of the tariff for electrical space and water heating (double tariff products).

URSO's decree of 31 August 2004 sets the price regulation procedure for electricity generation, transmission, distribution and supply. It defines

Figure 39

Electricity Prices in Slovakia and Other Selected OECD Countries, 1980 to 2004; Industry Sector and Household Sector



Source: Energy Prices and Taxes, *IEA/OECD Paris, 2005.*

Table 31

Electricity Tariffs for Household Consumers (VSE), 1 January 2005 (without 19% VAT)

Tariff Rate	Permanent monthly payment (SKK)	Consumption limits[1] (kWh/year)	High tariff Rate (SKK/kWh)	Low tariff Rate (SKK/kWh)	Low tariff validity period (hours)
		Single tariffs			
Standard Mini	26	1,114	4.60	–	–
Standard Maxi	156	1,114	3.20	–	–
		Double tariffs			
AKU Mini[2]	142	–	4.60	1.60	8 hours
AKU Maxi[2]	274	–	3.20	1.60	8 hours
AKU Thermo[3]	270 to 1,330	–	3.20	1.55	
Komplet[4]	270 to 1,330	25,000 to 80,000	4.90	1.55	20 hours

1. *Consumers are allowed to choose their tariff. The Standard Mini and Maxi tariffs are suggested as being suitable for consumers using less than 1,114 kWh. In the case of the Komplet double tariff product, if the respective consumption limit is exceeded, then the high tariff rate applies.*
2. *The AKU-Mini and AKU-Maxi tariffs are designed for supply points with higher electricity consumption during times of low load on the electricity supply system. The 8-hour period under which the low-tariff rate is applicable is divided into three time periods of one hour or more (i.e. the applicable time periods for the low tariff are not identical for all customers).*
3. *The AKU Thermo tariff rate is designed for supply points with electrical accumulation devices for heating and preparation of warm service water, where electrical heating equipment is also used for cooking. This requires electrical accumulation appliances with an input power of at least 2 kW for heating and with at least 50 litres capacity for warm service water. Circuit breaker from 3 x 25 A to over 3 x 63 A (six possibilities).*
4. *The Komplet tariff rate is designed for "electrical households" where electricity is used exclusively for heating, cooking, warm service water, and other purposes. It requires appliances installed by a contractor and controlled by a tariff switch. If annual consumption under the low tariff rate is not at least 7,000 kWh per year, then a fixed monthly payment of 1,000 SKK applies. Circuit breaker from 3 x 25 A to over 3 x 63 A (six possibilities).*

Sources: URSO and VSE.

categories of economically justified costs, including investments for long-term operability of the system and contributions to a fund for decommissioning and waste disposal of nuclear installations. The regulated companies are allowed a rate of return on operational assets, defined as the return on investment earned from equity capital or debt capital, depending on the structure of capital and the related margins of risk, taking into account any risk associated with doing business in the regulated activity. Prices must be proposed by the regulated entities for various services, such as connections and access to the

transmission system or balancing services. These price methodologies are based on price cap regulation and an inflation index.

The generation sector is not liberalised, given that URSO's price decree applies to the holder of a generation licence that produces more than 10 TWh per year on Slovak territory, *i.e.* only to SE. SE must submit a price proposal to URSO and is subject to a revenue cap. In 2003, URSO's price decisions were applied to SE as a regulated entity, setting a price cap per MWh for sales to the distribution companies and to final consumers connected to the transmission grid. Under the 2004 decree, the proposal for a price for system costs must be submitted along with a proposal for appraisal of ancillary services. Since SE is the only supplier of ancillary services to SEPS, this must be regulated.

Tariffs and prices for connection and access to the transmission system include only costs associated with such activities. In addition, these tariffs should be proposed so that the share of planned revenues earned from the fees for electricity transmission charged to Slovak generators connected to the transmission system should not exceed 10% of the maximum permitted revenue earned from such connection and access and control of the system. These rules do not seem to be applicable to connection to the distribution system.

URSO developed new pricing methodologies in 2005 in line with a consultation procedure defined in the new pricing rules adopted in the Regulatory Act as amended in October 2004. The Regulatory Act does not provide for consumer consultation and does not explicitly provide any scope for the Regulator to consider any "social aspects" in its price regulation. As in the prior energy law, the definition of "regulation" in the Regulatory Act includes among its many aspects a reference to "measures to protect consumers". In addition, USRO now has the power to set quality of service standards. However, a "duty to protect consumers" has not been elevated to a primary duty and is arguably not even listed as a secondary duty of the regulator under the Regulatory Act. The rights set forth for electricity consumers reflect the minimum requirements of the EU Electricity Directive and are generally set forth in Section 20 of the Energy Act. There is apparently no energy consumers' group or organisation and no legal requirement for one to be established, as some countries have provided for this in their basic energy laws.[41]

41. *The Slovak Consumer Protection Act and other laws may relate to the protection of consumers in the electricity sector, such as an Act on Products Liability. In addition, there are general consumers' organisations which may have participated in working groups dedicated to energy issues.*

Critique

Supply and Demand Balance

The energy policy statement of 2000 acknowledged that Slovakia has sufficient installed electricity capacity, stating that "there is overcapacity available for 10 years" and referring to the risk of not being able to "sell the overproduction of electricity even in the case of [a] dumping price". More recent assessments of generation adequacy take a less confident view in light of the scheduled decommissioning of 1.8 GW of capacity by 2010 and the prolonged uncertainty over the commissioning of new power plants.

The short-term outlook depends upon critical planning decisions, including the reported decision to complete the unfinished nuclear power plant EMO 3&4 at Mochovce. Such a plan, which was agreed between ENEL and the government in October 2005, will confront economic, legal and administrative issues (see below and chapter on nuclear). Nonetheless, the announced completion of new base load investments by SE for 1.3 GW, including EMO 3&4 will maintain the current base load overcapacity and its associated costs, and limit competition (see below).

The least cost supply plan[42] for meeting the future loss of generation capacity selected output-boosting projects at Bohunice V-2 and Mochovce EMO 1&2 in its two envisaged scenarios. It recommended carrying out complementary studies and audits to identify energy efficiency projects. Although electricity consumption has remained flat, the government should take additional measures to promote energy efficiency in the system and reduction of energy consumption, possibly through the new tendering procedure. This should be pursued in the short-term and in preference to creating new incentives for generators to build new capacity, as is reflected in the sequencing rules under the tendering procedure. If capacity is needed, CHPs offer preferable options as they supply jointly electricity and heat at competitive price with limited environmental impact.

Other indicators of security of supply, such as the reserve margin in generation capacity (93%) and import capacity as a percentage of demand (70/90%), are favourable as compared to many other UCTE countries. Within the UCTE, the CENTREL block is viewed as the only one likely to remain in the position of a structural exporter of electricity through 2010.[43] Given the

42. "BIDSF Least Cost Analysis" (2005) carried out for EBRD.

43. UCTE, System Adequacy Forecast, 2005-2015.

existing transfer capacity and the fact that the Slovak power system is at the heart of CENTREL, it arguably already has the level of cross-border "transmission adequacy" necessary for security of supply at current consumption levels. Available trade capacities, estimated at 3 GW for imports, would largely cover base load (90%) demand (in the improbable case of outages of most Slovak generation capacities) and a large part of peak load (70%). This potential could be further enhanced in combination with additional measures as outlined in the proposed EU directive for safeguarding security of electricity supply, such as demand management measures and interruptible customers.

● Market Structure and Development

In a relatively brief period of time, the Slovak government has restructured the electricity sector and developed market conditions. The government has effectively gone beyond the minimum unbundling requirements currently in effect under the 2003 Electricity Directive through the ownership separation of generation from transmission and distribution. This has improved transparency and created conditions for competition. In particular, the impartiality of SEPS, the grid operator, has been enhanced through full state ownership, away from the market players. Legal and managerial unbundling of distribution system operators is underway and should be completed by July 2007.

Challenges remain, however, to taking full advantage of cross-border trading opportunities so as to increase efficiency, reduce costs, and improve reliability and security. A more market-oriented and regional approach to the Slovak power market should be considered in the near future. This is of utmost importance, seeing that the national power market is clearly dominated by SE. The arrangements and market rules that facilitate different types of power trading, the switching of suppliers inside Slovakia, and congestion management should be made smooth and simple.

Further steps should be taken to increase liquidity and implement market conditions that facilitate customer choice and entry of new market players. In particular, the government should recognise the vital role of market operators in the development and operation of the internal market in electricity. As noted by the European Commission in its benchmarking report of January 2005, liquid wholesale markets are a key objective and the European power exchanges are still insufficiently liquid in this respect. The government should consider accepting the opportunities offered by the Czech market operator, OTE, for development of a publicly-funded

platform for short-term power trading on a Czech-Slovak basis with a view towards the ultimate establishment of a Central European power exchange.

In the longer run, the goal should be to establish a common regional power market with no borders and an integrated point-tariff system. The collective efforts being made by the TSOs and the regulators in the region to conduct explicit auctions on the borders, to monitor the possibilities for a regional power market with ancillary services, and to co-ordinate activities concerning emergencies are important steps in this direction.

An example of this market approach is in the area of balancing mechanisms of the TSO. Although SEPS is able to purchase system and ancillary services on the national market, this market is clearly dominated by SE. A negotiated solution between SEPS and SE is needed in the short term for a contract for system and ancillary services in 2005, and URSO can support this outcome. Irrespective of the outcome, however, SEPS should pursue other solutions, including contracting with suppliers outside the territory, negotiating arrangements with large industrial consumers for interruptible power, and reinforcement of the network where there is congestion.

SE remains the dominant supplier with a market share in generation of 84%, controlling almost all medium to large units above 100 MW capacity. In addition, the single buyer system put in place in the mid-1990s had not evolved significantly until 2004. SE continued to act as the dominant purchaser and reseller of imported power and independent generation. The persistence of this system as a structural barrier to direct trade and competition has been reinforced by the majority ownership of the state in SE and the distribution companies. Also, SE is expected to receive from the BIDSF a significant financial co-funding (€ 1.4 billion) for the modernisation and new generation facilities as well as for electricity imports to compensate the decommissioning of NPP V-1.

Nevertheless, the ongoing privatisation of SE and of additional state-owned shares in the distribution companies should accelerate the phasing out of SE's single buyer role in favour of direct contracting between distribution companies and eligible customers with domestic and foreign generators, and traders. However, the construction of new generation plants by SE and further concentration on the generation side, possibly through the purchase of PPC, the only independent generator, by SE, will harm competition. Cross-border capacities appear to be adequate for external suppliers to compete more aggressively in the Slovak market.

A strategy focused exclusively on ensuring national self-sufficiency in the electricity sector would run counter to the EU's objectives for integration of markets. The additional construction of large base load capacities by SE such as NPP EMO 3&4 at Mochovce, will reinforce its dominant position in generation, at above 85% and wholesale markets, at 90-95% in 2003 and will increase overcapacity. Nuclear power already accounts for 57% of total production, above the base load demand of 45%, raising the issue of the economics of new base load investments. In the absence of effective measures (such as requiring SE to divest a certain amount of capacity) to deal with the problem of concentration in the generation market and excessive market power, the prospects for new market entry and diversification of supply may be limited. At the same time, insufficient generation capacity in some parts of the European market is worrying for energy security.

By acquiring SE, ENEL can pursue its pan-European strategy whereby it can export Slovak power to the wider European market, including the home market of Italy, where it is engaged in distribution and earns most of its revenue. This could stimulate competition in the EU market, provided that adequate transmission capacity is available and there is no monopoly. It is important that all generation costs, nuclear waste management and decommissioning, are covered by the operator and passed on to domestic as well as to foreign customers. Without such an approach, competition would be distorted and costs would be transferred to domestic customers or the Slovak State.

Price reforms have been enforced through the establishment of pricing methodologies and implementation of steady increases in prices in order to phase out cross-subsidies from the generation industry to residential users for electricity. However, the fact that distortions persist in electrical heating tariffs (space heating tariffs are as low as the cost of generation and fully cover neither distribution nor network reinforcement costs) touching a small segment of the market (16% of households) but accounting for 35% or more of household consumption, constitutes an obstacle to an effective market opening in the sector. This distortion should be gradually removed and alternative space heating options and/or energy efficiency improvements provided to customers.

The regulator, in co-ordination with SEPS and the Statistical Office, should continuously monitor the development of the sector and of market and system adequacy. As TSO, SEPS verifies that an appropriate reserve capacity is available for balancing purposes. The regulator, through its information system, should provide relevant data and analysis to stakeholders. Reporting

and monitoring obligations as set forth in existing and proposed EU energy legislation relating to the power sector should be further developed in order to ensure efficiency, security of supply, and fair competition.

Based on a diverse hydroelectric and thermal power mix, and economic competitiveness of CHP, Slovakia might have pursued a decentralisation and pro-competition electricity strategy during the 1990s, leading to a more pluralistic sector. This would have entailed divestment of SE's generation assets, such as hydroelectric, creating a number of smaller companies, in a combination of public and private ownership. This approach would have left SE and the State responsible for pursuing the nuclear programme in greater competition, thus avoiding the privatisation of SE as the dominant producer and supplier. This option was unattractive both to SE and its nuclear programme and to a government used to central planning.

Current energy policy statement is directed at investment in distribution networks rather than distributed generation (DG). This is also reflected in legal and regulatory framework applicable to the distribution companies. In a recent survey, one of the distribution companies indicated a variety of rules that protect the interests of the distribution system operators (DSOs) against the development of DG in Slovakia.[44] In particular, the rules on connection of new producers are not well-developed. Although the distribution companies must ensure non-discriminatory conditions for the connection to the system to all its users, there appear to be no rules in place relating to sharing of connection costs and allocation of connection costs.

Prices for balancing services by the distribution licensees are covered by the price regulation methodology, but there appears to be no regulation of the provision of such services and balancing charges are unclear. System and ancillary services are defined in the Energy Act as services only of the TSO and not the DSOs. Further measures should therefore be taken to implement the requirements of the EU directives relating to network access for producers using renewable energy sources or CHP. Additional measures to streamline authorisation procedures, particularly to facilitate complex public inquiries, would also serve to remove barriers for independent power producers, which should be encouraged.

44. *Eurelectric*, the Operating Environment for Distribution Companies *(Working Group on Distribution Issues), February 2005.*

Recommendations

The government of the Slovak Republic should:

- Implement additional measures to promote energy efficiency, possibly through new tendering procedures for electricity operators.
- Complement the BIDSF least cost supply plan for meeting the future loss of generation capacity through studies and audits to identify energy efficiency projects.
- Progressively eliminate distortions in electrical heating tariffs and provide alternative solutions, and phase out fixed long-term purchase and sale contracts.
- Publish authorisation procedures and implement and respect EU rules for public participation in integrated licensing and environmental assessment of new power plants.
- Ensure a strong regulatory regime, both for nuclear safety and for the power market, including nuclear liabilities and BIDSF funding, especially when SE is privatised; Ensure the independence of SEPS from industry and government.
- Establish a more transparent and competitive market structure through more systematic co-operation among the Ministry, URSO, SEPS, and the Anti-Monopoly Office.
- Establish a framework for short-term power trading in co-operation with the Czech market operator (OTE) anticipating a Central European approach.
- Continue with privatisation of distribution companies to stimulate competition at wholesale level, replacing the current single buyer system.
- Ensure that distribution companies and eligible customers are free to choose and buy from generators, external suppliers, and traders.
- Consider divesting generation assets from SE to set competitive conditions in generation.
- Take additional measures to implement the requirements of the EU directives relating to network access for producers using renewable energy sources or CHP by improving rules for connections and balancing at distribution level.

HEAT

Key Information and Data (2003)

- **Share of heat in:**
  TFC: 8.7% (OECD Europe: 2.8%)
  Residential energy consumption: 27% (OECD Europe: 6%)
- **Installed capacity:** 6 GWt
- **Heat produced:** 1 Mtoe (51 PJ)
- **Heating mix:** gas (54%), coal (29%), brown coal (8%), nuclear (3.5%)
- **Share of CHP:** 52%
- **Average production efficiency:** 64%

Heat is one of the main final energies in residential use[45]. In most Slovak cities, a district heating network supplies heat (hot water and steam) to residential units, while most independent buildings operate a heat system. Systems generating both heat and power account for half of production, mainly in district heating, and have a role in the electricity market. 40% of TPES is used for heat production.

Heat Balance

Demand

Heat accounts for 8.7% of the total final consumption but has continued to decrease to reach 1 Mtoe in 2002/2003.

78% of the heat is consumed by the residential sector followed by the commercial and public services sectors (17%) and industry (15%). In the residential sector, 90% of apartments or around half of households are connected to district heating. Heat covers 27% of total residential needs, mainly for space and water heating.

There are two main segments in the heat market; the residential market supplied by district heating networks (80% of total consumption), and

45. *See IEA publication* Coming in from the Cold - Improving District Heating Policy in Transition Economies *(2004): www.iea.org/Textbase/publications/free_new_Desc.asp?PUBS_ID=1342.*

independent buildings (*i.e.* hospitals, education buildings) and industries (20% of total) supplied by heat-only boilers (HOBs) and/or cogeneration installations.

- **Supply**

  Total installed capacity for heat production stands at 6 GWt. Heat production is based primarily on natural gas, with a share of 54%, in progress at the expense of coal (2%) and brown coal (8%). Nuclear and renewable energy (biomass and geothermal) account for 3 and 1% of gross heat production, respectively.

  CHP or cogeneration accounts for 52% of total gross heat production. Natural gas is the main fuel used (42%) with coal and brown coal at 39% and 11%, respectively. Most (72%) of the electricity generated is consumed by the generator. The rest is sold. Such sales account for 7% of total net electricity generation, playing a critical role in peak power generation. In 2002, there were 40 CHP units above 20 MW for a total capacity of 1,100 MW and an electricity generation of 7.3 TWh (23% of total generation). Gas turbines represent a capacity of 560 MW, including PPC in Bratislava (218 MW). CHP potential for 2010 is estimated at 320 MW in the "residential and communal" sectors and 480 MW in the industry.

  Heat-only plants rely largely on natural gas (91%) which has marginalised solid fuels (2%) while waste and biomass have emerged with shares of 3.5% and 2.5%, respectively. Their announced efficiency is on average around 80% compared to 60% for CHPs.

  Losses from heat generation and transmission have declined overall, to 36% and 17%, respectively but there is still substantial improvement potential to be made on all supply segments as well as on the end-use side, which in most cases lacks metering and regulation.

  In 2003, the average heat generation cost was at 480 SKK/GJ.

Sector Structure and Ownership

In district heating, the role of municipalities was significant during the 1990s, but municipal ownership and control have been diminishing as sales of majority stakes in many district heating companies have taken place and are continuing. The heat production by Slovenské Elektráne (SE, a.s.) accounts for 10% of total heat generation but represents only 1% of SE's revenues.

Heat supply to buildings is provided by numerous entities operating heat-only boilers or cogeneration installations.

International investors have entered the Slovak heat market and play a significant role. Companies affiliated with the Electricité de France (EdF) Group, for example, such as Dalkia from France and ESTAG from Austria, hold majority stakes in companies such as C-TERM in Bratislava, and the companies STEFE, EMG, and BBES in Banská Bystrica. However, despite EBRD support, no sizeable ESCO could develop third party financing (TPF) projects as regulation largely prevents it (see tariff regulation below).

As of 1 January 2004, the state ownership in the six major district heating (DH) companies, worth a total capacity of 3,041 MWt, is administered by the National Property Fund (NPF) (see table below). The government plan to ned privatise 51% of the companies in 2006 and possibly transfer 34% of the shares to the local municipalities, keeping 15% within the NPF.

Table 31

Major District Heating Networks, 2003

Companies	Owner	Installed capacity (MWt)	Heat and electricity production (ktoe/GWh)
Bratislava District Heating Co. (BAT)			
National Property Fund (100%)		734	98/186
Trnava District Heating Co.	National	138	17/ -
Martin District Heating Co.	Property	483	65/118
Zvolen District Heating Co	Fund	310	16/90
Žilina District Heating Co.	(100%)	456	74/119
Košice District Heating Co. (TEKO)		920	138/437
TOTAL		3,041	408/950

Source: Ministry of Economy.

Regulation and Pricing

The 2004 Thermal Energy Act, in force since January 2005, sets the respective obligations for the various "heat market stakeholders" on matters such as licensing and authorisations, price regulation, installation of meters or heat-

cost allocators, billing, and customer-supplier relations. The State Energy Inspectorate Board is charged with responsibility for compliance and sanctions.

The Thermal Energy Act requires the Ministry of Economy or URSO to adopt various regulations, including a Ministerial regulation on rules for cogeneration. URSO expects that the draft regulations for the heat sector will be ready by March 2005 and that the consultation process will then begin. The Ministry of Economy delivers authorisations for the development of new thermal installations, or a part thereof, of 10 MW or more. In making its decision, the Ministry is required to evaluate, among other criteria, the possibilities for cogeneration and the utilisation of domestic renewable energy sources.

- **Tariffs**

Cogeneration and heat production, distribution and supply are regulated under three energy laws of October 2004. URSO presently applies rate of return regulation to the heat sector. Under the new rules for price regulation, the regulated entities must submit a price proposal to URSO no later than 31 October 2005. This price proposal must be in line with URSO's new price methodology which is based on cost-plus fees and still to be determined in consultation with the Ministry. It may consist of directly setting the maximum price, a fixed price or a "comparable price". URSO expects that price regulation will continue through 2007, at which time the market would be open and privatisation completed.

In the absence of individual metering, district heating companies apply for residential customer heat tariffs that are usually based on the size of flat or the number of occupants. For large clients in industry, the existence of metering enables the application of a tariff based on effective consumption (SKK/GJ).

Heat is competing with other energies, mainly gas and electricity on the heating market. In the residential sector, competition has been distorted by cross-subsidies that have benefited gas and electricity tariffs. Despite a process of gradual elimination of cross-subsidies since 2000 (see chapter on regulation), distortions have persisted. In January 2003, the average price of heat from district heating was 90% higher than gas prices and comparable with electricity prices (see total energy price in the table below).

Table 32

Prices of Main Energies and Carriers in the Residential Sector, January 2003

Type of Energy	Unit	Unit price in SKK	Caloric value in GJ/unit	Global efficiency of source in %	Total energy price including fixed rate in SKK/GJ	Average heating costs per year in SKK	
						Flat	Family House
Brown coal	t	2,620	17	70	220	8,807	22,017
Coke	t	5,360	27	80	249	9,944	24,861
Natural gas D2	cm	7.7	0.034	86	286	11,437	-
Natural gas D3	cm	6.5	0.034	86	254	-	25,362
Electricity-flat	kWh	1.5	0.0036	27.5	511	20,440	-
Electricity-Family house	kWh	1.5	0.0036	27.5	492	-	49,240
Propane (tank)	t	29,600	46	90	748	-	74,792
District heating	GJ	450	-	54	474	18,947	47,368

*Notes: **Annual consumption levels:** flat (40 GJ), house (100 GJ) ; Tariffs: Natural gas: D2 – annual consumption from 201 to 1,700 cm; D3 – annual consumption up to 6,500 cm ; Electricity: D11 ("Komplet")-low tariff, most uses are electrical (see Table 31) ; **Global efficiency of sources** : Brown coal and coke: stove ; Natural gas: transmission losses: 2%, distribution losses: 2%, boiler efficiency: 90% (new), 75% (old); global: 86% (new), 72% (old) ; Electricity: generation efficiency: 30%, transmission losses: 0.9%, distribution losses: 7.1%; global: 27.5% ; Propane: heater or boiler ; District heating: generation efficiency: 64%, transmission losses: 16%; global: 54%.*

Sources: IEA and SPP.

The accumulation of price distortions, and the absence of metering and regulation have contributed to significant disconnections of residential flat and commercial clients (90% connectable) to the profit of direct gas and electricity, and even inefficient and pollutant brown coal stoves. Disconnections have complicated the system operations and decreased its energy efficiency, which in turn pushes up prices and triggers new disconnections. Governmental subsidies paid to district heating companies, which reached SKK 4 billion per year were eliminated in 1998.

- **Other regulations**

The new act includes the development of new rules for cogeneration. A purchase obligation applies to heat distribution licensees in favour of heat produced from renewable energy sources or CHP ("mandatory off-take") at the determined or approved price. As with a similar purchase obligation under the 1998 Energy Act, this obligation does not apply if it would increase the price of heat for customers. The purchase obligation is also conditioned by other rules relating to cost efficiency.

A 5-year income tax exemption designed to promote small CHP installations of less than 10 MW applied only until end-2003.

In 1998, a regulation on heat tariffs allowing development of third party financing (TPF) was passed but the change has not generated substantial projects. Since 2003, district heating companies are not considered to be natural monopolies. The Anti-Monopoly Office monitors competition in the heat market and has reviewed and approved certain acquisitions in the district heating sector.

Critique

Heat has been important in the energy system, in particular for urban households. It is one of the cheapest and most efficient options for the combined supply of heat and electricity. A heat policy has progressively developed, leading to the adoption of a new and specific regulation with the 2004 Thermal Energy Act. Its independent enforcement away from the municipalities to avoid conflict of interests, has been a crucial step in the reform process. Regulatory reforms, in particular cost reflective prices, have contributed to the rehabilitation and modernisation of existing district heating networks, notably through partial privatisation.

The 2004 Thermal Energy Act has provided a single regulatory reference for heat supply. Nevertheless, the rules on heat cost allocation in multi-family buildings need to be developed further and should take into account the issues on the reliability of heat-cost allocators.

Heat as an energy carrier and the district heating sector face a number of challenges including: persistent competition distortion with natural gas and electricity heating tariffs reinforced by fixed flat payments in the case of non-metered flats; lower revenues caused by growing customer disconnections while expenditures on fuel for heat supplies such as natural gas are growing; complying with safety and environmental regulation, especially the large combustion plant directive. Furthermore, investments to reduce energy consumption along the supply and consumption chain are discouraged by current regulations and by the absence of legal and fiscal incentives.

The current system of tariff-setting for heat, based on cost-plus fees, has largely prevented third party financing (TPF) of investments in energy efficiency. In contrast, in Hungary, TPF has developed on a large scale (hundreds of projects) thanks to an incentive regulation (price cap) for heat. TPF has the advantage of avoiding an initial investment for the user. At the end of the investment period, the facilities are new or rehabilitated with lower operating and maintenance cost. The energy savings generate fees for the contractor.

The Ministry of Economy, in co-ordination with URSO may also consider adopting an incentive price regulation or anticipate the end of cost-plus fees regulation to allow TPF projects, initially in independent buildings, then for district heating. Both bodies should ensure that more liberalised energy markets will not discourage energy efficiency or distort the heat market.

On the supply side, gasification has developed rapidly and has enhanced technical, economic and environmental performance of heat production, in particular for cogeneration. There is a potential to increase generation and transmission efficiency as well as to diversify the energy mix, notably with biomass, geothermal and solar thermal. To this end, the availability of adapted co-funding for studies and investments, notably through EU structural funds will be crucial. In addition, energy efficiency and environmental/emission improvements projects could be eligible for additional co-funding through the EU Emissions Trading Scheme as well as through Joint Implementation. Operators and project developers should be aware of these opportunities and receive adequate information and advice from focal points.

At the local level, the operation and maintenance of energy systems, in particular district heating, should be regularly analysed under an overall energy plan, for both the demand and supply sides, in order to maximise efficiency and establish synergies between energy systems and available resources.

Recommendations

The government of the Slovak Republic should:

- Maintain competitiveness, technical and environmental performance of district heating through active state policy and adequate investment.
- Ensure effective enforcement of the 2004 Thermal Energy Act and consider adaptations when necessary.
- Develop incentive regulation to promote energy efficiency investment, demand-side measures and third party financing; anticipate the abolition of price control.
- Provide financial support for studies on district heating plants' switching from solid and liquid fuels to biomass, geothermal, solar thermal or gas.
- Complete privatisation of district heating companies without hindering heat and electricity competition.

ANNEX I

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY

		1973	1990	2002	2003	2010	2020	2030
TOTAL PRODUCTION		**2.58**	**5.28**	**6.63**	**6.40**	**5.59**	**7.09**	**8.71**
Coal[1]		1.70	1.40	0.93	0.82	0.66	0.50	0.26
Oil		0.13	0.08	0.06	0.05	0.05	0.05	0.05
Gas		0.39	0.34	0.15	0.17	0.15	0.20	0.19
Comb. Renewables & Waste[2]		0.18	0.17	0.31	0.35	0.45	0.90	1.38
Nuclear		0.06	3.14	4.72	4.70	3.70	4.70	5.70
Hydro		0.11	0.16	0.45	0.30	0.52	0.56	0.56
Geothermal		–	–	0.01	0.01	0.05	0.08	0.12
Solar/Wind/Other[3]		–	–	0.00	0.00	0.02	0.10	0.45
TOTAL NET IMPORTS[4]		**12.94**	**16.53**	**11.99**	**12.00**	**12.68**	**12.88**	**12.98**
Coal[1]	Exports	–	0.12	0.11	0.07	0.09	0.05	0.05
	Imports	6.26	6.12	3.40	3.73	3.05	2.90	2.80
	Net Imports	6.26	6.00	3.29	3.66	2.96	2.85	2.75
Oil	Exports	1.72	1.60	3.36	3.47	3.86	3.60	3.50
	Imports	6.97	6.33	6.55	6.51	7.52	7.60	7.59
	Bunkers	–	–	–	–	–	–	–
	Net Imports	5.25	4.73	3.19	3.05	3.66	4.00	4.09
Gas	Exports	–	–	–	0.00	–	–	–
	Imports	1.17	5.35	5.87	5.50	6.03	6.14	6.38
	Net Imports	1.17	5.35	5.87	5.50	6.03	6.14	6.38
Electricity	Exports	0.02	0.18	0.94	0.94	0.63	0.77	0.89
	Imports	0.26	0.62	0.58	0.74	0.65	0.66	0.65
	Net Imports	0.24	0.45	–0.36	–0.19	0.02	–0.11	–0.24
TOTAL STOCK CHANGES		**–0.01**	**–0.37**	**–0.09**	**0.12**	**–0.11**	**–0.14**	**–**
TOTAL SUPPLY (TPES)		**15.50**	**21.43**	**18.52**	**18.52**	**18.16**	**19.83**	**21.69**
Coal[1]		7.96	7.72	4.24	4.56	3.63	3.35	3.01
Oil		5.37	4.71	3.27	3.13	3.74	4.08	4.14
Gas		1.56	5.09	5.87	5.67	6.03	6.17	6.57
Comb. Renewables & Waste[2]		0.19	0.17	0.31	0.34	0.45	0.90	1.38
Nuclear		0.06	3.14	4.72	4.70	3.70	4.70	5.70
Hydro		0.11	0.16	0.45	0.30	0.52	0.56	0.56
Geothermal		–	–	0.01	0.01	0.05	0.08	0.12
Solar/Wind/Other[3]		–	–	0.00	0.00	0.02	0.10	0.45
Electricity Trade[5]		0.24	0.45	–0.36	–0.19	0.02	–0.11	–0.24
Shares (%)								
Coal		*51.4*	*36.0*	*22.9*	*24.6*	*20.0*	*16.9*	*13.9*
Oil		*34.6*	*22.0*	*17.7*	*16.9*	*20.6*	*20.6*	*19.1*
Gas		*10.1*	*23.7*	*31.7*	*30.6*	*33.2*	*31.1*	*30.3*
Comb. Renewables & Waste		*1.2*	*0.8*	*1.7*	*1.9*	*2.5*	*4.5*	*6.4*
Nuclear		*0.4*	*14.6*	*25.5*	*25.4*	*20.4*	*23.7*	*26.3*
Hydro		*0.7*	*0.8*	*2.4*	*1.6*	*2.9*	*2.8*	*2.6*
Geothermal		–	–	–	–	*0.3*	*0.4*	*0.6*
Solar/Wind/Other		–	–	–	–	*0.1*	*0.5*	*2.1*
Electricity Trade		*1.6*	*2.1*	*–1.9*	*–1.0*	*0.1*	*–0.5*	*–1.1*

0 means negligible, – means nil, .. means not available

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2002	2003	2010	2020	2030
TFC	**10.90**	**16.11**	**11.71**	**11.25**	**12.23**	**13.04**	**13.94**
Coal[1]	3.85	4.26	1.34	1.22	1.19	1.05	1.01
Oil	3.87	4.59	3.04	2.87	3.47	3.89	3.90
Gas	1.40	4.42	4.13	3.89	4.07	4.17	4.54
Comb. Renewables & Waste[2]	0.19	0.17	0.23	0.28	0.27	0.40	0.60
Geothermal	–	–	0.00	0.00	0.01	0.01	0.03
Solar/Wind/Other	–	–	–	–	0.01	0.05	0.20
Electricity	1.06	2.01	1.95	1.97	2.20	2.42	2.52
Heat	0.53	0.65	1.02	1.03	1.02	1.05	1.14
Shares (%)							
Coal	*35.3*	*26.5*	*11.4*	*10.8*	*9.7*	*8.1*	*7.2*
Oil	*35.6*	*28.5*	*26.0*	*25.5*	*28.4*	*29.8*	*28.0*
Gas	*12.9*	*27.4*	*35.3*	*34.6*	*33.3*	*32.0*	*32.6*
Comb. Renewables & Waste	*1.7*	*1.1*	*1.9*	*2.5*	*2.2*	*3.1*	*4.3*
Geothermal	–	–	–	–	–	*0.1*	*0.2*
Solar/Wind/Other	–	–	–	–	*0.1*	*0.4*	*1.4*
Electricity	*9.7*	*12.5*	*16.7*	*17.5*	*18.0*	*18.6*	*18.1*
Heat	*4.8*	*4.0*	*8.7*	*9.1*	*8.3*	*8.1*	*8.2*
TOTAL INDUSTRY[6]	**6.15**	**8.98**	**4.45**	**4.96**	**4.59**	**4.93**	**5.69**
Coal[1]	2.66	2.44	0.99	1.10	0.88	0.80	0.78
Oil	1.74	2.97	1.13	1.06	1.28	1.40	1.55
Gas	0.82	2.09	1.31	1.41	1.31	1.46	1.72
Comb. Renewables & Waste[2]	0.19	0.17	0.22	0.28	0.22	0.24	0.40
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	0.10
Electricity	0.72	1.29	0.78	0.98	0.88	1.00	1.10
Heat	0.02	0.02	0.03	0.16	0.02	0.03	0.04
Shares (%)							
Coal	*43.2*	*27.2*	*22.2*	*22.1*	*19.2*	*16.2*	*13.7*
Oil	*28.3*	*33.0*	*25.4*	*21.3*	*27.9*	*28.4*	*27.2*
Gas	*13.4*	*23.3*	*29.3*	*28.3*	*28.5*	*29.6*	*30.2*
Comb. Renewables & Waste	*3.1*	*1.9*	*5.0*	*5.5*	*4.8*	*4.9*	*7.0*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	*1.8*
Electricity	*11.7*	*14.4*	*17.4*	*19.7*	*19.2*	*20.3*	*19.3*
Heat	*0.3*	*0.2*	*0.6*	*3.1*	*0.4*	*0.6*	*0.7*
TRANSPORT[7]	**1.70**	**1.08**	**2.29**	**2.21**	**2.55**	**2.98**	**2.89**
TOTAL OTHER SECTORS[8]	**3.05**	**6.05**	**4.98**	**4.08**	**5.09**	**5.13**	**5.36**
Coal[1]	1.19	1.82	0.35	0.12	0.31	0.25	0.23
Oil	0.49	0.65	0.14	0.12	0.16	0.19	0.15
Gas	0.58	2.33	2.37	2.02	2.30	2.20	2.30
Comb. Renewables & Waste[2]	–	–	0.00	0.00	0.05	0.06	0.10
Geothermal	–	–	0.00	0.00	0.01	0.01	0.03
Solar/Wind/Other	–	–	–	–	0.01	0.05	0.10
Electricity	0.29	0.62	1.12	0.94	1.26	1.35	1.35
Heat	0.51	0.63	1.00	0.87	1.00	1.02	1.10
Shares (%)							
Coal	*39.0*	*30.1*	*7.0*	*3.0*	*6.1*	*4.9*	*4.3*
Oil	*15.9*	*10.7*	*2.9*	*3.0*	*3.1*	*3.7*	*2.8*
Gas	*19.0*	*38.5*	*47.6*	*49.6*	*45.2*	*42.9*	*42.9*
Comb. Renewables & Waste	–	–	*0.1*	*0.1*	*1.0*	*1.2*	*1.9*
Geothermal	–	–	–	–	*0.1*	*0.2*	*0.6*
Solar/Wind/Other	–	–	–	–	*0.2*	*1.0*	*1.9*
Electricity	*9.5*	*10.3*	*22.4*	*23.0*	*24.7*	*26.3*	*25.2*
Heat	*16.6*	*10.4*	*20.0*	*21.3*	*19.7*	*19.9*	*20.5*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2002	2003	2010	2020	2030
ELECTRICITY GENERATION[9]							
INPUT (Mtoe)	**2.64**	**6.29**	**8.32**	**8.54**	**7.40**	**8.46**	**9.52**
OUTPUT (Mtoe)	**1.06**	**2.02**	**2.77**	**2.66**	**2.55**	**2.98**	**3.24**
(TWh gross)	12.30	23.43	32.21	30.99	29.68	34.64	37.70
Output Shares (%)							
Coal	*64.4*	*32.2*	*17.3*	*20.6*	*16.7*	*13.0*	*10.6*
Oil	*17.7*	*3.4*	*2.2*	*2.3*	*2.5*	*2.3*	*1.9*
Gas	*5.3*	*4.9*	*7.8*	*7.7*	*13.5*	*12.1*	*5.3*
Comb. Renewables & Waste	-	–	*0.5*	*0.4*	*1.3*	*1.7*	*3.4*
Nuclear	*1.9*	*51.4*	*55.7*	*57.7*	*47.2*	*52.0*	*61.0*
Hydro	*10.7*	*8.0*	*16.4*	*11.2*	*18.4*	*17.3*	*16.0*
Geothermal	–	–	–	–	*0.0*	*0.1*	*0.1*
Solar/Wind/Other	–	–	*0.1*	*0.1*	*0.3*	*1.4*	*1.6*
TOTAL LOSSES	**3.29**	**5.24**	**6.80**	**7.30**	**5.93**	**6.79**	**7.75**
of which:							
Electricity and Heat generation[10]	0.82	3.41	4.33	4.55	3.63	4.24	4.91
Other Transformation	1.61	0.66	0.73	0.79	0.61	0.87	0.98
Own Use and Losses[11]	0.87	1.17	1.74	1.97	1.69	1.68	1.86
Statistical Differences	**1.31**	**0.08**	**0.02**	**–0.03**	**–**	**–**	**–**

INDICATORS

	1973	1990	2002	2003	2010	2020	2030
GDP (billion 2000 USD)	13.51	18.55	22.03	23.01	29.88	40.94	52.41
Population (millions)	4.64	5.30	5.39	5.38	5.40	5.30	5.30
TPES/GDP12	1.15	1.16	0.84	0.80	0.61	0.48	0.41
Energy Production/TPES	0.17	0.25	0.36	0.35	0.31	0.36	0.40
Per Capita TPES[13]	3.34	4.05	3.44	3.44	3.36	3.74	4.09
Oil Supply/GDP[12]	0.40	0.25	0.15	0.14	0.13	0.10	0.08
TFC/GDP[12]	0.81	0.87	0.53	0.49	0.41	0.32	0.27
Per Capita TFC[13]	2.35	3.04	2.17	2.09	2.26	2.46	2.63
Energy-related CO_2 emissions (Mt $CO2$)[14]	41.6	55.5	38.2	38.7	36.1	36.3	35.9
CO_2 emissions from bunkers (Mt CO_2)	–	–	0.2	0.1	0.1	0.1	0.1

GROWTH RATES (% per year)

	73-79	79-90	90-02	02-03	03-10	10-20	20-30
TPES	4.0	0.8	-1.2	-0.0	-0.3	0.9	0.9
Coal	0.8	-0.7	-4.9	7.6	-3.2	-0.8	-1.1
Oil	4.2	-3.4	-3.0	-4.5	2.6	0.9	1.1
Gas	12.5	4.4	1.2	-3.4	0.9	0.2	0.6
Comb. Renewables & Waste	-0.8	-0.3	4.9	10.6	4.0	7.2	4.4
Nuclear	45.1	17.0	3.5	-0.4	-3.4	2.4	1.9
Hydro	6.0	–	8.9	-34.0	8.2	0.7	–
Geothermal	–	–	–	-11.1	29.9	4.8	4.1
Solar/Wind/Other	–	–	–	-25.0	29.2	18.7	16.2
TFC	3.7	1.6	-2.6	-3.9	1.2	0.6	0.7
Electricity Consumption	5.0	3.2	-0.3	1.1	1.5	1.0	0.4
Energy Production	2.0	5.6	1.9	-3.5	-1.9	2.4	2.1
Net Oil Imports	4.5	-3.3	-3.2	-4.3	2.7	0.9	0.2
GDP	2.5	1.6	1.4	4.5	3.8	3.2	2.5
Growth in the TPES/GDP Ratio	1.4	-0.7	-2.6	-4.3	-3.9	-2.2	-1.6
Growth in the TFC/GDP Ratio	1.2	0.0	-4.0	-8.0	-2.5	-2.5	-1.8

Please note: rounding may cause totals to differ from the sum of the elements.

Energy Balance 2003

Million tonnes of oil equivalent

SUPPLY AND CONSUMPTION	Coal	Crude Oil	Petroleum Products	Gas	Nuclear	Hydro	Geotherm. Solar etc.	Combust. Renew. & Waste	Electricity	Heat	Total
Production	0.82	0.05	–	0.17	4.70	0.30	0.01	0.35	–	0.00 e	6.40
Imports	3.73	5.68	0.83	5.50	–	–	–	0.00	0.74	–	16.48
Exports	-0.07	-0.07	-3.39	-0.00	–	–	–	-0.01	-0.94	–	-4.48
Intl. Marine Bunkers	–	–	–	–	–	–	–	–	–	–	–
Stock Changes	0.09	0.04	-0.00	0.00	–	–	–	-0.00	–	–	0.12
TPES	**4.56**	**5.70**	**-2.57**	**5.67**	**4.70**	**0.30**	**0.01**	**0.34**	**-0.19**	**0.00**	**18.52**
Transfers	–	0.14	-0.15	–	–	–	–	-0.00	–	–	-0.01
Statistical Differences	0.03	0.00	–	–	–	–	–	–	–	–	0.03
Electricity Plants	-0.31	–	-0.00	–	–	-0.30	-0.00	-0.00	0.38	–	-0.24
CHP Plants	-1.64	–	-0.11	-0.74	-4.70	–	-0.00	-0.05	2.29	0.72	-4.24
Heat Plants	-0.03	–	-0.01	-0.62	–	–	-0.01	-0.01	-0.00 e	0.60 e	-0.07
Gas Works	–	–	–	–	–	–	–	–	–	–	–
Petroleum Refineries	–	-6.18	6.41	–	–	–	–	–	–	–	0.22
Coal Transformation	-0.98 e	–	–	–	–	–	–	–	–	–	-0.98
Liquefaction Plants	–	–	–	–	–	–	–	–	–	–	–
Other Transformation	–	0.36	-0.28	-0.10	–	–	–	–	–	–	-0.02
Own Use	-0.39	–	-0.43	-0.19	–	–	–	-0.00	-0.33	-0.12	-1.46
Distribution Losses	-0.04	-0.00	-0.00	-0.12	–	–	–	-0.00	-0.17	-0.18	-0.51
TFC	**1.22**	**0.00**	**2.86**	**3.89**	**–**	**–**	**0.00**	**0.28**	**1.97**	**1.03**	**11.25**
INDUSTRY SECTOR	**1.09**	**0.00**	**0.78**	**1.40**	**–**	**–**	**–**	**0.27**	**0.98**	**0.16**	**4.69**
Iron and Steel	0.80 e	–	–	0.15	–	–	–	0.01	0.21	–	1.17
Chemical and Petrochem.	0.00	0.00	0.67	0.41	–	–	–	0.01	0.13	0.06	1.28
of which: Feedstocks	–	*0.00*	*0.40 e*	*0.00*	–	–	–	–	–	–	*0.40*
Non-Ferrous Metals	0.01	–	–	0.03	–	–	–	–	0.17	–	0.21
Non-Metallic Minerals	0.13	–	0.05	0.21	–	–	–	0.00	0.09	0.01	0.48
Transport Equipment	0.00	–	–	0.09	–	–	–	0.00	0.02	0.00	0.11
Machinery	0.01	–	0.01	0.14	–	–	–	0.00	0.06	–	0.22
Mining and Quarrying	0.00	–	0.00	0.03	–	–	–	–	0.01	0.00	0.05
Food and Tobacco	0.00	–	0.00	0.16	–	–	–	0.00	0.05	0.02	0.24
Paper. Pulp and Printing	0.09	–	0.01	0.04	–	–	–	0.21	0.08	0.05	0.48
Wood and Wood Products	–	–	0.00	0.01	–	–	–	0.03	0.01	–	0.06
Construction	0.00	–	0.02	0.04	–	–	–	0.00	0.03	0.00	0.09
Textile and Leather	0.01	–	0.00	0.05	–	–	–	–	0.09	0.00	0.15
Non-specified	0.04	–	0.02	0.03	–	–	–	0.01	0.04	–	0.14
TRANSPORT SECTOR	**–**	**–**	**1.68**	**0.47**	**–**	**–**	**–**	**–**	**0.06**	**–**	**2.21**
International Aviation	–	–	0.04	–	–	–	–	–	–	–	0.04
Domestic Aviation	–	–	–	–	–	–	–	–	–	–	–
Road	–	–	1.65	–	–	–	–	–	–	–	1.65
Rail	–	–	–	–	–	–	–	–	0.06	–	0.06
Pipeline Transport	–	–	–	0.46	–	–	–	–	–	–	0.46
Domestic Navigation	–	–	–	–	–	–	–	–	–	–	–
Non-specified	–	–	–	0.00	–	–	–	–	0.01	–	0.01
OTHER SECTORS	**0.12**	**–**	**0.12**	**2.02**	**–**	**–**	**0.00**	**0.00**	**0.94**	**0.87**	**4.08**
Agriculture	0.00	–	0.07	0.08	–	–	0.00	0.00	0.08	0.01	0.24
Comm. and Publ. Services	0.04	–	0.04	0.33	–	–	0.00	0.00	0.42	0.18	1.02
Residential	0.08	–	0.01	1.61	–	–	–	–	0.43	0.68	2.82
Non-specified	–	–	–	–	–	–	–	–	–	–	–
NON-ENERGY USE	**0.00**	**–**	**0.27**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**0.27**
in Industry/Transf./Energy	0.00	–	0.21	–	–	–	–	–	–	–	0.21
in Transport	–	–	–	–	–	–	–	–	–	–	–
in Other Sectors	–	–	0.06	–	–	–	–	–	–	–	0.06
Electricity Generated - TWh	***6.40***	**–**	***0.71***	***2.40***	***17.86***	***3.48***	***0.03***	***0.11***	**–**	**–**	***30.99***
Electricity Plants	*0.90*	–	*0.01*	–	–	*3.48*	*0.00*	*0.00*	–	–	*4.39*
CHP plants	*5.49*	–	*0.70*	*2.40*	*17.86*	–	*0.03*	*0.11*	–	–	*26.59*
Heat Generated - PJ	***12.02***	**–**	***0.92***	***39.40***	***2.02***	**–**	***0.17***	***1.04***	***0.00***	***0.01***	***55.59***
CHP plants	*11.26*	–	*0.67*	*15.70*	*2.02*	–	–	*0.60*	–	–	*30.25*
Heat Plants	*0.76*	–	*0.25 e*	*23.70*	–	–	*0.17*	*0.45*	*0.00 e*	*0.01 e*	*25.34*

e: means estimate.

Footnotes to Energy Balances and Key Statistical Data

1 *Includes lignite.*

2 *Comprises solid biomass, liquid biomass, biogas, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.*

3 *Other includes ambient heat used in heat pumps.*

4 *Total net imports include combustible renewables and waste.*

5 *Total supply of electricity represents net trade. A negative number indicates that exports are greater than imports.*

6 *Includes non-energy use.*

7 *Includes less than 1% non-oil fuels.*

8 *Includes residential, commercial, public service and agricultural sectors.*

9 *Inputs to electricity generation include inputs to electricity, CHP and heat plants. Output refers only to electricity generation.*

10 *Losses arising in the production of electricity and heat at main activity producer utilities (formerly known as public) and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of 33% for nuclear, 10% for geothermal and 100% for hydro.*

11 *Data on "losses" for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.*

12 *Toe per thousand US dollars at 2000 prices and exchange rates.*

13 *Toe per person.*

14 *"Energy-related CO_2 emissions" have been estimated using the IPCC Tier I Sectoral Approach. In accordance with the IPCC methodology, emissions from international marine and aviation bunkers are not included in national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 2003 and applying this factor to forecast energy supply. Future coal emissions are based on product-specific supply projections and are calculated using the IPCC/OECD emission factors and methodology.*

ANNEX II

INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The 26 member countries* of the International Energy Agency (IEA) seek to create the conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants.

In order to secure their objectives they therefore aim to create a policy framework consistent with the following goals:

1. **Diversity, efficiency and flexibility within the energy sector** are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable. Non-fossil fuels, particularly nuclear and hydro power, make a substantial contribution to the energy supply diversity of IEA countries as a group.

2. Energy systems should have **the ability to respond promptly and flexibly to energy emergencies**. In some cases this requires collective mechanisms and action: IEA countries co-operate through the Agency in responding jointly to oil supply emergencies.

3. **The environmentally sustainable provision and use of energy** is central to the achievement of these shared goals. Decision-makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should where practicable have regard to the Polluter Pays principle.

4. **More environmentally acceptable energy sources** need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of IEA members wish to retain and improve the nuclear option

* *Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.*

for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

5. **Improved energy efficiency** can promote both environmental protection and energy security in a cost-effective manner. There are significant opportunities for greater energy efficiency at all stages of the energy cycle from production to consumption. Strong efforts by governments and all energy users are needed to realise these opportunities.

6. Continued **research, development and market deployment of new and improved energy technologies** make a critical contribution to achieving the objectives outlined above. Energy technology policies should complement broader energy policies. International co-operation in the development and dissemination of energy technologies, including industry participation and co-operation with non-member countries, should be encouraged.

7. **Undistorted energy prices** enable markets to work efficiently. Energy prices should not be held artificially below the costs of supply to promote social or industrial goals. To the extent necessary and practicable, the environmental costs of energy production and use should be reflected in prices.

8. **Free and open trade** and a secure framework for investment contribute to efficient energy markets and energy security. Distortions to energy trade and investment should be avoided.

9. **Co-operation among all energy market participants** helps to improve information and understanding, and encourage the development of efficient, environmentally acceptable and flexible energy systems and markets worldwide. These are needed to help promote the investment, trade and confidence necessary to achieve global energy security and environmental objectives.

(The Shared Goals were adopted by IEA Ministers at their 4 June 1993 meeting in Paris.)

ANNEX III

LIST OF ABBREVIATIONS AND UNITS

In this report, abbreviations are substituted for a number of terms.

AAU	Assigned Amount Unit; tradeable unit under the Kyoto Protocol emissions trading mechanism. Each unit allows the country to emit one tonne of CO_2 or CO_2 equivalent.
AIJ	Activities Implemented Jointly.
a. s.	Joint Stock Company.
ASMR	Administration of State Material Reserves.
ALTENER	EU energy support programme for renewable energy.
BIDSF	International Decommissioning Support Fund.
CENTREL	(association of Central European TSOs).
CERM	Co-ordinated Emergency Response Measures.
CIS	Commonwealth of Independent States.
CCGT	Combined-cycle gas turbine.
CEEC	Central and Eastern European Countries.
COMECON	Council for Mutual Economic Assistance: economic organisation between former Socialist states. Its military counterpart was the Warsaw Pact.
CHP	Combined production of heat and power; sometimes, when referring to industrial CHP, the term "co-generation" is used.
CO	Carbon monoxide.
CO_2	Carbon dioxide.
DG	Distributed generation.
DH	District heating.
DSM	Demand Side Management: refers to actions taken on the customer's side to increase energy efficiency and/or to reduce peak demand.

DSO	Distribution system operator.
EBRD	European Bank for Reconstruction and Development.
EC	European Commission.
ECB	Energy Centre Bratislava.
EIA	Environmental Impact Assessment.
ETG	Eural Trans Gas.
€	Euro.
EU	The European Union, whose members are Austria, Belgium, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, the Netherlands and the United Kingdom.
EU ETS	European Union Emissions Trading Scheme.
ESCO	Energy service company; develops, installs, and finances projects to improve energy efficiency and reduce operations and maintenance costs for customer facilities.
FDI	Foreign Direct Investment.
GDP	Gross Domestic Product.
GHG	Greenhouse gas.
IA	Implementing Agreement (IEA international co-operation on energy technologies).
IAEA	International Atomic Energy Agency.
IEA	International Energy Agency whose members are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.
IEP	International Energy Program, one of the founding documents of the IEA.
IEM	EU Internal Energy Market.

IKL	Ingolstadt-Kralupy-Litvínov oil pipeline.
IPP	Independent Power Producer.
IPPC	Intergovernmental Panel on Climate Change.
JI	Joint Implementation.
LILW	Low and intermediate level (nuclear) waste.
LPG	Liquefied petroleum gas; refers to propane, butane and their isomers, which are gases at atmospheric pressure and normal temperature.
LNG	Liquefied natural gas.
MOE	Ministry of Economy.
N/A	Not available.
NAP	National Allocation Plan.
NEAP	National Environmental Action Programme.
NESO	National Emergency Scheme Operator.
NGO	Non-governmental organisation.
NOx	Nitrogen oxides.
NPF	National Property Fund.
NPP	Nuclear power plant.
OECD	Organisation for Economic Co-operation and Development.
PHARE	EU technical assistance programme for Central and Eastern Europe.
PPC	Paroplynový Cyklus. a.s.; CCGT plant in Bratislava.
PPP	Purchasing Power Parity: the rate of currency conversion that equalises the purchasing power of different currencies, *i.e.* estimates the differences in price levels between different countries.
R&D	Research and Development, especially in energy technology; may include the demonstration and dissemination phases as well.

RES	Renewable energy sources.
RUE	RosUkrEnergo.
SAVE	EU energy support programme for energy efficiency.
SEA	Slovak Energy Agency.
SE	Slovenské Elektráne, a.s.; power generation company.
SE-VYZ	Nuclear waste management and decommissioning company.
SEPS	Slovenska elektrizacna prenosova sustava, a.s.; Slovak Electricity Transmission System.
SME	Small and Medium enterprises.
SNIDF	State Fund for the Decommissioning of Nuclear Power Generating Facilities and for Spent Fuel and Radioactive Wastes Treatment.
SO_2	Sulphur dioxide.
SPP	Slovensky Plynarensky Priemysel, a.s.; Slovak natural gas company.
SSE	Stredoslovenská energetika, a.s.; Central Slovakia electricity distribution company.
SKK	Slovak currency (Koruna); 2005 exchange rates: one US dollar equivalent to SKK 48 and one euro equivalent to SKK 40.
TFC	Total Final Consumption of energy; the difference between TPES and TFC consists of net energy losses in the production of electricity and synthetic gas, refinery use and other energy sector uses and losses.
TPA	Third Party Access; nTPA: negotiated Third Party Access, rTPA: regulated Third Party Access.
TPES	Total Primary Energy Supply.
TPF	Third party financing; financial mechanism in which an ESCO designs, installs and finances the energy efficiency investment project and is remunerated from the savings achieved.
TSO	Transmission System Operator.
UCTE	Union for the Co-ordination of Transmission of Electricity; association of TSOs in continental Europe.
UJD	Úradu jadrového dozoru; Nuclear Regulatory Authority.
UNFCCC	United Nations Framework Convention on Climate Change.

URSO	Úrad pre reguláciu sieťových odvetví; Regulatory Office for Network Industries.
USD	United States dollar.
USSR	Union of Socialist Soviet Republics.
VAT	Value-Added Tax.
VOC	Volatile Organic Compounds.
VSE	Východoslovenská energetika, a.s.; Eastern Slovakia electricity distribution company.
VVER	Russian acronym of the Pressurised Water Reactor (PWR).
ZSE	Západoslovenská energetika, a.s.; Western Slovakia electricity distribution company.

Units*

bcm	billion cubic metre.
Bl	barrel of oil; equivalent to 159 litres or 41.868 GJ.
cm	cubic metre.
GJ	gigajoule, or 1 joule $\times 10^9$; equivalent to 0.0238 toe.
GW	gigawatt, or 1 watt $\times 10^9$.
kWh	kilowatt-hour = one kilowatt $\times$ one hour, or one watt $\times$ one hour $\times 10^3$; equivalent to 0.0859 toe or 3.6 GJ.
kt	thousand tonnes.
m	million.
mcm	million cubic metres.
Mt	million tonnes.
Mtoe	millions of tonnes of oil equivalent; see toe.
MW	megawatt of electricity or 1 Watt $\times 10^6$.
MWh	megawatt-hour = one megawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^6$.

** See IEA unit converters: http://www.iea.org/Textbase/stats/unit.asp.*

MWt	megawatt of heat or 1 Watt $\times 10^6$.
PJ	petajoule, or 1 joule $\times 10^{15}$.
sq. m	square metre.
toe	tonne of oil equivalent, defined as 10^7 kcal; equivalent to 41.868 GJ.
TW	terawatt, or 1 watt $\times 10^{12}$.
TWh	terawatt $\times$ one hour, or one watt $\times$ one hour $\times 10^{12}$.

ANNEX IV

RELEVANT WEB SITES

- **Slovakia**

Government

Ministry of Economy: www.economy.gov.sk
Ministry of Education: www.minedu.sk
Ministry of the Environment: www.enviro.gov.sk
Ministry of Finance: www.finance.gov.sk
Ministry of Transport, Posts and Telecommunication: www.telecom.gov.sk

Regulators

URSO (Regulatory Office for Network Industries): www.urso.gov.sk
UJD (Nuclear Regulatory Authority): www.ujd.gov.sk

Other administrations

ASMR (Administration of State Material Reserves): www.reserves.gov.sk
Anti-monopoly Office: www.antimon.gov.sk
NPF (National Property Fund): www.natfund.gov.sk
Statistical Office: www.statistics.sk
SEA (Slovak Energy Agency): www.sea.gov.sk

Other organisations

Academy of Sciences: www.sav.sk
ECB (Energy Centre Bratislava): www.ecb.sk; eFilip:www.e-filip.sk
EGU (Energy Institute): www.egu.sk
Dexia Banka Slovensko (registry for EU ETS): www.dexia.sk
SAPPO (Slovak Association of Petroleum Industry and Trade): www.sappo.sk

Companies

BAT (Bratislava district heating company): www.batas.sk
C-Term s r.o. (district heating company): www.c-term.sk
Nafta Gbely (oil and gas company): www.naftagbely.sk
Pozagas (gas storage): www.pozagas.sk
SE (power generation company): www.seas.sk
Slovnaft (oil company): www.slovnaft.sk
SPP (Slovak natural gas company): www.spp.sk

SPP Bohemia (gas storage): www.sppbohemia.cz
SEPS (Slovak Electricity Transmission System): www.sepsas.sk
SSE (Central Slovakia electricity distribution company): www.sse.sk
Terming s r.o. (district heating company): www.terming.sk
Transpetrol (oil company): www.transpetrol.sk
VSE (Eastern Slovakia electricity distribution company): www.vse.sk
ZSE (Western Slovakia electricity distribution company): www.zse.sk

- **Regional and EU**

CENTREL (association of Central European TSOs): www.centrel.org
CEER (Council of European Energy Regulators): www.ceer-eu.org
CENS (Center for Nuclear Safety in Central and Eastern European Countries): www.censee.org
C3EM (Central and Eastern European Energy Market): http://c3em.uni-corvinus.hu
CEECAP (Central and Eastern European Appliance Policy): www.ceecap.org
ECEEE (European Council for an Energy-Efficient Economy): www.eceee.org
ECS (Energy Charter Secretariat): www.encharter.org
ETSO (European Transmission System Operators): www.etso-net.org
EURELECTRIC (Association of the electricity generation industry in Europe): www.eurelectric.org
ERRA (Energy Regulators Regional Association): www.erranet.org
Eurogas (Association of the Gas Industry in Europe): www.eurogas.org
EREC (European Renewable Energy Council): www.erec-renewables.org
European Commission-Directorate-General for Energy and Transport (DG TREN): http://europa.eu.int/comm/energy/
European Commission-Directorate-General for Environment: http://europa.eu.int/comm/environment
GIE (Gas Infrastructure Europe): www.gte2.be
UCTE (association of TSOs in continental Europe): www.ucte.org
REEEP (Renewable Energy and Energy Efficiency Partnership): www.reeep.org
Visegrad Group: www.visegradgroup.org

- **IEA**

Central and Eastern Europe:
http://www.iea.org/Textbase/subjectqueries/nmc/europe.asp
Country Reviews:
http://www.iea.org/Textbase/subjectqueries/keyresult.asp?KEYWORD_ID=4151
Technology Agreements: http://www.iea.org/textbase/techno/index.asp
Energy Statistics: http://www.iea.org/Textbase/stats/index.asp

- **OECD**

  Economic Directorate:
  http://www.oecd.org/infobycountry/0,2646,en_2649_37443_1_70780_1_1_37443,00.html

  Environment Directorate:
  http://www.oecd.org/infobycountry/0,2646,en_2649_37465_1_70780_1_1_37465,00.html

  NEA (Nuclear Energy Agency): www.nea.org

- **UN**

  IAEA (International Atomic Energy Agency): www.iaea.org
  UNDP (United Nations Development Programme): www.undp.org
  UNEP (United Nations Environment Programme): www.unep.org

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