International Energy Agency

Energy Policies of IEA Countries

The Slovak Republic

2012 Review

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The Slovak Republic imports virtually all of its natural gas and crude oil from a single supplier, the Russian Federation. Energy security is therefore an overarching concern and priority in the Slovak Republic's energy policy agenda. The government is taking steps to diversify supplies and build on lessons learned from the gas supply disruption in 2009.

Enhancing regional co-operation, particularly in the development of gas and electricity interconnections, is an essential step towards meeting the dual policy objectives of enhancing energy security and market competition. The Slovak Republic has moved forward with coupling its electricity market with the Czech Republic's, and supports the construction of a North-South pipeline connection that would link planned LNG terminals in Croatia and Poland, including an interconnector to Hungary.

Despite a sharp decline in greenhouse gas (GHG) emissions since 1990, the Slovak Republic remains a GHG-intensive economy by OECD standards, with energy-related CO_2 emissions accounting for over 70% of total GHG emissions. The country must continue to implement policies that ease the transition to a low-carbon economy. Nuclear power and renewable energy can play crucial roles in the Slovak Republic's efforts to decarbonise its electricity production. Significant efforts can also be made to improve energy efficiency, especially in the transport and building sectors. District heating is a notable area with huge potential for reducing national GHG emissions.

This review analyses the energy-policy challenges currently facing the Slovak Republic, and provides sectoral studies and recommendations for further policy improvements. It is intended to help guide the country towards a more secure and sustainable energy future.

9 789264 098244

(61 2011 07 1P1)
978-92-64-09824-4 €75

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INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its primary mandate was – and is – two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its 28 member countries and beyond. The IEA carries out a comprehensive programme of energy co-operation among its member countries, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency's aims include the following objectives:

- Secure member countries' access to reliable and ample supplies of all forms of energy; in particular, through maintaining effective emergency response capabilities in case of oil supply disruptions.
- Promote sustainable energy policies that spur economic growth and environmental protection in a global context – particularly in terms of reducing greenhouse-gas emissions that contribute to climate change.
- Improve transparency of international markets through collection and analysis of energy data.
- Support global collaboration on energy technology to secure future energy supplies and mitigate their environmental impact, including through improved energy efficiency and development and deployment of low-carbon technologies.
- Find solutions to global energy challenges through engagement and dialogue with non-member countries, industry, international organisations and other stakeholders.

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The European Commission also participates in the work of the IEA.

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1. EXECUTIVE SUMMARY AND KEY RECOMMENDATIONS

EXECUTIVE SUMMARY

POLICIES AND MEASURES

The Slovak Republic has made sound progress since the last IEA in-depth review of its energy policies. The country's energy policies, outlined in the *Energy Policy of the Slovak Republic* (adopted in 2006 and whose updated version is currently under preparation) and the *Energy Security Strategy of the Slovak Republic* (2008) are in line with the IEA member countries' policy goals to achieve energy security, environmental sustainability and economic development. The key objectives of the Slovak energy policy agenda are increasing efficiency in the power and end-use sectors, reducing energy intensity, reducing dependence on energy imports, expanding the use of nuclear power, increasing the share of renewables in the heat and electricity sectors, and supporting the use of alternative fuels for transport. With these sound objectives in place, the government should now focus on the cost-effective implementation of the adopted policies through concrete actions.

ENERGY SECURITY

Because of high dependence on oil and gas imports, energy security is very high on the policy agenda in the Slovak Republic. Natural gas is currently the most significant energy source, accounting for about 30% of the country's primary energy supply. A considerable proportion of households depends on natural gas for heating. Moreover, gas import dependence is very likely to remain high in the future. Gas is supplied mainly from Russia with long-term import contracts. Dependence on a single supplier makes the Slovak Republic vulnerable to supply disruptions. The government took a proactive approach to improve the security of gas supplies following the January 2009 gas crisis, including through expanding storage capacities and enabling reverse flows at the country's two western interconnectors. These actions have appreciably improved the ability to respond to a gas supply disruption. The government should continue with plans to further expand storage capacity and to develop an interconnector with Hungary.

Since 99% of the crude oil used within the Slovak Republic is imported from Russia via the Druzhba pipeline, the government is rightly concerned about oil supply route diversification. The various potential pipeline projects to interconnect the Slovak pipeline network with other supply sources would improve supply security, particularly in light of the possible redirection of Russian exports via alternative routes in the coming years. The government should prioritise these projects and accordingly take tangible steps to promote and advance their development, including co-ordinating with industry and neighbouring countries on issues of reversibility and capacity expansions.

REGIONAL CO-OPERATION

The Slovak government recognises the importance of regional co-operation in meeting its energy policy objectives, particularly with regard to enhancing energy security and market competition. Notably, the Slovak Republic has moved forward with market coupling with the Czech Republic and has taken progressive steps to improve co-operation with other neighbouring countries. The successful coupling with the Czech Republic has greatly improved electricity market functioning. The Slovak energy regulator, the Regulatory Office for Network Industries (RONI), takes an active part in regional co-operation concerning cross-border network access for electricity transmission and gas pipelines. The government should continue to support infrastructure projects which will enhance energy security. In particular, initiatives in the framework of the Visegrád Group, which includes the Slovak Republic, Poland, Hungary and the Czech Republic, should be pursued.

The Slovak government is right to support the construction of a north-south connection linking the planned liquefied natural gas (LNG) terminals in Croatia and Poland, including an interconnector to Hungary in the framework of the collaboration with the Visegrád Group. This connection could significantly contribute to regional market integration.

With respect to the regional electricity market, generation fleet investments and upgrades to the Slovak power system will position it favourably within the regional marketplace. With heavy reliance on nuclear and hydropower, strengthened interconnection capability, storage and greater co-operation across regional markets will be needed to facilitate system balance in the Slovak Republic, particularly during periods of power imbalances and low domestic demand.

Formally engaging in long-term electricity system planning would greatly facilitate investment decisions in incremental generation, storage and transmission assets to the benefit of all countries in the Visegrád Group. With growing shares of intermittent renewables entering the marketplace, a regionally focused investment strategy will help minimise investments aimed strictly at improving system reliability from a national perspective.

LOW-CARBON ECONOMY

The Slovak Republic is to be commended for having decoupled economic growth from growth in greenhouse gas (GHG) emissions. The decline in GHG emissions since 1990 has been one of the steepest among OECD countries. Economic restructuring was the main driver behind the dramatic decrease in GHG emissions in the 1990s and the stabilisation of emissions in the 2000s, although energy efficiency improvements and fuel switching also played a role. Nevertheless, in 2009, the Slovak Republic ranked among the ten most GHG-intensive economies in the OECD. Energy-related CO_2 emissions account for the largest share of total GHG emissions (over 70%). Thus, reducing emissions related to energy production, transportation and consumption will have a huge impact on the country's overall GHG intensity.

So far, meeting international commitments for emissions reductions has not been particularly challenging for the Slovak Republic. The country has exceeded its Kyoto target and has a significant surplus of tradable emission allowances in the first commitment period of the Kyoto Protocol. The profits resulting from the use of the flexible mechanisms of the Kyoto Protocol can be reinvested, for example through the

Green Investment Scheme, in measures aiming at further reductions of GHG emissions. However, the use of the Kyoto flexibility mechanisms is low in the Slovak Republic compared with neighbouring countries.

The Slovak Republic's participation in the EU Emissions Trading System (ETS) has been characterised by an over-allocation of allowances. The absence of challenging targets could explain why climate change has not been high on the government's agenda. It could also be the reason why a comprehensive and coherent climate change strategy is still lacking. However, GHG emissions reductions obligations in the Slovak Republic will likely become more stringent after 2020. Much deeper emission cuts up to 2050 have been discussed at the EU level. The forecast emission trends might not be in accordance with mitigation commitments, in particular in the longer perspective beyond 2020-2030.

According to government projections, GHG emissions to 2020 are expected to grow in the transport and industry sectors. The government recognises that such a trend presents a potential challenge for the Slovak Republic in meeting its reduction targets in the non-ETS sectors, particularly the transport sector. A detailed plan with specific actions and interim targets for each of the non-ETS sectors is therefore needed. An important general principle in the assessment and prioritisation of different GHG mitigation measures and policies should be cost-effectiveness.

The Slovak energy infrastructure is ageing and will require investment in replacement or modernisation, particularly when economic growth recovers, leading to increasing energy demand. Large parts of the building stock and of the vehicle fleet are also ageing, calling for modernisation and replacement. The Slovak government should seize the opportunity of anticipated economic growth and related investments to progress towards a low-carbon economy, primarily by maintaining a low-carbon electricity production, thanks to nuclear electricity and renewable energy, and by improving drastically energy efficiency and increasing the use of renewables.

With the planned commissioning of two new nuclear units at the Mochovce nuclear facility in 2012 and 2013, the generating portfolio of the largest Slovak utility will be strategically positioned with a fleet of low-carbon capacity. However, the large share of nuclear in the Slovak energy mix requires special attention to issues of decommissioning and waste management. The National Nuclear Fund in 2006 has put in place an effective institutional arrangement to collect and manage funds for decommissioning and long-term radioactive waste management and disposal. Moreover, the government has created a national company for decommissioning and for radioactive waste management and disposal. These steps are to be commended. However, the principal omission is a firm plan and timescale to develop a deep geological repository for final disposal of spent fuel. Despite its high degree of dependence on nuclear power, the Slovak Republic currently has no clear timeline to develop its own repository.

In its renewable energy policy, the government gives priority to biomass. Biomass represents a significant low-carbon energy resource for the Slovak Republic. However, strict rules and controls on biomass production may prevent the country from reaching its envisaged target. Agriculture and forestry policies should be aligned with energy policy to achieve the national goals in the most effective manner.

The Slovak government has introduced feed-in tariffs to encourage investment in renewable electricity technologies. In order to avoid excessive upward pressure on final electricity prices, it would be helpful to establish the annual maximum uptake of a particular technology. This should be determined in consultation with the transmission

operator, SEPS, so that system security concerns can be adequately considered and the impact on rate structures can be effectively managed. It is vital to avoid retroactive reduction of support as this would severely damage investor confidence. On the other hand, it is important to develop and apply a predictable and transparent monitoring process, to analyse regularly the cost-effectiveness of the feed-in tariffs and to adjust them accordingly for new projects, in order to encourage investment while avoiding placing an excessive burden on consumers.

ENERGY EFFICIENCY

Given the multiple benefits of energy efficiency in terms of energy security, GHG mitigation, and the often low or negative costs of such measures, unleashing the energy efficiency potential should be a policy priority. Energy efficiency has had a relatively low profile on the agenda in some ministries in the Slovak Republic and this has been reflected in low levels of programme funding. Access to funding for energy efficiency improvement projects is still hampered by a lack of transparency and excessive administrative barriers. Based on the Strategy on Energy Efficiency, adopted in July 2007, a robust legal framework has been set up which should serve to partly rectify this situation. Now the focus on energy efficiency should shift strongly towards implementation of the Strategy's proposed measures to ensure the realisation of energy savings.

The Slovak Republic has realised impressive results in energy efficiency over the past five years. Energy intensity decreased by 33% between 2002 and 2008, but it still remains higher than the IEA European average and huge energy saving potential still exists in most sectors, especially in buildings and transport. Regarding buildings, low-energy and passive buildings should be clearly defined and included in a future revision of the building codes. As for transport, energy efficiency should be an integral part of the transport policy, especially in the context of a projected rise in fossil fuel use in the transport sector. Policy measures aimed at improving the fuel efficiency of the Slovak vehicle fleet should be implemented.

Improving energy efficiency in the electricity and heating sectors will also be important in order to achieve major energy savings over the long term. Currently, there is little incentive for distribution utilities to invest in end-use efficiency programmes that would help residential and commercial consumers save electricity or heat in a cost-effective manner. The current rate and ownership structure across these systems largely favours throughput rather than efficiency. Given that energy security is a priority for the Slovak government, electricity and heat suppliers should be encouraged to implement end-use energy savings, without compromising their profitability as sales decline.

The transmission company, SEPS, has been upgrading its transmission system and strengthening interconnection capability over the past decade and has clearly defined investment plans extending out to 2020. The distribution system operators may wish to monitor developments in relevant smart grid-related technologies as these, where appropriately deployed, can reduce transmission losses and environmental impacts while helping to maximise system reliability and stability. Smart grid-related investments, including advanced metering infrastructure, and additional transmission system interconnections will strengthen the flexibility of the Slovak power system, which will facilitate the effective integration of new nuclear and variable renewable generating capacities to the generation mix.

Another important area for the government's attention is the efficiency of the heating sector. The Slovak Republic has a long tradition of district heating and overall consumption in the form of heat represents nearly half of total final energy consumption. Improving the efficiency and lowering the environmental impact of district heat production and consumption has been a low priority, compared with measures in the electricity and transport sectors. A successful strategy on heat should integrate the entire energy chain from generation to end-use. Several components of these successful strategies that the Slovak government should consider are: collecting statistics on heating and cooling markets; creating an adequate policy and regulatory framework for the heating sector; supplying heat to consumers at a reasonable cost; developing a framework which provides long-term predictability for investors in district heating networks; and further promoting combined heat and power (CHP) generation, energy efficiency and renewable energy sources.

MARKET REFORMS AND REGULATORY FRAMEWORK

The Slovak Republic has achieved notable progress in market liberalisation. Both the electricity and natural gas markets have been opened, and competition in the industrial segment of each market increased markedly in 2009. In the electricity sector, the number of residential and non-residential consumers switching suppliers in 2009 was dramatically higher than 2008 levels. The Slovak government should be commended for making the strategic decision several years ago to access managerial and operational expertise by partnering with leading power companies across Europe. This has given the electricity sector considerable strength in serving the needs of residential, commercial and institutional customers.

In the gas sector, many challenges still remain. Despite the fact that a legal framework to open the gas market has been in place since 2006, competition among private sector companies has been gradually increasing in recent years. At present, there are several active suppliers on the gas market. The supply to households comes mostly from the incumbent supplier; however, additional suppliers entered the market in 2011. Regulated end-user prices for households are functioning as a barrier to more competition and new market entrants, and this may prevent necessary private investment in the market. Further, the Regulatory Office for Network Industries should assess whether the network fees are at the appropriate level to cover the need for investment in reconstruction and should make information about the gas market publicly available.

A stable, predictable and transparent regulatory environment is the key prerequisite not only to well-functioning markets but also to attracting the needed investment in the energy infrastructure. Following years of underinvestment, the need for investments to upgrade the Slovak Republic's energy infrastructure is pressing. It is commendable that the government is committed to creating conditions for the efficient development and safe and reliable operation of energy systems, while allowing appropriate returns on their investment. The role of the energy regulator in creating a stable, predictable and transparent framework is of utmost importance since the national utility and the transmission company still have dominant positions in the electricity and gas markets respectively. As part of the implementation of the Third Energy Market Liberalisation Package, the government will ensure that RONI has full autonomy, the decisive powers and the resources necessary to carry out its role effectively. The regulatory process should be carried out in a transparent manner and should include consultations with stakeholders.

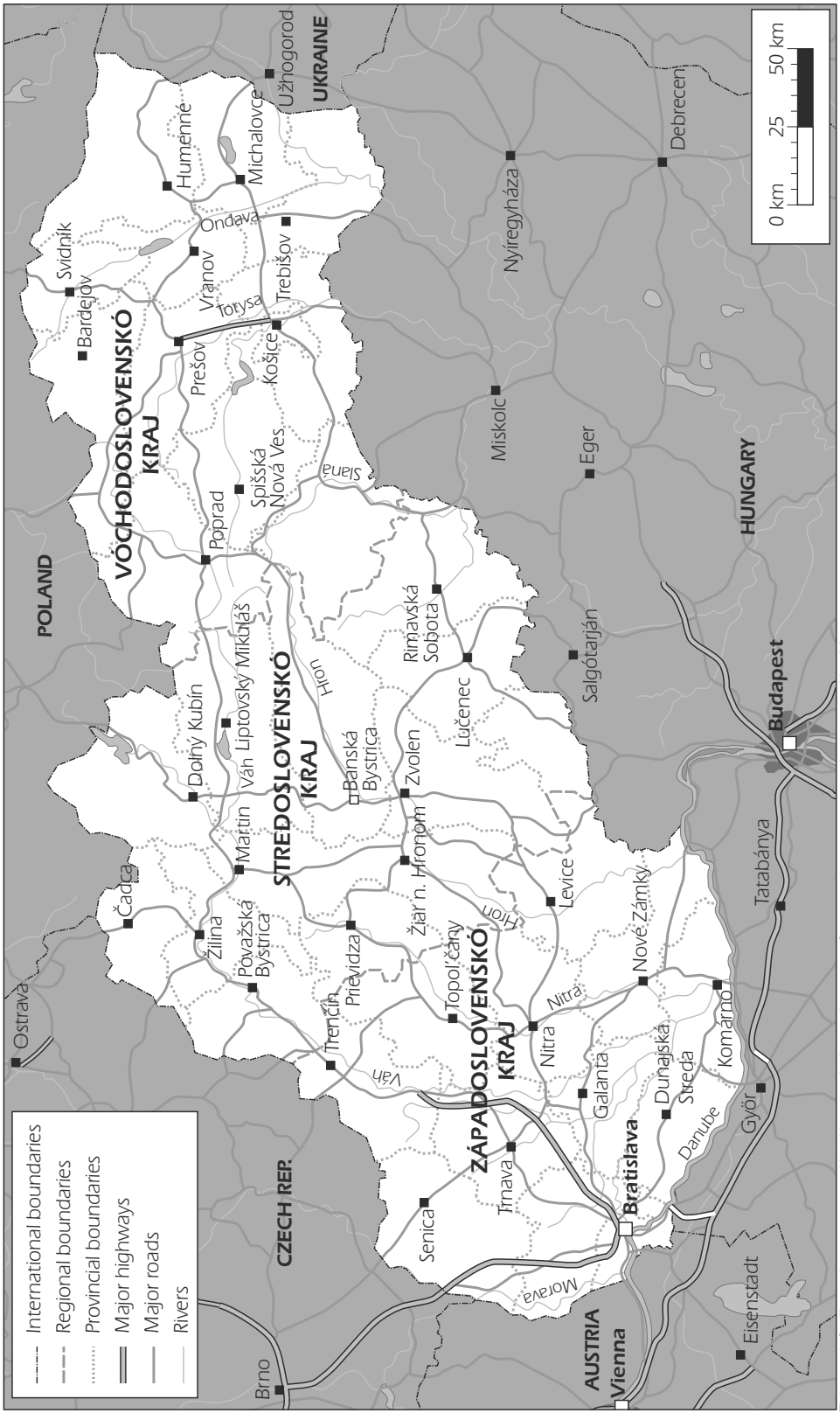
KEY RECOMMENDATIONS

The government of the Slovak Republic should:

- *Enhance energy security by supporting infrastructure projects which diversify energy supply sources and routes.*
- *Continue to pursue its national energy policy objectives within a regional context, strengthening regional co-operation, integrating regional energy markets and supporting increased interconnections.*
- *Step up CO_2 emissions reduction efforts, notably in the transport and buildings sectors, including through the creation of a detailed plan with specific actions and interim targets and an assessment of the cost-effectiveness of different mitigation measures, to ensure the national target for non-ETS emissions is achieved.*
- *Ensure timely implementation of energy efficiency policies and measures and raise public awareness of energy efficiency improvement options, given the critical importance of energy efficiency for energy security, climate change mitigation and economic competitiveness.*
- *Ensure a stable and predictable legislative framework, with an independent and adequately resourced regulator, and encourage investments in energy projects in accordance with the long-term national energy strategy.*

PART I
POLICY ANALYSIS

Figure 1.**Map of the Slovak Republic**



2. GENERAL ENERGY POLICY

Key data (2010 estimates)

Population: 5.4 million

GDP: USD 94.7 billion (2000 prices and PPPs), +59.7% since 2000

GDP per capita: USD 17 500 (OECD average: USD 26 900)

TPES: 17.3 Mtoe (gas 30%, nuclear 22%, oil 21%, coal 20%, renewables 7%) -0.2% on average per year since 2000

TFC: 10.8 Mtoe in 2009 (industry 40%, transport 21%, residential 20%, other 19%) -0.5% on average per year since 2000

Electricity generation: 27.3 TWh (nuclear 53%, hydro 20%, coal 15%, gas 7%, oil 2%, biofuels 2%)

Inland energy production: 6.1 Mtoe, 36% of TPES

COUNTRY OVERVIEW

The Slovak Republic, with a population of 5.4 million and a territory of about 49 000 km^2, was established on 1 January 1993 following the break-up of the former Czechoslovakia. It is a land-locked country in the middle of Central Europe and its territory is dominated by forests and mountains, but agricultural land covers nearly half of the country's territory. Most of the population lives in the west of the country. Slovaks account for a large majority of the population (about 86%), with Hungarians and Roma being the two main minority groups. The Slovak Republic is an industrialised country with an open economy. Key industrial sectors include iron and steel, chemicals, electro-chemical, car making, light industry and food processing. Despite its modern economy and society, the Slovak Republic is decidedly rural. About 45% of Slovaks live in villages of less than 5 000 people, and 14% in villages of fewer than 1 000.[1]

The Slovak Republic joined the Organisation for Economic Co-operation and Development (OECD) in 2000 and the International Energy Agency (IEA) in 2007. A member of the European Union (EU) since May 2004, it adopted the common EU currency (EUR) in January 2009. Along with other Central and Eastern European countries and new EU members, the Slovak Republic has faced the historic double challenge of making the transition to a market economy and implementing EU common policies and legislation.

The global recession in 2009-2010 affected the Slovak economy more profoundly than most other OECD countries, primarily because of its exposure to world trade and its specialisation in cyclical export goods, notably cars. In tandem with developments in its

1. http://www.state.gov

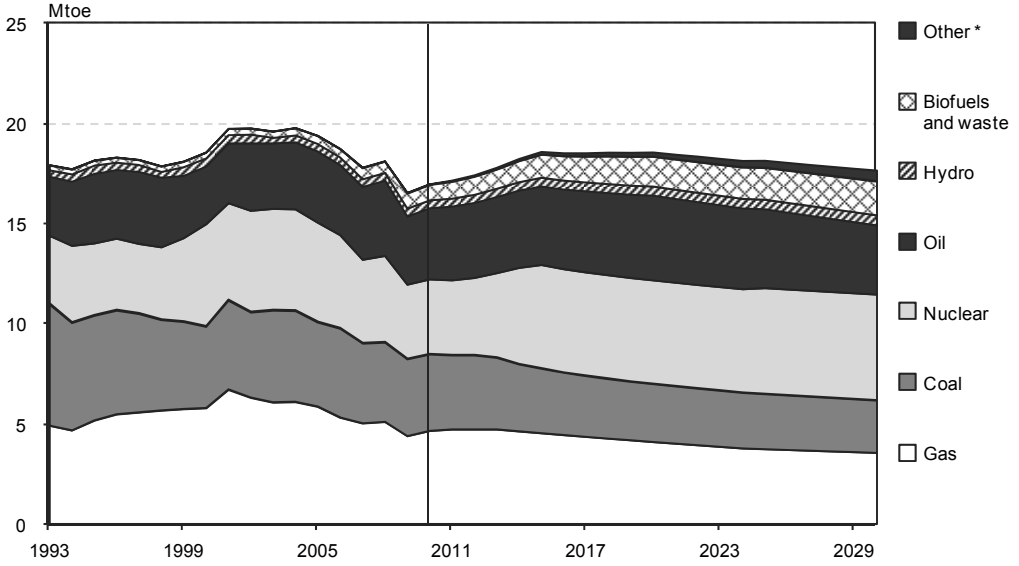
main trading partner economies, the recovery of the Slovak economy proceeded at an above-average pace. In order to realise a sustainable high-growth trajectory, the government needs to reduce unemployment, bring government finances back on a sustainable path and make efforts to reap the benefits of a transition to greener growth.[2]

SUPPLY AND DEMAND

SUPPLY

In 2010, total primary energy supply (TPES) in the Slovak Republic was 17.3 million tonnes of oil equivalent (Mtoe), a decrease of 8.2% compared with 18.3 Mtoe in 2008.

Figure 2. **Total primary energy supply, 1993 to 2030**



* *Other* includes wind, geothermal and solar.

Note: This graph shows historical data until 2010 and the government's projections from 2011 to 2030.

Sources: Ministry of Economy of the Slovak Republic and *Energy Balances of OECD Countries*, IEA/OECD Paris, 2011.

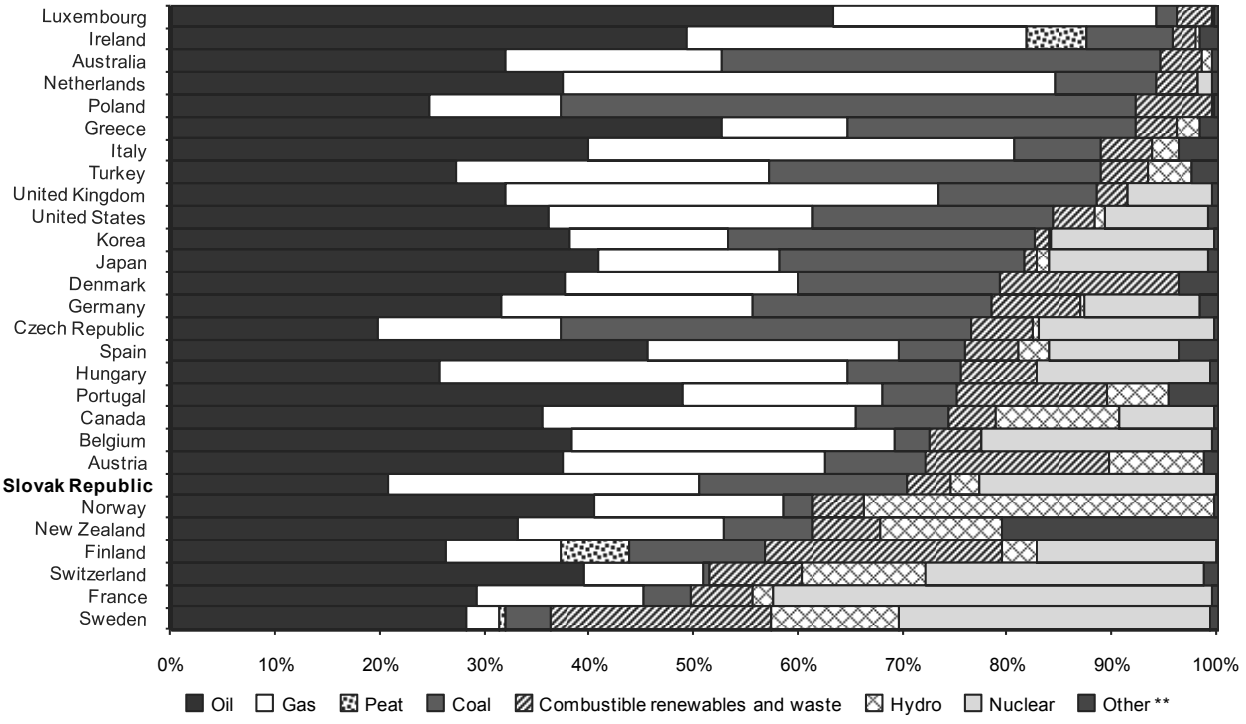
TPES is well diversified compared with other IEA countries. Gas has been the largest energy source since 1996, and its share has remained roughly constant at around 30% of TPES. At the same time, coal, the historically more developed energy source, has seen its share in TPES steadily decline. In 2010, coal was the fourth-largest energy source with 20% of TPES, after nuclear power, 23% and oil, 21%. The small remaining part of total energy supply comes from renewable energy sources, mainly biomass and waste (4.1%) and hydro (2.7%). Geothermal and solar energy account for less than 0.1% of TPES.

2. For more details see *OECD Economic Surveys: Slovak Republic,* OECD, Paris, 2010.

The Slovak government expects that the energy mix will remain well diversified to 2030. Total primary energy supply is expected to reach around 17.5 Mtoe in 2030. According to government forecasts, coal demand will continue to decline, while gas, nuclear and renewable energy sources will see their shares increase.

Among all IEA member countries, the Slovak Republic has the lowest share of oil in TPES, while the shares of nuclear power and gas are relatively high (Figure 3).

Figure 3. **Breakdown of total primary energy supply in IEA member countries, 2010***



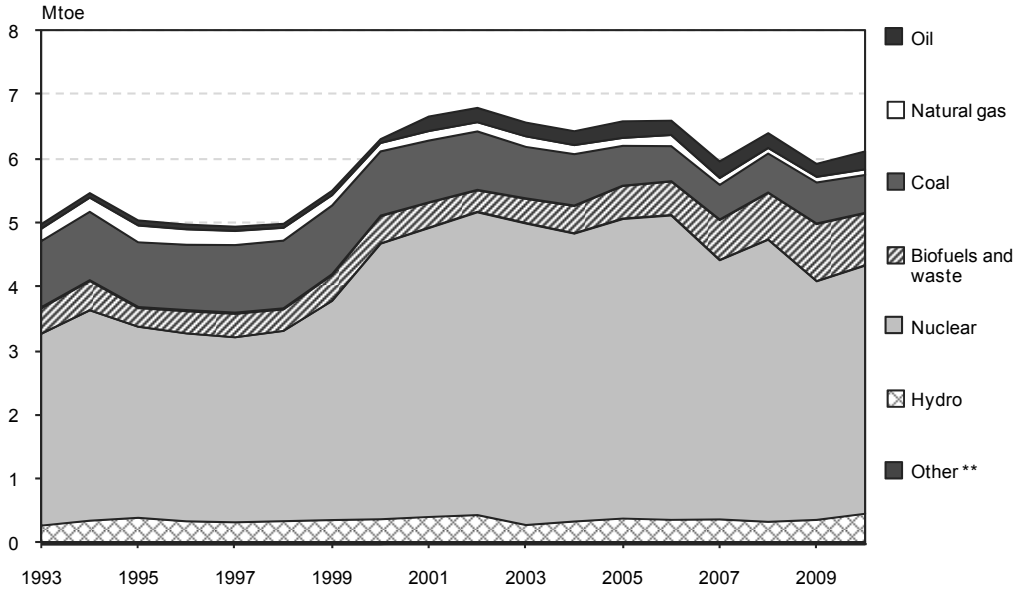
* Estimates.

** *Other* includes ambient heat used in heat pumps.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2011.

In terms of energy production, the Slovak Republic produces only around a third (36%) of its total primary energy supply, or 6.1 Mtoe in 2010 (Figure 4). Domestic production has increased slightly over the past few years, and is expected to account for 40% of TPES in 2030. Nuclear is the largest domestic energy source, with 63% of total energy production in 2010, followed by biomass and waste (13%) and coal (10%). Import dependence in the Slovak Republic was 63% in 2010, much higher than the EU-27 average. Nearly all of the oil and gas consumed in the Slovak Republic is imported from the Russian Federation.

Figure 4. **Domestic energy production by source, 1993 to 2010***



* Estimates for 2010.

** *Other* includes wind, geothermal, solar and ambient heat used in heat pumps (negligible).

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2011 and country submission.

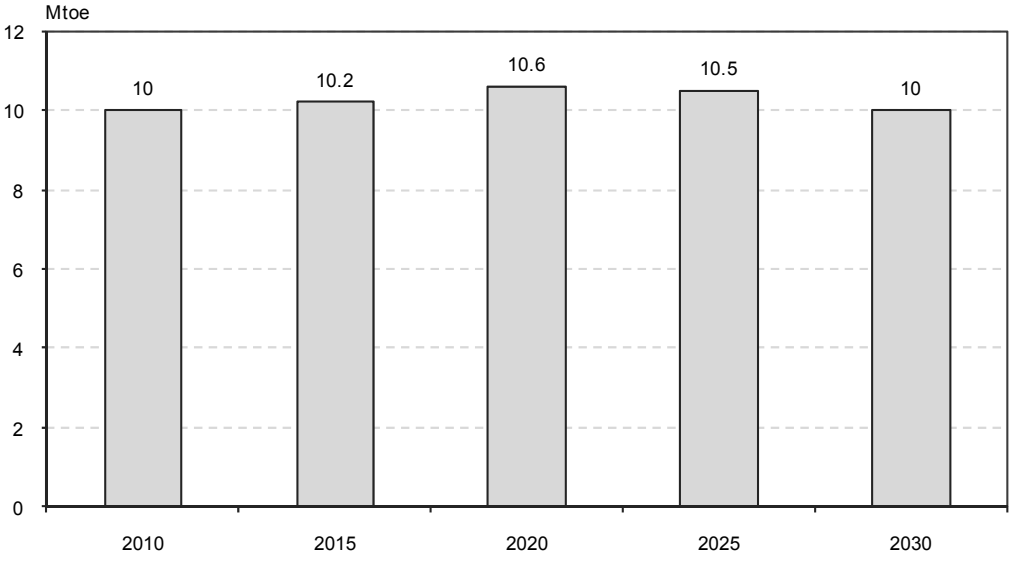
DEMAND

Total final energy consumption (TFC) in the Slovak Republic was 10.8 Mtoe in 2009, increasing over the past decade at a rate similar to TPES (1% per year). Industry is the largest energy-consuming sector with approximately 4.3 Mtoe or 40% of TFC. Industry's share has remained rather constant since 1993. The second largest energy-consuming sector is transport, accounting for 21% of TFC in 2009. The Slovak Republic is the only country among IEA members with a large share of gas (almost a quarter) in transport sector consumption. In the Czech Republic, gas accounts for around 5% of transport sector consumption, the second largest share among IEA countries. Most of the gas in the Slovak Republic is used in pipeline transport as it is a key transit country for transporting Russian gas to Europe. The Slovak Republic also uses compressed natural gas (CNG) for public and road transport. In 2010 the country produced 8.1 million kilograms (some 11.5 million m^3) of CNG for 823 vehicles, mainly city buses and municipal vehicles. At end-2010, there were 11 CNG stations in the Slovak Republic. CNG accounts for around 0.04% of transport sector consumption. Liquefied petroleum gas (LPG) is also used by some 60 000 cars.

Nearly 20% of total final energy is consumed in residential buildings and around the same level in commercial buildings, the service sector and agriculture. In these sectors gas is by far the most important fuel, accounting for over half of energy consumption.

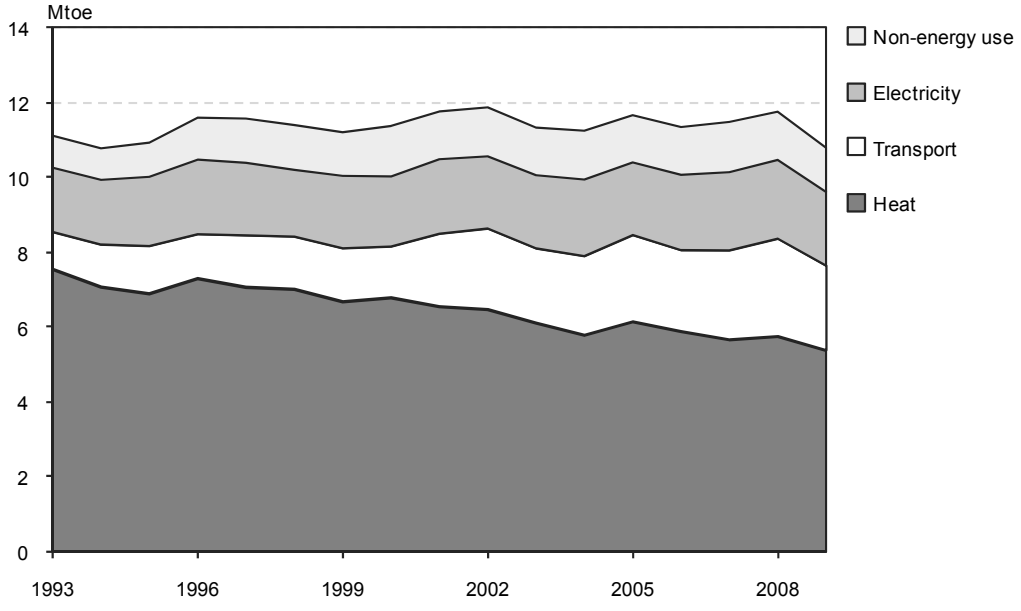
The share of primary energy converted into heat in the Slovak Republic, nearly 50%, is among the highest in IEA member countries, and only lower than in Poland, Turkey, Hungary, Denmark and Germany.

Figure 5. **Total final energy consumption forecasts, 2010 to 2030**



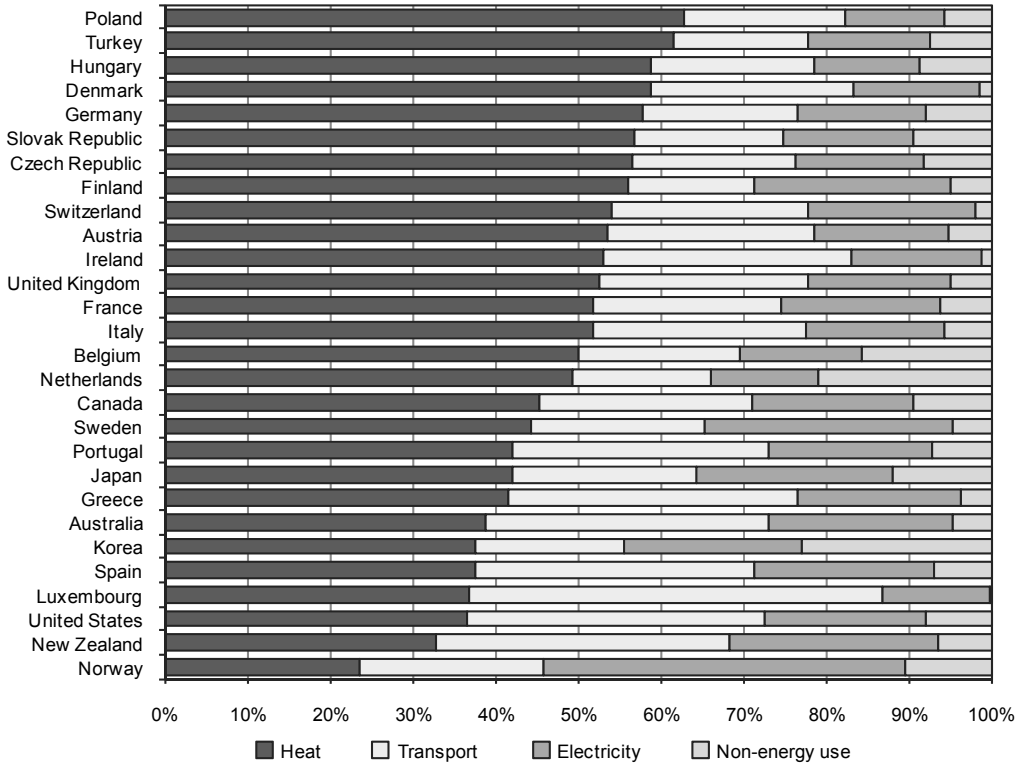
Source: Ministry of Economy of the Slovak Republic.

Figure 6. **Final energy use in the Slovak Republic, 1993 to 2009**



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

Figure 7. **Final energy use in IEA countries, 2009**



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010 and country submission.

ENERGY POLICY INSTITUTIONS

A number of institutions deal directly or indirectly with energy policy in The Slovak Republic.

The Ministry of Economy holds the main responsibility for energy policy in the development and implementation of a policy framework.

The Ministry of Environment is responsible for the development and implementation of environmental, climate change and adaptation policy.

The Ministry of Transport, Infrastructure, Construction and Telecommunications is responsible for policies and measures in the transport and buildings sectors. The implementation of EU directives related to buildings is a shared responsibility, with the Ministry of Transport, Infrastructure, Construction and Telecommunications responsible for buildings-related legislation and the Ministry of Economy responsible for boilers, air-conditioning and other heating and cooling equipment. These two ministries co-operate on the implementation of energy efficiency measures that fall under their jurisdiction.

The Ministry of Agriculture and Rural Development co-operates with the Ministry of Economy in the development and implementation of renewable energy policy and utilisation of biomass.

The Ministry of Foreign Affairs is responsible for diplomatic affairs, including *ad hoc* energy issues. It deals with international aspects of energy security (see also the section below on Energy Security).

The **Regulatory Office for Network Industries (RONI)** regulates the following activities in the energy sector:

- connection and access to the transmission and distribution systems in the natural gas and electricity sectors;
- electricity transmission and distribution, gas transportation and distribution;
- ancillary services in the electricity and gas sectors;
- services of the transmission and distribution system operators;
- access and connection of new electricity and gas producers to the system or network;
- heat generation and distribution;
- access to the underground gas storage facilities and gas storage;
- regulation of prices for: *i)* transmission, distribution and other network activities; *ii)* electricity for households and small businesses; *iii)* gas for households and for district heating companies that produce heat for households; *iv)* district heating (see more details in Chapters 6, 9 and 10);
- determination of the method, procedure and conditions for the system or network operation for electricity and gas supply, generation, transmission and distribution of electricity generated from renewable sources of energy and combined heat and electricity production.

RONI reports directly to the Parliament. However, its proposals of regulatory policy are submitted to the Ministry of Economy for approval in order to ensure their compliance with the energy policy objectives. RONI is financed from the state budget. In 2008, the Slovak Board for Regulation assessed regulatory policy for 2009-2011 and, in March 2011, it put forth regulatory policy proposals for the period 2012 to 2016. The independence and regulatory powers of RONI will be reinforced with the implementation of the Third Energy Market Liberalisation Package. In compliance with EU directives, budgetary independence from the Ministry of Economy will also be ensured. The Act on Energy and the Act on Regulation will be amended accordingly with expected entry into force as of February 2012. The Status, Rights and Obligations of RONI will be fully in accordance with the EU Liberalisation Directive.

The Slovak Innovation and Energy Agency is the implementation agency under the Ministry of Economy. Its key responsibilities include analysis, monitoring and implementation of programmes in the areas of energy efficiency and renewable energy.

The State Energy Inspection is a supervising agency that monitors the implementation of legal provisions in the gas, electricity and heating sectors, and in the drinking water and waste water systems.

The National Property Fund owns state shares in joint stock companies (although the performance of energy sector companies with state shares is supervised by the Ministry of Economy).

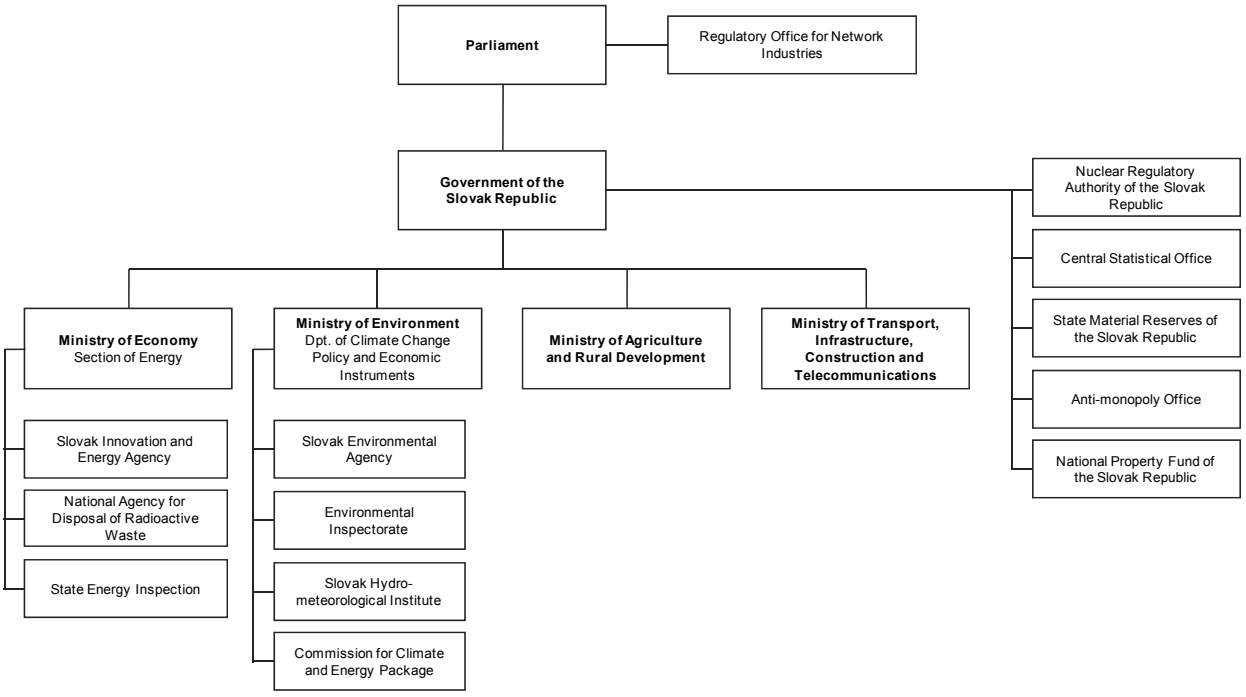
The Anti-monopoly Office's areas of competence include supervision of a competitive environment and abuse of dominant position, as well as approval of mergers.

The State Material Reserves owns public emergency oil stocks (see Chapter 7).

Inter-ministerial commissions have been established to improve co-operation between different institutions on some cross-cutting issues. **The Commission for Climate and Energy Package,** established in August 2008, is a co-ordination body for developing policies and measures in the areas of climate change and renewable energy sources. The Slovak Republic also has an **Inter-ministerial Commission on Energy Security**.

Chapter 3 describes the institutions involved in climate change and environmental policy. The role of the Nuclear Regulatory Authority and the National Agency for the Disposal of Radioactive Waste is discussed in Chapter 11.

Figure 8. **Administrations involved in energy policy and implementation**



Source: Country submission.

KEY ENERGY POLICY DIRECTIONS

Energy policy in the Slovak Republic is driven to a large extent by EU directives and requirements, particularly with respect to liberalising gas and electricity markets. As a member of the EU, the Slovak Republic has to implement the "Third Energy Market Liberalisation Package", which will have a strong impact on the structure of its energy markets. In addition, the EU Energy and Climate Package sets targets for GHG reductions, energy efficiency improvements and renewable energy for all EU members (see below the EU Energy Policy Framework).

Energy policy is also driven by high dependence on energy imports from Russia. Gas imports from Russia are 98% of consumption and oil imports, 99%. The government is aware of inherent risks of such dependence and energy security is a dominant theme of Slovak energy policy.

Energy policy directions are outlined in the *Energy Policy of the Slovak Republic*, adopted in January 2006. In addition, the *Energy Security Strategy*, adopted in November 2008, outlines more concrete practical measures for enhancing energy security in all energy sub-sectors.

EU ENERGY POLICY FRAMEWORK[3]

The EC Green Paper "Towards a European Strategy for the Security of Energy Supply" (2000) represented the first step towards a common European energy policy. Subsequent steps included a Green Paper on a European Strategy for Sustainable, Competitive and Secure Energy (March 2006), a proposal of a new "Energy Policy for Europe" (January 2007) and a Second Strategic Energy Review (November 2008). The Second Strategic Energy Review put forward a strategy to promote solidarity regarding energy supply concerns among member countries, stimulate investment in more efficient energy networks and encourage broader energy efficiency improvements.

Third EU Energy Market Liberalisation Package

Building on earlier initiatives in the electricity and gas markets, the "third liberalisation package", adopted between September 2007 and July 2009, requires EU member states to:

- separate production and supply from transmission networks;
- facilitate cross-border trade in energy;
- make national regulators more independent and more effective;
- promote cross-border collaboration and investment;
- encourage greater market transparency in network operation and supply;
- promote increased solidarity among EU countries.

"20-20-20" targets and the Climate-Energy Package

In March 2007 the governments in EU countries endorsed an integrated approach to climate and energy policy that aims to combat climate change and increase the EU's energy security while strengthening its competitiveness. The EU Heads of State and Government set climate and energy targets to be met by 2020, known as the "20-20-20" targets. These are:

- a reduction in EU greenhouse gas emissions of at least 20% below 1990 levels[4];
- a target that 20% of EU gross final energy consumption must come from renewable energy sources;
- a 20% reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency.

3. This section is based on information from the EC website (http://ec.europa.eu).

4. The EU leaders also offered to increase the emissions reduction target to 30%, on condition that other major emitting countries in the developed and developing world committed to doing their fair share under a global climate agreement.

In January 2008, the European Commission proposed binding legislation to implement the 20-20-20 targets. The Climate and Energy Package was agreed by the European Parliament and Council in December 2008 and became law in June 2009. The package delivers on EU leaders' commitments on GHG emissions and renewable resources, and contributes to the target of improving energy efficiency by 20%. It consists of four legislative texts:

- a directive revising the EU Emissions Trading System (EU-ETS), which covers some 40% of greenhouse gas emissions in the EU;
- an "effort-sharing" decision setting binding national targets for emissions from sectors not covered by the EU-ETS;
- a directive setting binding national targets for increasing the share of renewable energy sources in the energy mix;
- a directive creating a legal framework for the safe and environmentally sound use of carbon capture and storage technologies.

Two legislative acts were also recently passed, focusing on achieving the non-ETS target, in particular in the transport sector:

- a regulation requiring a reduction in CO_2 emissions from new cars to an average of 120 g per km, to be phased in between 2012 and 2015, and a further reduction to 95 g per km in 2020. This measure alone will contribute more than one-third of the emission reductions required in the non-ETS sectors;
- a revision of the Fuel Quality Directive requiring fuel suppliers to reduce greenhouse gas emissions from the fuel production chain by 6% by 2020.

Legislation was also adopted and will be proposed in the area of energy efficiency (recast of the Directive on the Energy Performance of Buildings; Ecodesign and labelling implementing measures, Revision of the Energy Services Directive, etc.).

With the adoption of the Energy and Climate Package, the EU 20-20-20 objectives translated into the following concrete targets for the Slovak Republic by 2020:

- limit the increase in GHG emissions in non-ETS sectors to 13% relative to the 2005 level;
- increase the share of renewable energy in gross final energy consumption to 14%; and the share of renewable energy in the transport sector to 10%.

Energy 2020

The European Commission adopted the communication "Energy 2020 – A strategy for competitive, sustainable and secure energy" on 9 November 2010. This communication defines energy priorities for the next ten years and sets out the actions to be taken in order to: tackle the challenges of saving energy; achieve a market with competitive prices and secure supplies; boost technological leadership; and effectively negotiate with the EU’s international partners.

Energy infrastructure priorities for 2020 and beyond

On 17 November 2010, the European Commission adopted the communication "Energy infrastructure priorities for 2020 and beyond – A Blueprint for an integrated European energy network". This communication defines EU priority corridors for the transport of electricity, gas and oil. It also proposes a toolbox which will enable governments to implement these priorities in a timely manner.

ENERGY POLICY OF THE SLOVAK REPUBLIC

The Slovak Republic updates its energy policy strategy every five years. The latest official *Energy Policy of the Slovak Republic* was approved by the government on 11 January 2006. It sets objectives for the period up to 2020 and provides an outlook up to 2030. The objectives are to:

- ensure sufficient electricity production to meet domestic demand in an economically efficient way;
- ensure, at maximum efficiency, safe and reliable supply of all forms of energy in requested quantity and quality;
- decrease energy intensity of the Slovak economy, *i.e.* reduce the ratio of gross domestic energy consumption to gross domestic product.

The *Energy Policy of the Slovak Republic* envisages to meet these key objectives through the following actions:

- replace retiring electricity plants so as to ensure sufficient electricity production to cover domestic demand in an economically effective way;
- adopt measures focusing on energy efficiency on the demand side;
- decrease dependence on energy supplies from high-risk regions through diversification of sources and transport routes;
- use domestic primary energy sources for electricity and heat production, in an economically effective way;
- increase utilisation of combined heat and power generation (CHP or cogeneration);
- utilise nuclear power as a diversified, economically efficient and environmentally acceptable option for electricity production;
- ensure safety in nuclear power plant operation safety;
- increase the share of renewable energy sources in electricity and heat production;
- complete plant and network construction in order to facilitate safe and reliable transport, transmission and distribution of electricity and gas;
- build new transmission lines in order to improve connection with the EU internal market as well as markets in other countries;
- support utilisation of alternative fuels in the transport sector.

An updated official version of the *Energy Policy of the Slovak Republic* is to be adopted in December 2011. To prepare the new energy concept, the Ministry of Economy has launched a public consultation process and created a website for "energy dialogue" with

stakeholders. The updated energy policy document is expected to be broadly in line with the *Government Manifesto*, introduced by the current Slovak government, which was formed after the parliamentary elections of 12 June 2010 (Box 1).

Box 1. **Extract from the *Government Manifesto: Energy***

"In recent years, pressure has emerged in the energy sector of Slovakia to increase political influence and the unjustified influence of public administration and administrative burden. Therefore, the Government will undertake efforts to **minimize political and public influence** and will make sure that there are professional experts at the Office for the Regulation of Network Industries, as well as on the management boards and serving as state representatives in energy companies where the government owns a stake.

The Government will prepare an update of the Energy Policy of the Slovak Republic, the main goals of which will be security, competitiveness, efficiency and sustainability. The Government will create conditions for the diversification of energy resources, support the development of energy infrastructure with an emphasis on regional projects, ensuring a link between the electric, gas and oil grids of the Slovak Republic with the grids of neighboring countries and to strengthen the energy security of the region. To this end, the Government will promote the cooperation and coordination of the countries in the region to obtain financial support from EU funds to implement projects of a common regional interest.

In the area of **energy supply security**, the Government will place an emphasis on increasing the cross-border capacity of the electric grid connections with Hungary and support the process of deeper integration of the electricity markets in the region of Central and Eastern Europe. To increase gas supply security, the Government will promote the construction of the north-south connection linking the LNG terminals in Croatia and Poland and transiting all V4 countries, thus creating the possibility for Slovakia to be connected to important gas projects of the South corridor (Nabucco, South Stream, etc.). In terms of oil supply security, the Government will foster a coordinated approach of the countries in the region in the search for alternative ways of oil supply. The Government will ensure reduced dependence on the imports of fossil fuels by developing the use of forest and agricultural biomass.

The updated energy policy will mainly pursue the interest of customers and end users in order to fully be able to use the advantages of a **liberalised and secure energy market**. The Government will adjust the rules for the energy market in order to continue in the liberalisation of this market, to increase competition in the energy sector, to strengthen consumer protection and to enhance the quality of services. A **qualified and professional regulation** of monopoly industries in the energy sector, primarily in transfer and distribution, will result in adopting rules focused on higher and better consumer protection and on preventing the abuse of a dominant position.

The Government will **adjust rules disproportionately interfering with the management of energy companies** in order to create conditions for efficient development and safe and reliable operation of energy systems and grids, while allowing appropriate returns on their investment. In companies with a government stake, the Government will ensure the efficient and economical management of assets and transparent use of funds. In state-owned joint stock companies,

Box 1. **Extract from the *Government Manifesto: Energy*** (continued)

the Government will strictly apply the principles of transparent public procurement, especially in investment projects or in the purchasing of services.

When developing the energy infrastructure, the Government will ensure the **protection of the environment** and sources of drinking water, and the respect of strict safety instructions and environmental aspects. Thus, the Government will not allow the construction of an oil pipeline across the Žitný ostrov (Rye Island).

The Government will support the development of **low-carbon technologies and energy resources**. In the case of **nuclear** energy, it will place an emphasis on respecting the high standards of nuclear safety. The Government will support the project of constructing the nuclear source in Jaslovské Bohunice only on the condition that it will be based on private investments without any further participation of the state.

The Government will support the use of **renewable and secondary energy resources**, taking into account the expected life-cycle of a given installation and long-term return on investment. When projecting the use of renewable energy resources, it will take into account the principle of minimizing costs applying the integrated approach in order to use renewable energy resources and to reduce greenhouse gas emissions. Priority will be given to **technologies** whose use allows achieving energy prices close to the prices on the market, with regard to an acceptable end-user price of energy. The Government will align the support to renewable energy resources from small water power plants with plans for flood protection.

The Government will support the implementation of the principles of increasing **energy efficiency** and reducing energy requirements on the production side, as well as on the consumption side, including the preparation and implementation of supporting mechanisms.

In negotiations at all levels of EU institutions, the Government will **defend the interests of Slovakia** in all energy subsectors. It will assess the impact of the EU directive on greenhouse gasses and the EU directive on industry emissions on the sectors of electric energy, heating and industry."

Source: *Government Manifesto,* Bratislava, 2010

ENERGY SECURITY

Because of its high dependence on Russia for oil and gas imports, energy security remains very high on the Slovak policy agenda. In October 2008 the Slovak government adopted the *Energy Security Strategy of the Slovak Republic*. This comprehensive document, prepared by the Ministry of Economy, describes potential developments in the Slovak energy sector until 2030 from a security of supply perspective. It also proposes legal and institutional measures, as well as investment projects, to enhance energy security. Possible impacts of executing the propositions in the strategy on energy prices, employment and the environment are also discussed. The document identifies energy efficiency as one key tool to improve the country's energy security.

The Ministry of Foreign Affairs runs the project "External Energy Security of the Slovak Republic" which is focused on *i)* enhancing co-ordination and information exchange between relevant stakeholders, and *ii)* analysing economic and foreign policy aspects of energy security.

Issues related to security of oil, gas, coal and electricity supply are discussed in more detail in the relevant chapters.

REGIONAL INITIATIVES

VISEGRAD 4

The Slovak Republic, Poland, Hungary and the Czech Republic form the Visegrád Group, known as V4, which facilitates co-operation and stability among the four countries and with other countries, including Germany, Austria and Slovenia. Energy security is one of priority areas for V4. A high-level V4 Group on Energy Security has been established at the level of state secretaries or special envoys. In addition, there are two working groups focusing on north-south interconnections in the electricity, gas and oil sectors. V4 gas initiatives are discussed in more detail in Chapter 6.

REGIONAL ELECTRICITY MARKET

The Slovak Republic takes part in the Electricity Regional Initiative (ERI), the aim of which is to accelerate the integration of Europe's national electricity markets. The initiative in the Central-Eastern part of Europe is led by the Austrian Energy Regulator (E-Control) and aims to integrate Austria, the Czech Republic, Germany, Hungary, Poland, the Slovak Republic and Slovenia into a single regional electricity market. The key priorities of the Central-Eastern ERI are managing congestion, increasing transparency, reducing barriers to market entry and developing regulatory competences.[5] The Slovak Republic actively participates in the project of co-ordinated congestion management and capacity allocation.

The electricity markets of the Czech and Slovak Republics have been coupled (see more details in Chapter 9).

REGIONAL GAS MARKET

The Slovak Republic also participates in the EU's Gas Regional Initiative (GRI) launched in 2006. The South South-East (SSE) region in this initiative includes Austria (co-chair), Italy (co-chair), Bulgaria, the Czech Republic, Greece, Hungary, Poland, the Slovak Republic, Slovenia and Romania. Nearly half of European transit gas is transported through these countries; therefore, this region plays an important role for the energy security of the EU. The main priorities for the SEE GRI include monitoring the proper implementation of the European gas regulation, analysis of the regional market and its challenges, transparency in access to storage and hub services, and inter-operability issues, such as gas quality, infrastructure interconnection agreements and operational balancing.[6]

5. http://www.energy-regulators.eu

6. http://www.energy-regulators.eu

MARKET REFORMS

The Slovak Republic has achieved notable progress in liberalisation over the last few years, although many challenges still remain. The country has opened its electricity and natural gas markets, and competition in the industrial segment started to grow markedly in 2009. In the electricity sector, 7 700 residential and 3 000 non-residential consumers switched supplier – a significant growth compared to 2008 (eight households and 1 462 non-residential customers). In the gas sector, four new gas suppliers entered the market in 2009 and 58 gas consumers (non-residential) switched supplier.

Electricity transmission, natural gas transport and distribution are regulated. While a market for new entrants has been opened, much of the electricity, natural gas and heat markets are still regulated. Electricity prices for households and small businesses, gas prices for households, small businesses, and heat production, heat prices from combined heat and power (CHP) produced from natural gas and domestic coal, and electricity production from domestic coal are all regulated.

ENERGY PRICES, TAXES AND SUBSIDIES

PRICES AND TAXES

End-user prices for electricity, oil products, natural gas and coal include excise duties. As of 2011, they are also subject to a value-added tax (VAT) of 20% (up from 19% in 2010). The VAT is refunded to industry. Despite relatively high end-use prices for most energy sources, the implicit tax rate on energy is the lowest in the EU.[7]

The tax policy of the Slovak Republic related to energy is governed by the EU Directive 2003/96/EC on the Taxation of Energy Products and Electricity. The Slovak Republic reached the minimum required excise duty rates on solid fuels (coal, coke) by 1 January 2009 and on electricity and natural gas used as heating fuel by 1 January 2010.

The share of non-oil energy taxes (*i.e.* excise taxes on coal, natural gas and electricity) in total energy tax revenues is low. This is partly due to many exemptions and reduced tax rates. According to the *OECD Economic Survey 2010*, removing many of the existing tax exemptions could significantly support efforts to mitigate climate change and provide potential revenue gains of EUR 120 million, around 9% of total environmental tax revenues, or 0.2% of GDP.

The following energy sources benefit from tax exemptions:

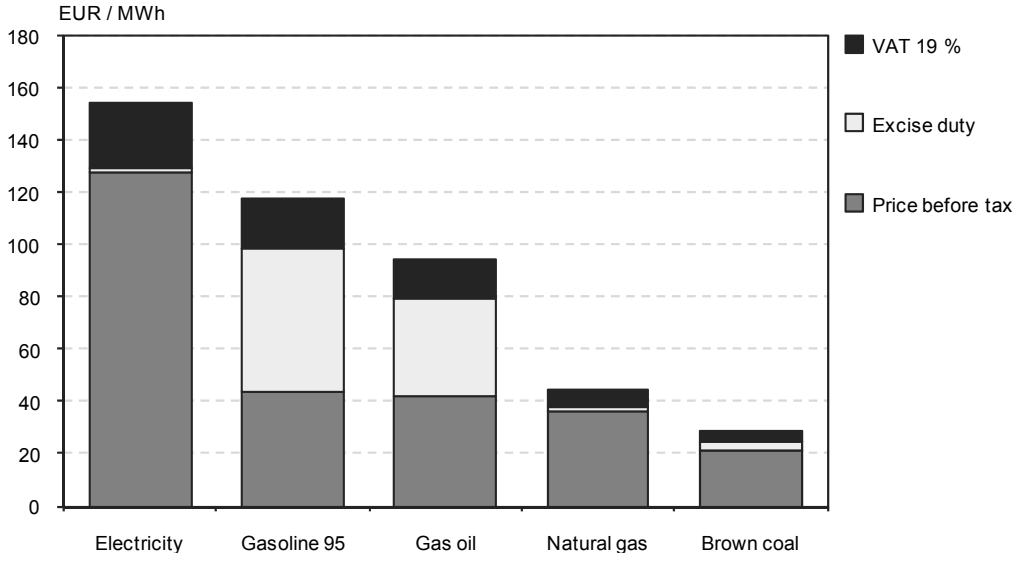
- electricity, gas and coal used by final household customers;
- electricity used for some specified purposes (*i.e.* for industrial production if the electricity costs represent more than 50% of the average own costs of the product manufactured);
- electricity, coal and gas used for the transportation of persons and cargo by public transport (*e.g.* trains, underground and tramways);
- electricity produced from renewable energy sources and CHP;

7. For more details see *OECD Economic Survey* 2010.

- pure biofuels;
- natural gas and coal used *i)* to produce electricity and combined heat and power as well as heat for domestic use, *ii)* for operational and technological purposes and *iii)* for any purpose other than motor fuel or as heating fuel.

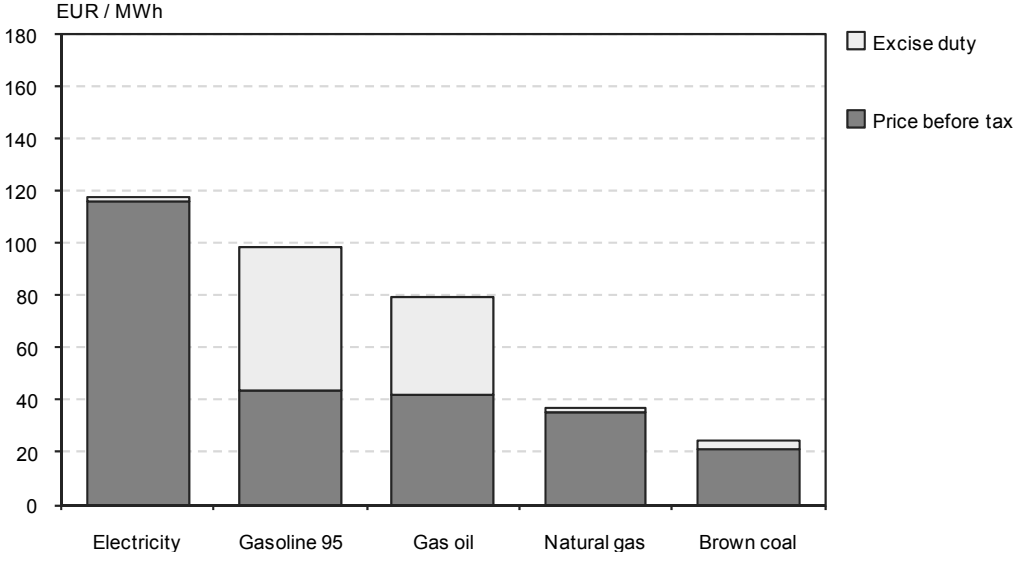
From 1 January 2010, the excise duty for electricity and for natural gas used for heating was 1.32 EUR/MWh which corresponds to the minimum tax rate. The tax rate for coal, 10.62 EUR/tonne also corresponded to the minimum tax rate as of 1 January 2010.

Figure 9. **Average energy prices in the residential sector, 2010**



Source: Ministry of Economy.

Figure 10. **Average energy prices in the industry sector, 2010**



Source: Ministry of Economy.

In order to harmonise its tax policy with EU directives, the Slovak government removed the tax allowance for coal and gas for heat production for households in January 2011. In addition, liquefied petroleum gas (LPG) for transport and natural gas used for the production of compressed natural gas (CNG) for transport were previously exempt from the excise duty, but this exemption was cancelled as of 1 January 2011. The new exemption for LPG is 0.182 EUR/kg (0.1 EUR/litre) and for CNG 13.27 EUR/MWh (0.14 EUR/kg).

Reduced tax rates apply to the following:

- mixture of mineral oil and biogenic materials, such as vegetable oils, biogas or ethyl tertiary butyl ether (ETBE) produced from ethanol;
- marked gas oil ("red diesel") if it is used as a heating fuel or as a motor fuel in rail transport or for electricity generation.

As of 1 January 2011, gas oil for agriculture does not benefit from a reduced tax rate.

A motor vehicle tax is levied on vehicles used for business purposes depending on vehicle weight and the number of axles (for trailers) and on the engine cylinder capacity (for passenger vehicles). The taxation is therefore not related to the energy consumption of the vehicles or their emissions of air pollutants and CO_2.

According to provisional data, published in the *OECD Economic Survey 2010*, the revenues from environmental taxation[8] accounted for 2.2% of GDP in 2008, just above the OECD average of 2.1%. Taxes include excise duties on oil products (82%), other energy taxes (1%), taxes on motor vehicles and transports (7%) and taxes on other polluting activities (*e.g.* waste disposal and GHG emissions).

SUBSIDIES AND SUPPORT SCHEMES

The Slovak Republic supports renewable energy sources through feed-in tariffs (see Chapter 5). In addition, the Ministry of Economy grants subsidies to households for the installation of solar collectors and biomass boilers. The country also supports domestic brown coal mining and electricity generation from domestic coal (Chapter 8).

CRITIQUE

The Slovak Republic has made commendable efforts in transposing most of the EU Directives into national law in a timely manner. Moreover, the government is actively working on the transposition of the most recent EU requirements set by the Energy and Climate Package and the Third Energy Market Liberalisation Package. The government should now focus on effective implementation of the adopted legislation through concrete actions.

The energy policy directions outlined in the *Energy Policy of the Slovak Republic* (adopted in 2006) are in line with the IEA's policy goals to achieve energy security, environmental sustainability and economic development. The document's key objectives are sound; they include meeting energy demand in a cost-effective way and reducing

8. Environmental taxation includes taxes and charges on air pollution, water pollution, waste management, noise, energy products, transport, and resource exploitation.

energy intensity. In addition, the *Energy Security Strategy* (adopted in November 2008) outlines more concrete practical measures for enhancing energy security in all energy sub-sectors.

In 2009, the gas supply disruption severely affected the Slovak economy. The disruption reconfirmed the necessity to have a solid energy security strategy focusing on diversification of both primary supply sources and transport routes. The government is to be commended for having adopted a robust energy security strategy.

An updated version of the *Energy Policy of the Slovak Republic* will be adopted in December 2011. It is very encouraging that, during the preparation process, public consultation has been encouraged and a website for "energy dialogue" has been created. Consulting with stakeholders should be continued in the future. Analysis supporting legislative proposals should also be made public.

Energy policy and legislation have major impacts on the business environment, electricity and natural gas prices, competition, and compliance costs for businesses and households. Therefore, it is important to conduct consistent impact assessments for new legislative proposals and legislative revisions. Such assessments should identify the market or regulatory failure that should be corrected; set objectives; define credible alternatives to reach the objectives; assess the main economic, social and environment impacts and justify why the preferred option is superior to the others.

POLICY CO-ORDINATION

While the Ministry of Economy has the primary responsibility for designing and implementing the country's energy policy, other ministries also develop policies in the Slovak Republic, focusing on R&D, climate change mitigation, air pollution protection, transport, construction and agriculture, among others. These sectoral policies have either direct or indirect links with the Ministry of Economy's energy policy objectives. In this regard, effective co-ordination and consistent analytical approaches are important. The Commission on Climate and Energy Package (CEP) is a good example of increased co-operation between Slovak institutions in delivering on the policy objectives set out by the EU requirements and the Slovak policy documents. Such co-ordination should be further enhanced and improved.

REGIONAL POLICY

The Slovak government very well understands the importance of regional co-operation in meeting its energy policy objectives, particularly as regards energy security and competitive markets. In close co-operation with its neighbours, the government should continue supporting infrastructure projects which will decrease dependence on only one supply source. Energy security initiatives in the framework of the Visegrád Group should be pursued. Because of the relatively small size of the Slovak electricity and gas markets, it would be worthwhile to improve regional co-operation and continue to interconnect with regional markets. The successful market coupling between the Slovak Republic and the Czech Republic is an excellent example. This coupling has improved electricity market functioning. It is also commendable that RONI takes an active part in regional co-operation concerning the cross-border network access for electricity transmission and for gas pipelines.

MARKET REFORMS AND REGULATORY FRAMEWORK

The Slovak Republic has achieved notable progress in liberalisation over the past few years, although many challenges still remain. It has opened its electricity and natural gas markets, and competition in the industrial segment started to grow markedly in 2009. However, the market liberalisation is an ongoing process and many challenges remain, as in other countries, before fully competitive, open markets emerge.

A stable, predictable and transparent regulatory environment is the key prerequisite not only to well-functioning markets but also to attracting the needed investment in energy infrastructure. Following years of underinvestment, the need for investments to upgrade the Slovak Republic's energy infrastructure is pressing. A clearer separation of the government's functions as policy maker, regulator and shareholder would contribute to creating a favourable investment environment. In its *Manifesto*, the government commits itself to adjusting the rules "disproportionately interfering with the management of energy companies in order to create conditions for efficient development and safe and reliable operation of energy systems and grids, while allowing appropriate returns on their investment." This intention is commendable and should be implemented without delay. The government has already begun this process by adopting on 29 March 2011 the Law No. 117/2011 Coll., which ended state influence on energy companies when proposing a price to RONI. Most of the energy companies with state ownership have had their management rights shifted to foreign stakeholders.

The role of the energy regulator in creating a stable, predictable and transparent framework is of utmost importance since SE and SPP still have dominant positions in the electricity and gas markets respectively. Therefore the government should ensure that RONI has the autonomy, the decisive powers and resources necessary to carry out its role effectively. The regulatory process should be carried out transparently and include consultations with stakeholders.

ENERGY TAXES AND SUBSIDIES

Taxation of energy sources, if well targeted, can be an effective tool to reduce energy demand and to encourage investment in less carbon-intensive energy sources. However, in the Slovak Republic tax exemptions vary markedly among energy sources. Such exemptions have adverse environmental effects and lead to a misallocation of resources. As they suppress the price signal created by the tax, they encourage wasteful consumption, provide incentives to develop or maintain energy-consuming technologies and impede investment in clean energy sources. It is encouraging that the government has approved the removal of several tax exemptions, such as for electricity, for natural gas and coal used for heating households, for LPG and CNG for transport and for gas oil used in the agricultural sector.

To foster energy savings, remaining exemptions on energy taxes should be removed. In particular, the exemptions offered to energy-intensive industries should be eliminated as they encourage firms to increase energy consumption. Well-targeted and time-limited compensation could be offered to energy-intensive industries to offset the financial loss related to the increase in taxation and ease the transition towards higher energy costs. Remaining exemptions for household energy consumption should also be phased out, but targeted financial support measures for low-income households should be instituted so as to limit negative social impacts.

RECOMMENDATIONS

The government of the Slovak Republic should:

- *Continue to pursue its national energy policy objectives within a regional context, strengthening regional co-operation, integrating regional energy markets and supporting increased interconnections.*
- *Ensure a stable and predictable legislative framework, with an independent and adequately resourced regulator, so as to encourage investments in energy projects in accordance with the long-term national energy strategy.*
- *Improve energy security, especially in natural gas delivery, by continuing to support infrastructure projects which diversify primary energy sources and supply routes.*
- *Ensure effective co-ordination and consistency of energy and other related policies across relevant ministries, whose responsibilities should be clearly defined.*
- *Building on the recent Energy Dialogue process, extend stakeholder consultation to future energy policies and measures.*
- *Strengthen the impact assessment process for proposed energy policies and measures, considering alternative options and analysing their economic, social and environmental implications. These analyses should be made public.*

3. ENERGY AND CLIMATE CHANGE

Key data (2009)

Total GHG emissions excluding LULUCF: 43.4 Mt CO_2-eq in 2009, -41% compared to base year 1990. 2008-2012 target: -8%

CO_2 emissions from fuel combustion: 33.2 Mt (-1.3% on average per year since 2000)

Emissions by fuel: coal 43%, gas 29%, oil 27%, biomass 1%

Emissions by sector: Electricity and heat generation 25%, energy industries 14%, manufacturing industry 23%, transport 18%, residential 9%, commercial and agriculture 11%

CO_2 EMISSIONS FROM FUEL COMBUSTION

CO_2 emissions from fuel combustion accounted for 76% of total greenhouse gas (GHG) emissions in the Slovak Republic in 2009, thus highlighting the importance of the energy sector for addressing climate change.

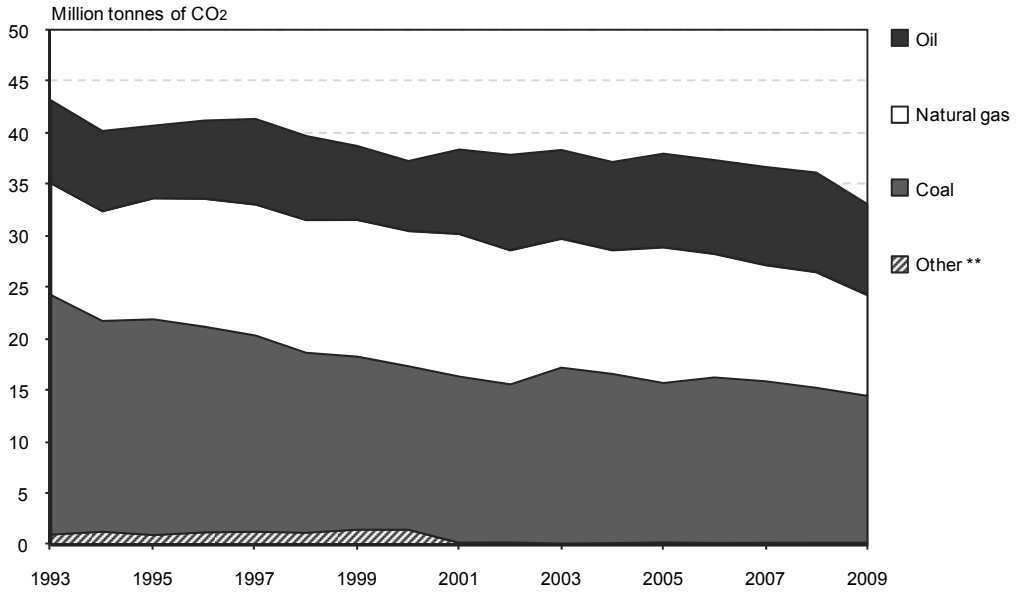
CO_2 EMISSIONS

In 2008 CO_2 emissions from fuel combustion in the Slovak Republic were around 33.2 million tonnes, or 23% lower than in 1993 (Figure 11 and 12). The main driver to this decline was the steep, although temporary, slowing in economic activity, accompanied by the restructuring of the economy. An expansion in the use of more efficient technologies, the switch away from coal in industry and for electricity generation, a reduction in the share of energy-intensive industry and a larger share of services in GDP also played a role in the decline in emissions over the period.

In terms of emissions by sector, the industry sector accounted for 37% of total CO_2 emissions in the Slovak Republic, followed by the power and heat generation sector, representing 25% of CO_2 emissions in 2009. Transport was the third-largest emitting sector, with 18% of total emissions. The residential-commercial sector and agriculture accounted respectively for 9% and 11% of total emissions. Over the last few years, emissions have been declining in all sectors, except for transport, where emissions have been growing steadily, mostly in road transport.

In 2009 the largest amount of CO_2 emissions came from coal combustion, representing 43% of total emissions, followed by gas (29%) and oil (27%).

Figure 11. **CO_2 emissions by fuel*, 1993 to 2009**

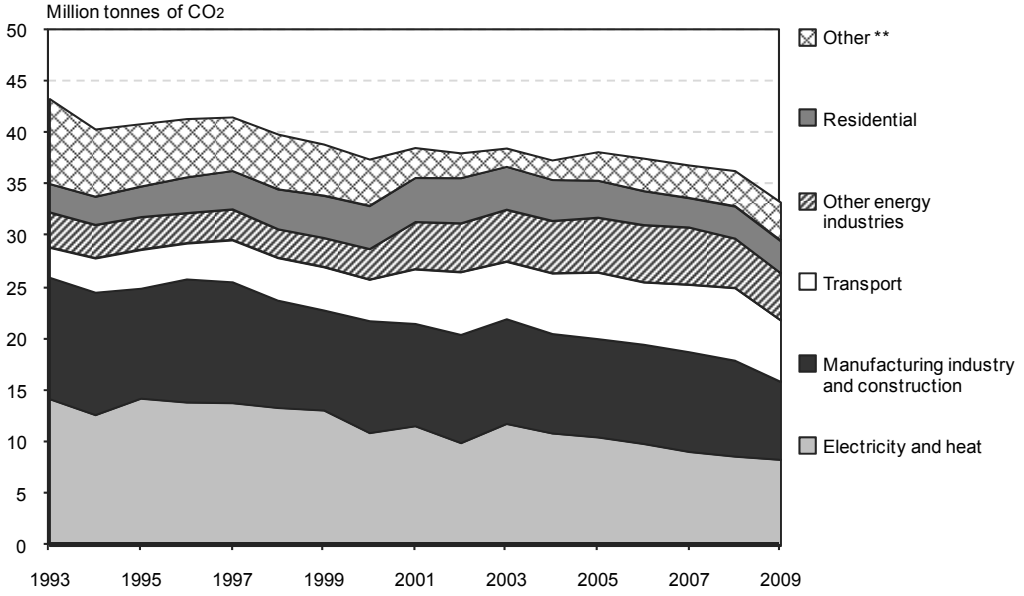


* Estimated using the IPCC Sectoral Approach.

** *Other* includes industrial waste and non-renewable municipal waste.

Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2010.

Figure 12. **CO_2 emissions by sector*, 1993 to 2009**



* Estimated using the IPCC Sectoral Approach.

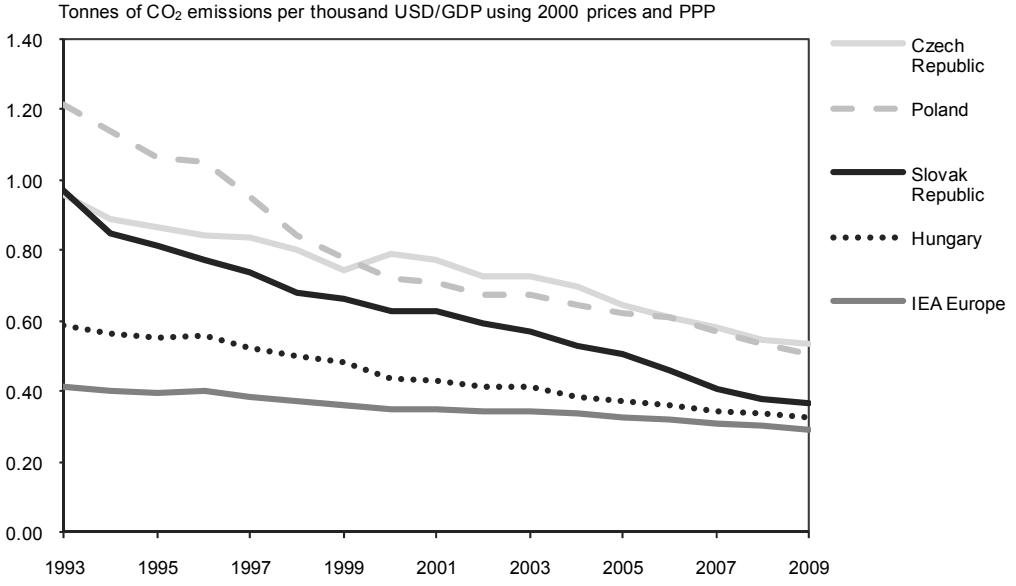
** *Other* includes emissions from commercial and public services, agriculture/forestry and fishing.

Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2010.

CO_2 INTENSITY

Between 1993 and 2008, CO_2 emissions per unit of GDP declined by more than 60% (Figure 13). While in 1993 the CO_2 intensity of the Slovak economy was nearly 130% higher than the average among European members of the IEA (IEA Europe), in 2009 intensity was only 25% higher than the average. In 2009, the Slovak Republic was the seventh most carbon-intensive country among the 28 IEA members, mainly because of its high emissions in the industry sector.

Figure 13. **Energy-related CO_2 emissions per GDP in the Slovak Republic and in other selected IEA member countries, 1993 to 2009**



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010 and *National Accounts of OECD Countries*, OECD Paris, 2010.

TARGETS AND OBJECTIVES

The Slovak Republic has been a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) since 1994 and a party to the Kyoto Protocol since 2002. Under the Kyoto Protocol, it has an individual target to reduce its greenhouse gas (GHG) emissions by 8% in the period from 2008 to 2012 relative to their 1990 level. The Slovak Republic is not part of the EU Burden-Sharing Agreement for the first commitment period of the Kyoto Protocol.

As an EU member state, the Slovak Republic participates in the European Emissions Trading System (EU-ETS) and has to comply with the EU climate and energy package. This package, as an integrated approach to climate and energy policy (see more details in Chapter 2), translates into the following targets for the Slovak Republic:

- limit GHG emissions in sectors not covered by the EU-ETS to 13% above the 2005 level;
- increase the share of renewable energy to 14% of gross final energy consumption;
- save 11% of final energy consumption relative to the average of 2001-2005.

PROGRESS TOWARDS MEETING THE TARGETS

Like many other transition economies, the Slovak Republic has achieved emissions reductions exceeding the target. In 2009, total GHG emissions, excluding land use, land-use change and forestry (LULUCF), were 35.9% below the base-year level. As a result, the Slovak Republic has a surplus of assigned amount units (AAUs) of about 27 million tonnes of CO_2-equivalent. The country is expected to continue to exceed its Kyoto Protocol target up to 2012 (see section on Emissions Projections below). At the EU level, the Slovak Republic's target for non-EU-ETS sectors could be more challenging to meet because of growing emissions in the transport sector. The Slovak actions towards meeting the EU-driven targets are discussed in Chapter 4 on Energy Efficiency and Chapter 5 on Renewable Energy.

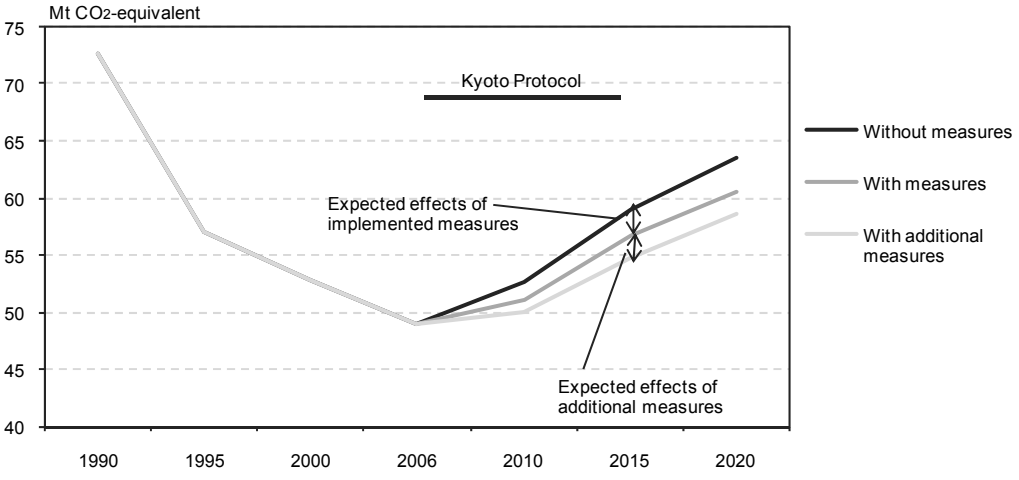
EMISSIONS PROJECTIONS

The Slovak Hydro-meteorological Institute developed projections for greenhouse gas emissions taking year 2006 as the reference year for modelling. Projections of GHG emissions were elaborated for 2010, 2015 and 2020 according to the following scenarios (Figure 14 and Table 1):

- *Scenario without measures*: not taking into account policies and measures that have been implemented, adopted or projected after 2006.
- *Scenario with measures*: taking into account the effect of implemented and adopted policies and measures that have been adopted after 2006.
- *Scenario with additional measures*: taking into account policies and measures implemented and adopted after 2006 as well as the effect of projected policies and measures.

All three scenarios show a steady growth in emissions after 2010. Although the Slovak Republic is expected to meet its Kyoto target in all the scenarios, the expected continued growth in emissions is not sustainable. It may be hard for the country to meet its possible future longer-term commitments.

Figure 14. **Projections of aggregated GHG emissions**



Source: *The Fifth National Communication of the Slovak Republic on Climate Change*, Bratislava, 2009.

Table 1. **Aggregated GHG emission projections by sector (in Gg CO_2-equivalent)**

Category	1990*	1995	2000	2006	2010	2015	2020
Scenario without measures:							
CO_2-eq. without LULUCF	72 611	56 979	52 759	48 920	52 703	59 027	63 513
CO_2-eq. with LULUCF	70 222	54 295	50 373	45 914	49 619	56 348	60 757
Energy	59 884	42 542	38 532	37 351	41 264	46 142	48 935
of which transport	*5 036*	*4 384*	*4 335*	*5 944*	*7 807*	*8 379*	*8 058*
Industrial processes	4 617	4 431	4 635	5 925	6 290	7 703	9 233
Solvents and other products use	17	31	20	82	85	85	85
Agriculture	7 036	4 389	3 487	3 178	2 662	2 577	2 613
LULUCF	-2 388	-2 684	-2 386	-3 006	-3 084	-2 679	-2 756
Waste	1 058	1 202	1 750	2 383	2 402	2 520	2 645
Scenario with measures:							
CO_2-eq. without LULUCF	72 611	56 979	52 759	48 920	51 011	56 708	60 556
CO_2-eq. with LULUCF	70 222	54 295	50 373	45 914	47 948	54 051	57 821
Energy	59 884	42 542	38 532	37 351	39 980	44 313	46 465
of which transport	*5 036*	*4 384*	*4 335*	*5 944*	*7 545*	*7 961*	*7 427*
Industrial processes	4 617	4 431	4 635	5 925	6 338	7 777	9 471
Solvents and other products use	17	31	20	82	49	49	49
Agriculture	7 036	4 389	3 487	3 178	2 251	2 169	2 187
LULUCF	-2 388	-2 684	-2 386	-3 006	-3 063	-2 658	-2 735
Waste	1 058	1 202	1 750	2 383	2 393	2 400	2 385
Scenario with additional measures:							
CO_2-eq. without LULUCF	72 611	56 979	52 759	48 920	49 930	54 712	58 554
CO_2-eq. with LULUCF	70 222	54 295	50 373	45 914	46 850	51 823	55 089
Energy	59 884	42 542	38 532	37 351	39 170	42 679	44 940
of which transport	*5 036*	*4 384*	*4 335*	*5 944*	*7 377*	*7 770*	*7 288*
Industrial processes	4 617	4 431	4 635	5 925	6 336	7 775	9 471
Solvents and other products use	17	31	20	82	49	75	75
Agriculture	7 036	4 389	3 487	3 178	1 982	1 783	1 684
LULUCF	-2 388	-2 684	-2 386	-3 006	-3 079	-2 889	-3 465
Waste	1 058	1 202	1 750	2 383	2 393	2 400	2 385

*Emissions in the base year under the Kyoto Protocol.

Source: *The Fifth National Communication of the Slovak Republic on Climate Change*, Bratislava, 2009.

POLICIES AND MEASURES

INSTITUTIONS

The Ministry of Environment is responsible for the national climate change and adaptation policy as well as for the development of strategic documents and legal instruments in this field. The ministry's Department of Climate Change Policy and Economic Instruments is the national focal point to the UNFCCC.

Several institutions, linked with the Ministry of Environment (see Figure 8 in Chapter 2), are also involved in climate change policy. **The Slovak Environmental Agency** provides the ministry with expertise and documentation for drafting strategies and regulations,

co-ordinates environmental activities and projects, supervises the fulfilment of the Slovak Republic's international obligations, and contributes to harmonisation of environmental legislation. **The Slovak Inspectorate of the Environment** and its regional offices supervise compliance with environmental regulations, impose fines and introduce corrective measures. In the areas of air quality, climate and radioactivity, responsibilities of the **Slovak Hydro-meteorological Institute** include collecting, processing and dissemination of information, monitoring and assessment; participation in the reporting process; and participation in the development of strategic documents. The **Environmental Fund** provides state support for investments in environmental protection projects as grants and loans for approved type of activities. It is financed by environmental charges and penalties.

Academic and research institutions (*i.e.* the Water Research Institute, the National Forestry Centre in Zvolen, the Slovak University of Agriculture in Nitra, the Slovak Technical University in Bratislava, the Faculty of Mathematics and Physics of Comenius University in Bratislava, the Slovak Academy of Sciences), non-governmental organisations and associations of interested groups (the Slovak Energy Agency, PROFING, EFRA Zvolen, the Slovak Association of Refrigeration and Air Conditioning, SPIRIT, Ecosys) are involved in the process of development policy and measures to mitigate climate change.

POLICY CO-ORDINATION

Since 2005, the Slovak Republic has had an Inter-ministerial Working Group on Climate Change, including officials and experts from all relevant ministries. It has co-ordinated the preparation of National Allocation Plans and National Communications on Climate Change.

As mentioned in Chapter 2, a Commission for Climate and Energy Package at the level of state secretaries of all relevant ministries was established in 2008 under the supervision of the Ministry of Environment and the Ministry of Economy. In 2008, the main objective of the Commission was to prepare positions for EU negotiations related to GHG and renewable energy. The main task for the Commission on Climate and Energy Package in 2010 was to develop a national strategy on climate change and renewable energy sources, as well as to define a package of tools and measures to achieve the adopted goals. The Commission regularly reports the outcomes of its activities to the Slovak government.

Despite these co-ordination efforts, there is still some overlap in the development and implementation of the Slovak environment and energy policies. For example, several funds are devoted to the same objective, notably the improvement of energy efficiency in the housing sector and renewable energy development.[9] The multiplicity of funds and programmes reduces cost-effectiveness of support and may lead to a misallocation of resources.

9. In the housing sector, the projects could potentially be financed by national funds such as SLOVSEFF, the state housing development fund (SFRB), the Programme for support of housing development, the subsidy system for elimination of systemic failures, and the EU funds through notably the Regional Operational Programme (2007-2013) "Improving the thermal properties of building use for civil infrastructure". The same applies to renewable energy sources (RES) with the Environmental Fund, the Programme for the Promotion of Biomass and Solar Energy Use in Households, and three different EU funds (Operational programme for Competitiveness and Economic Growth, Operational programme for Environment or programme for Rural Development. Source: *OECD Economic Survey 2010.*

EU EMISSIONS TRADING SYSTEM

The EU Emissions Trading System (EU-ETS) established in 2003 by Directive 2003/87/EC is a mandatory cap-and-trade system covering CO_2 emissions from installations in nine energy-intensive sectors: combustion installations, refinery processes, coke ovens, metal ores, steel, cement, glass, ceramics, and cellulose and paper. The EU-ETS was launched in 2005 and its first commitment period ran until the end of 2007. The second phase covers 2008-2012. Installations in the EU-ETS can meet their obligations either by implementing emissions reduction measures of their own, by purchasing allowances from other installations covered by the EU-ETS, or by purchasing credits from the Kyoto Protocol's flexible mechanisms (joint implementation or clean development mechanism).

The contribution of the ETS to the reduction of GHG emissions was relatively small in the Slovak Republic because of the over-allocation of allowances. In 2009, emissions represented 67% of the allocated allowances in the Slovak Republic while they accounted for 95% on average in the EU27.[10] The Slovak Republic recently introduced a tax on emission allowances valid for years 2011 and 2012. Only the over-allocated allowances are subject to the tax rate of 80%.

From 2013, new rules for the EU-ETS will apply. For example, all allowances for the power sector will have to be auctioned, whereas manufacturing industry can still receive part of its allowances for free, on the basis of stringent EU-wide benchmarks. The number of allowances available to businesses will be progressively reduced, the free allocation of allowances will be gradually replaced by auctioning, and the sectors and GHG emissions covered by the system will be expanded.

DOMESTIC MEASURES OUTSIDE THE EU-ETS

In an effort to meet the commitments under EU legislation, the Slovak Republic has implemented a range of sectoral and cross-sectoral policies with a direct or indirect impact on GHG mitigation. These include:

- measures to stimulate energy efficiency (see Chapter 4);
- feed-in tariffs and other measures promoting renewable energy; support for biofuels (see Chapter 5);
- direct support of investments in renewable energy, high-efficiency cogeneration and energy efficiency (through the Environmental Fund, EU structural funds and special programmes financed by bilateral and multilateral donors);
- fiscal policy instruments, such as exemption from excise tax for electricity produced from renewable sources.

Important non-EU-ETS sectors in terms of GHG mitigation potential include the buildings and transport sectors. There are some measures in place for improving energy efficiency in the buildings sector, as discussed in Chapter 4; however, their implementation could be better enforced.

10. *OECD Economic Survey 2010*.

A sector representing considerable challenges is the transport sector. As discussed in Chapter 2, CO_2 emissions in the transport sector have been growing steadily. This underlines the importance of more aggressive policies and measures to curb the rapidly increasing emissions.

KYOTO PROTOCOL MECHANISMS

As indicated above, the Slovak Republic expects a surplus of assigned amount units (AAUs) of about 42 Mt of CO_2-equivalent (15 in 2008 and 27 in 2009) over the period 2008-2012. Like other transition economies, the Slovak Republic created a framework known as a Green Investment Scheme (GIS) for investing the revenues from the sale of AAUs in GHG mitigation activities. Projects that can be financed through the GIS include energy efficiency activities, fuel-switching projects, developing renewable energy sources and reducing methane emissions. The Slovak Green Investment Scheme was developed and officially approved by the Ministry of Environment in November 2009.

The entity managing the GIS is the Ministry of Environment in close co-operation with the Environmental Fund. Two Acts ensure a transparent and efficient procedure to sell the AAUs: the Act on Emissions Trading stating that all proceeds from AAU sales go to the Environmental Fund; and the Act on Environmental Fund defining the process of selection and funding of priority areas. The GIS framework has not yet been used for selling AAUs in the Slovak Republic. The 15 million AAUs in 2008 were not sold via the GIS and the revenues were managed by the State Housing Development Fund for supporting the insulation of 14 000 flats. This work was finalised in 2010 and achieved a 21 kilotonnes of CO_2 reduction per year.

The project “landfill gas recovery in the Slovak Republic” (eight landfills) has not yet been approved as a joint implementation (JI) project. By the end of 2010, this is the only project which has been assigned as a joint implementation project in the Slovak Republic. The project, financed by the Netherlands, was expected to contribute 0.5 Mt of CO_2-eq. Memorandums of understanding on the JI and emissions trading have been signed with The Netherlands, Austria and Denmark.

MONITORING

The Slovak Republic regularly reports to the EU and UNFCCC on progress in implementing its climate change policy. Progress is being monitored using the indicators as requested in the regular reporting obligations to the European Commission as well as to the UNFCCC as part of the National Inventory Reports and National Communications. The Slovak Republic has not yet developed and applied a consistent methodology in order to consider the cost-effectiveness of the adopted measures.

AIR QUALITY

Over the last decade, the Slovak Republic successfully decoupled air pollution emissions from economic growth; while GDP increased by more than 60% until 2008, emissions of most pollutants (sulphur oxides SO_x, nitrogen oxides NO_x, carbon monoxide CO, ammonia NH_3, small particles $PM_{2.5}$, mercury Hg and dioxins/furans) decreased and emissions intensities per unit of GDP now are similar to the OECD average. The Slovak Republic is on track to meet its goals under the Convention on long-range transboundary

air pollution. Switching to cleaner fuels, plant upgrading and separation technologies have been influential factors in this success. Accession to the EU imposed more stringent pollution standards and accelerated the implementation of policy measures. Emission taxes and non-compliance fees have been effective incentives to adopt best available technologies. However, there is no evidence that emissions abatement has been achieved in the most cost-effective way. Since 2000, emissions of NO_x from road transport, of non-metallic volatile organic compounds (NMVOC) from solvents use and of particulates from the residential sector are growing. Increasing trends are recorded for cadmium, lead, polycyclic aromatic hydrocarbons (PAHs) and hexachlorobenzene (HCB) emissions. Emission intensities per unit of GDP are still above the OECD European average, in particular for heavy metals. Although most of standards on air quality are respected, particulate matters and ground-level ozone concentrations regularly exceed limit values for the protection of human health.

CRITIQUE

The Slovak Republic is to be commended for having decoupled economic growth from the growth in greenhouse gas emissions. The decline in GHG emissions since 1990 has been one of the steepest among OECD countries. Economic restructuring was the main reason behind this dramatic decrease in the 1990s and the stabilisation of emissions in the 2000s, despite rapid economic growth, but energy efficiency improvements and fuel switching also played a role. Over the last couple of decades, the Slovak Republic has experienced a decline in the energy and carbon intensities of its economy.

Nevertheless, the Slovak Republic ranks among the ten most GHG-intensive economies in the OECD. Energy-related CO_2 emissions account for the largest share of total GHG emissions (over 70%). Therefore, reducing emissions related to energy production, transportation and consumption will have a huge impact on the country's overall GHG intensity.

So far, meeting its international commitments for emissions reductions has not been particularly challenging for the Slovak Republic. The country has exceeded its Kyoto target. The Slovak Republic's participation in the EU Emissions Trading System (EU-ETS) has been characterised by an over-allocation of allowances. This absence of challenging targets could explain why climate change has not been high on the government's agenda and why a comprehensive and coherent climate change strategy is still lacking. This policy gap, combined with a lack of public understanding of climate change issues, could lead to complacency with regard to future GHG responsibilities. This is not a sustainable approach because the Slovak Republic's GHG emissions reduction obligations will likely become more stringent after 2020. Much deeper emission cuts up to 2050 have been discussed at the EU level. The forecast emission trends might not be in accordance with the Slovak Republic's mitigation commitments, in particular in the longer perspective beyond 2020-2030.

According to government projections, GHG emissions to 2020 are expected to grow in the transport and industry sectors. The government recognises that such a trend presents a potential challenge in meeting its reduction targets in the non-ETS sectors, particularly transport. A detailed plan with specific actions and interim targets for each

of the non-ETS sectors is therefore needed. An important general principle in the assessment and prioritisation of different GHG mitigation measures and policies should be cost-effectiveness.

The government could consider establishing a clear, predictable and credible carbon tax in the sectors not covered by the EU-ETS. Putting a national price on GHG abatement through such a tax would limit the cost of mitigation efforts, remove distortions across sectors and provide fiscal resources to replace more distortive taxes. A rapid and significant reduction of energy intensity would also help to reduce GHG emissions and contribute to creating sustainable conditions for growth. In addition, it would reduce dependence on imported fossil fuels, and limit the vulnerability of the economy to energy-price shocks and to shortfalls in primary resources.[11]

The Slovak energy infrastructure is ageing and will require investment in replacement or modernisation, particularly when economic growth recovers, leading to increasing energy demand. Large parts of the building stock and the public vehicle fleet are also ageing, calling for modernisation and replacement. The Slovak government should seize the opportunity of anticipated economic growth and related investments to progress towards a low-carbon and less energy-intensive economy. More precisely, this should be done by *i)* maintaining a low-carbon electricity production thanks to nuclear electricity and renewable energy; *ii)* improving drastically energy efficiency and increasing the use of renewables in the buildings sector and *iii)* reducing the carbon impact of the transport sector through, for example, enhanced vehicle fuel efficiency, low-carbon motor fuels and modal shifts.

While the EU-ETS has not created sufficient incentives for GHG mitigation in the Slovak Republic so far, the ETS rules will become more stringent in the future. From 2013, the number of EU-ETS allowances available to businesses will be progressively reduced, the free allocation of allowances will be gradually replaced by auctioning, and the sectors and GHG covered by the system will be expanded. As the sectors covered by the EU-ETS account for roughly half of total GHG emissions in the Slovak Republic, the revision of the EU-ETS will encourage a significant reduction of GHG emissions but also weigh on the costs of production.

As mentioned above, the Slovak Republic has exceeded its Kyoto target thus gaining a significant surplus of tradable emission allowances in the first commitment period of the Kyoto Protocol. The profits resulting from the use of the flexible mechanisms of the Protocol can be reinvested, through the Green Investment Scheme, in measures aimed at further reductions of GHG emissions. However, the use of the Kyoto flexibility mechanisms is low in the Slovak Republic compared to its neighbours such as the Czech Republic. The use of the joint implementation (JI) has been limited to only one project and the sale of excess assigned amount units (AAUs) under the Kyoto Protocol. Energy efficiency improvements are key for the Slovak Republic to improve its energy security while enhancing its economic and environmental performance. The decline in energy intensity has been impressive over the last two decades. However, the average energy intensity per unit of GDP is still higher than the average among OECD countries and considerable energy-saving potential still exists in most sectors, especially buildings and transport. Given the multiple benefits of energy efficiency in terms of energy security, GHG mitigation, and the often low or negative costs of such measures,

11. This recommendation, initially suggested by the *OECD Economic Survey*, is supported by the IEA.

unleashing the energy efficiency potential should be a policy priority. Without reaping the benefits of energy efficiency, the costs of reducing GHG emissions and obtaining energy security will increase.

Nuclear and renewable energy, both low-carbon sources, will also contribute to meeting the Slovak energy security and climate change goals simultaneously (see Chapters 5 and 11).

RECOMMENDATIONS

The government of the Slovak Republic should:

- *Make better use of revenues from the Kyoto mechanisms through the Green Investment Scheme to accelerate measures that reduce greenhouse gas emissions in a cost-effective manner.*
- *Step up CO_2 emissions reduction efforts, notably in the transport sector, to ensure that the national target for non-ETS emissions is achieved.*
- *As the economy grows, seize the opportunity to progress towards a low-carbon and less energy-intensive system.*
- *Ensure timely implementation of the energy efficiency policies and measures and raise the profile of energy efficiency in the public debate, given its critical importance for energy security, climate change mitigation and economic competitiveness.*

4. ENERGY EFFICIENCY

Key data (2009)

Energy use per capita: 3.1 toe per capita (OECD average: 4.3), -6% since 2000

Energy intensity: 0.18 toe per 1 000 USD in PPP (OECD average USD 0.16), -39% since 2000

Total final consumption: industry sector 40%, transport 21%, residential 20%, commercial and agriculture 19% (OECD average: industry 31%, transport 32%, residential 20%, other 16%)

OVERVIEW

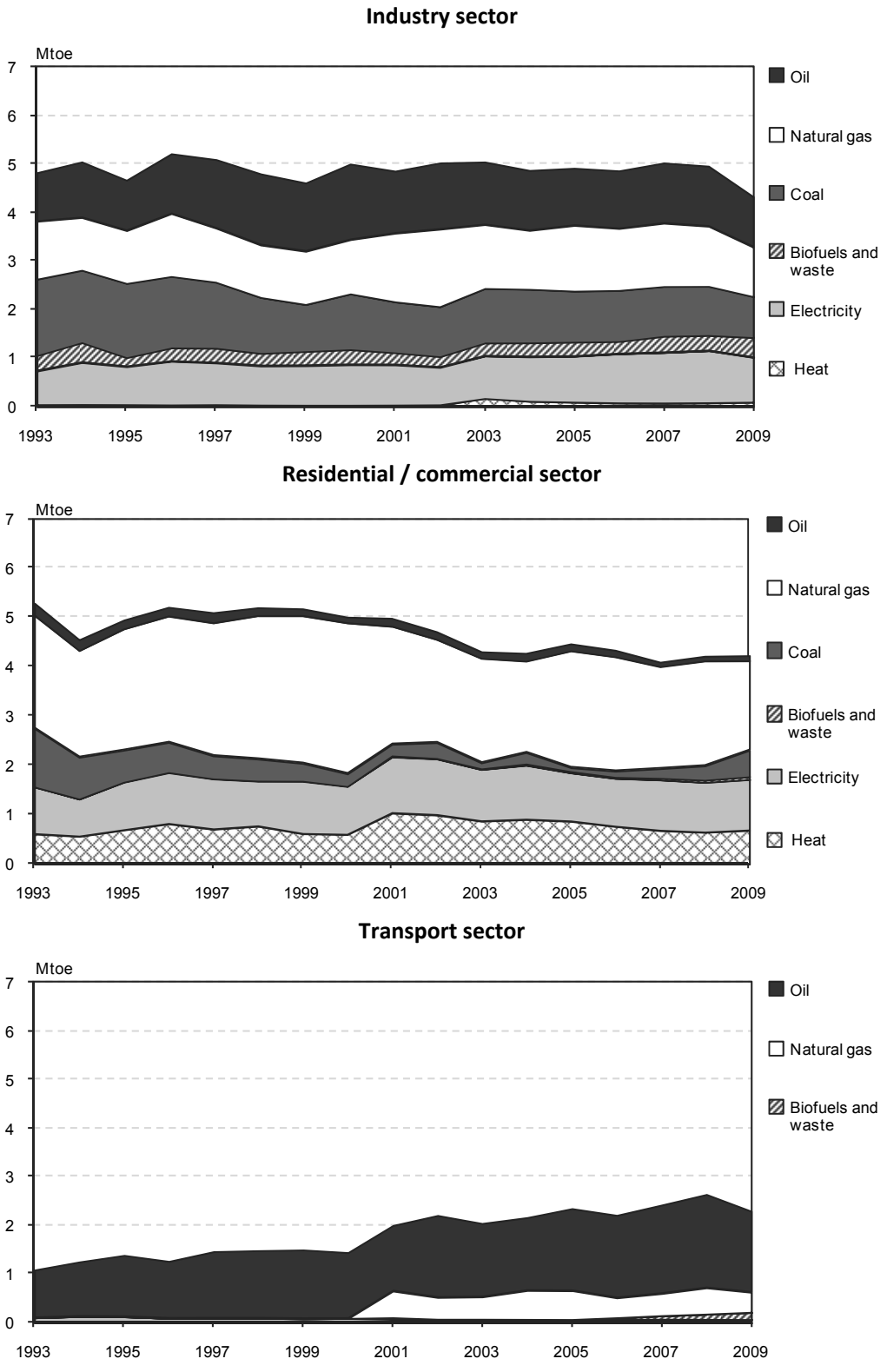
Total final consumption (TFC) of energy in the Slovak Republic was 10.8 Mtoe in 2009, down 2.9% from 1993. Industry accounted for the largest share of TFC, about 40%, in 2009. Transport accounted for the second-largest share with 21%, followed by the residential sector with 20%. The service sector consumed 18% of TFC and the agricultural sector 1% in 2009. In comparison, average shares among IEA countries in 2009 were 32% for transport, 20% for residential, 31% for industry and 16% for other sectors.

Despite strong economic growth over the past two decades, TFC in the Slovak Republic has increased only modestly. Final demand across sectors has exhibited a pattern over the last two decades which is typical of developed economies. The share of final energy demand in the industry sector has fallen from one-third to less than a quarter, while in the residential and service sectors the share has increased. The share of transport energy demand in TFC has remained roughly stable from 1990 to 2009.

In the July 2010 National Renewable Energy Action Plan, the government projects gross TFC (*i.e.* including losses in power and heat generation and distribution) to increase by between 7% and 14% from 2010 to 2020, depending on the pace of economic recovery and of implementation of energy efficiency measures.

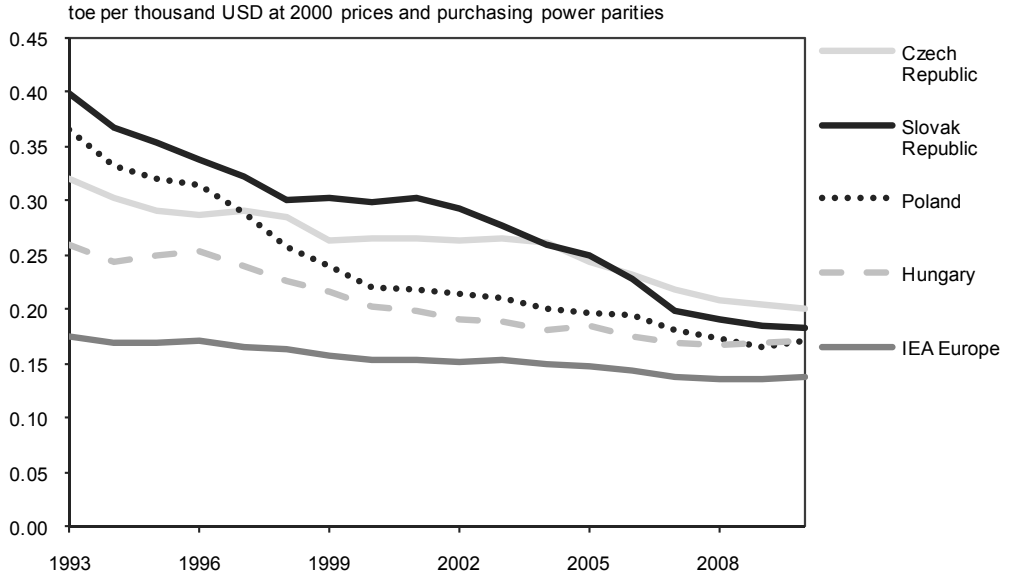
In 2010, the Slovak Republic required 0.18 tonnes of oil equivalent (toe) of primary energy for each thousand USD of gross domestic product (GDP). Despite an impressive 54% decrease since 1993, Slovak energy intensity remains higher than the IEA European average of 0.14 toe (Figure 16). The high energy intensity of the Slovak economy is explained by the sustained predominance of industry, which still represented 40% of total final consumption in 2010. Nevertheless, energy intensity has improved on average by 3.6% per year from 1990 to 2010, twice the IEA member country average of 1.3% per year.

Figure 15. **Total final consumption by sector and by source, 1993 to 2009**



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

Figure 16. **Energy intensity in the Slovak Republic and other selected IEA member countries, 1993 to 2010**



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2011 and *National Accounts of OECD Countries*, OECD Paris, 2011.

INSTITUTIONAL FRAMEWORK

The Ministry of Economy (MoE) is responsible for the formulation of energy efficiency policy. It prepares an Energy Efficiency Strategy and is responsible for its implementation through the National Energy Efficiency Action Plan (NEEAP), which covers all sectors of the economy. It is also responsible for co-ordinating energy efficiency policy across other institutions and for drafting legal proposals.

The MoE's main partner in this area is the Slovak Innovation and Energy Agency (SIEA). The SIEA prepares legislative proposals and analytical and strategic documents for MoE, and implements several energy efficiency projects and measures in the NEEAP. The SIEA also set up a system for monitoring energy efficiency improvements in 2011.

The Ministry of Transport, Construction and Regional Development (MoTCaRD) is responsible for implementing the portions of the European Directive on the Energy Performance of Buildings which are related to buildings legislation and certification. The MoE handles legislation related to heating, cooling and ventilation systems, and the transposition of the European Directive on the Energy Efficiency in Buildings. The MoE is also responsible for transport policy, including energy efficiency measures.

The Bohunice International Decommissioning Support Fund (BIDSF) is currently managing a Sustainable Energy Finance Facility (SLOVSEFF), which finances thermal insulation of buildings, as well as a pilot project on energy efficiency in public buildings. The Fund is administered by European Bank for Reconstruction and Development (EBRD), and was originally set up to compensate for the decommissioning of the Bohunice V1 nuclear power plant.

POLICIES AND MEASURES

Energy efficiency is one of the main priorities in the *Energy Policy of the Slovak Republic*, adopted in January 2006. The Strategy on Energy Efficiency, adopted in July 2007, provides more detailed objectives by sector. The main implementing instruments of the Strategy are three national energy efficiency action plans. While the Strategy sets a framework for energy efficiency over the long term, the action plans set out energy efficiency measures in different sectors of the economy for a period of three years.

In line with the EU Directive 2006/32/ES on Energy End-use Efficiency and Energy Services, the Slovak Strategy sets an energy savings target of 9% by 2016, compared with average final energy consumption in 2001-2005.

The first National Energy Efficiency Action Plan (NEEAP) for 2008-2010 was published in October 2007. The Slovak Republic adopted the second NEEAP for 2011-2013 in May 2011. The second Action Plan evaluates energy savings and investment outlays from efficiency measures in the first Action Plan, and, on the basis of these results, improves the existing measures or sets out new ones. The target for the second period is a 2.7% reduction in energy use. This is lower than the previous target of 3% owing to budgetary concerns.

According to the evaluation method provided by the European Commission, the Slovak Republic met the intermediary target of energy savings of 3% by 2010.

The second Action Plan proposes horizontal measures and measures in the following sectors: buildings, public, appliances, industry and transport.

Buildings

- Improvement in the thermal properties of residential and commercial buildings through several programmes (SLOVSEFF, governmental programme of thermal insulation II, State Fund for Housing Development, EU Structural Funds);
- Implementation of Act No. 555/2005 Col. on the Energy Performance of Buildings;
- Implementation of Act No. 17/2007 Col. on Regular Inspection of Boilers, Heating Systems and Air-Conditioning Systems;
- Implementation of Act No. 657/2004 Col. on the Heat Supply Sector, as amended by Act No. 99/2007;
- Strategy on Energy Efficiency in Buildings, enacted in June 2008, with an outlook to 2020;
- Revision of Construction Act No. 50/1976 Col. as amended, Act No. 555/2005 Col. and Act No. 17/2007 Col. due to the implementation of EU Directive 2010/31/EU on the Energy Performance of Buildings;
- Construction of low-energy and passive buildings;
- Analysis of a support mechanism for low-energy and passive buildings.

Public

- Improvement in the thermal properties of public buildings through several programmes (EU Structural Funds, Pilot project on energy efficiency in public buildings from the Bohunice International Decommissioning Support Fund);
- Modernisation of public lighting systems;
- Application of energy efficiency principles in public procurement;
- Awareness-raising campaign;
- Support for construction of low-energy and passive buildings ;
- Adoption of support documents that enhance the role of the public sector.

Appliances

- Efficient white goods;
- Efficient lighting;
- Efficient electric and electronic household appliances;
- Efficient office appliances;
- Awareness-raising campaigns;
- Regular monitoring of efficiency improvements of appliances;
- Act No. 529/2010 Col. on environmental design and use of energy-using products, as amended to meet the EU EcoDesign Directive requirements;
- Legislative regulations laying down energy labelling of appliances (Government Regulations 178/2002, 188/2002, 193/2002, 199/2002, 210/2002, 211/2002, 229/2003, 231/2003);
- Legislative regulations laying down the minimum technical efficiency of appliances (Government Regulations 425/2000, 295/2002, 433/2000, 594/2002).

Industry

- Support of innovation and technology transfer in industrial enterprises (EU Structural Funds);
- Decrease in energy intensity (EU Structural Funds);
- Enforcement of energy audits based on obligation set in Act No. 476/2008 Col. on efficiency in energy use.

Transport

- Strategy for regional bus and rail transport;
- Modernisation of the vehicle stock in rail transport;
- Modernisation of the rail transport infrastructure;
- Construction of a public net of terminals for intermodal transport;
- Support the increased usage of public transport;
- Decrease the specific fuel consumption in individual transport;

- Support for non-motor modes of transport (especially cycling);
- Optimisation of traffic control and intelligent traffic systems.

Horizontal measures

- Training courses, *e.g*. "Energy auditor";
- Education of children on energy efficiency;
- Awareness-raising campaign on energy efficiency;
- Monitoring and information system for energy efficiency improvements;
- Legislative proposals related to energy services in the heat sector and public procurement;
- Harmonisation of reporting systems which monitor the emissions impact on air quality at the source level;
- Support for development of energy services;
- Energy consultations (to households, industry, cities and regions) and support of energy management in cities;
- Support for research and development in the area of energy savings;
- Cross-cutting monitoring of energy savings;
- Analysis of energy-savings potential in different sectors of the economy;
- Analysis of support mechanisms for energy efficiency;
- Assistance in preparation of Sustainable Energy Action Plans.

IMPLEMENTATION OF EUROPEAN UNION REQUIREMENTS

Many of the measures outlined in the Slovak Republic's NEEAP must be implemented in order to comply with EU laws. The following EU regulations and directives guide much of the Slovak Republic's energy efficiency policy:

The Energy Efficiency Act 476/2008 transposes the Directive on Energy End-use Efficiency and Energy Services (2006/32/EC), which encourages energy efficiency through the development of a market for energy services and the delivery of energy efficiency programmes and measures to end-users.

The Directive on the Energy Performance of Buildings (EPBD, 2002/91/EC) sets requirements for energy efficiency in the building sector. It is implemented by two acts – Act No. 555/2005 Col. on energy performance of buildings and Act No. 17/2007 Col. on regular inspection of boilers, heating systems and air-conditioning systems,

A recast of the EPBD (2010/31/EU) was adopted in May 2010 with the aim to strengthen the energy performance requirements, in particular after 2019, and to clarify and streamline some provisions. Transposition of this directive into Slovak legislation will require revision of Act No. 555/2005 Col. and Act No. 17/2007 Col. and other related legislation.

Requirements for energy labelling of household appliances are based on several directives adopted over the past 15 years which also include compulsory minimum energy efficiency requirements (2009/125/EC). These directives include the new

Energy Labelling Directive (2010/30/EU). Requirements have expanded in the Slovak Republic and in other EU member countries and will continue to expand to new product groups, as well as upgrading existing ones. The Energy Labelling Directive was transposed to Slovak legislation by the Energy Labelling Act No. 182/2011 Col. (June 2011). Before adoption of this Act, only government declarations for energy labelling were applied to cover all relevant appliances.

The recast Directive Establishing a Framework for Setting Ecodesign Requirements for Energy-related Products (Ecodesign, 2009/125/EC) aims to improve energy efficiency throughout a product's lifecycle. It applies to products that use energy and to products that have an impact on energy use, such as building components. This directive was transposed to Slovak legislation by Act No. 529/2010 Col. on environmental design and use of products (Ecodesign Act).

There have been positive recent EU transport policy developments that aim to reduce CO_2 emissions from new passenger cars. In May 2009, the EU adopted Regulation EC/443/2009 to reduce CO_2 emissions from new passenger cars to reach a fleet average of 130 g CO_2/km by 2015. From 2020 on, this limit will be 95 g CO_2/km. The regulation will be complemented by measures to further cut emissions by 10 g CO_2/km. Complementary measures include efficiency improvements for car components with the highest impact on fuel consumption, and a gradual reduction in the carbon content of road fuels.

Another EU transport development is related to tyre labelling requirements. Regulation EC/1222/2009 of November 2009 seeks to harmonise information on the energy performance of tyres, wet braking and external rolling noise. It will apply to EU member countries, including the Slovak Republic, from November 2012.

The Slovak Republic will also have to meet a binding EU target for the share of renewable energy in gross final energy consumption by 2020. Energy efficiency improvements will be very important to increasing the share of renewable energy in terms of final energy consumption.

CRITIQUE

The Slovak Republic has realised impressive results in energy efficiency over the past five years. Its energy intensity decreased by 33% between 2002 and 2008, the largest decline among all OECD member countries. On the policy front, a number of key policies have been passed. Additionally, most of the energy efficiency-related regulations and directives enacted by the European Union have been transposed over the past three years.

Yet, despite these achievements, significant improvements are still necessary to deliver the full energy efficiency potential in the Slovak Republic. Notably, energy efficiency has had a relatively low profile on the agenda in some ministries, which is reflected in low levels of programme funding. Access to funding is hampered by a lack of transparency and excessive administrative barriers. Now that a sizeable legal framework has been set up in recent years, the focus on energy efficiency should shift strongly towards implementation of the proposed measures to ensure the realisation of energy savings.

According to a 2009 IEA study[12], significant potential remains to achieve a least-cost, optimum level of energy use in the buildings and transport sectors. As of March 2009, the Slovak Republic had substantially or partially implemented only 21% of the IEA recommendations for improving energy efficiency in the buildings sector, while none of the four recommendations in the transport sector had been implemented.

However, as of May 2011), implementation is under way for three out of four of the IEA transport recommendations, following the enactment of the new EU directives and regulations for tyres, fuel efficiency standards and eco-driving. Besides, improved transposition of the Energy Performance of Buildings Directive (EPBD) has increased the share of substantially or partially implemented IEA recommendations in the buildings sector to 43%.[13]

Box 2. **IEA 25 Energy Efficiency Recommendations**

To support governments with their implementation of energy efficiency, the IEA recommended the adoption of specific energy efficiency policy measures to the G8 summits in 2006, 2007 and 2008. The consolidated set of recommendations to these summits covers 25 fields of action across seven priority areas: cross-sectoral activity, buildings, appliances, lighting, transport, industry and power utilities. The fields of action are outlined below.

1. The IEA recommends action on *energy efficiency* across sectors. In particular, the IEA calls for action on:

- Measures for increasing investment in energy efficiency.
- National energy efficiency strategies and goals.
- Compliance, monitoring, enforcement and evaluation of energy efficiency measures.
- Energy efficiency indicators.
- Monitoring and reporting progress with the IEA energy efficiency recommendations themselves.

2. *Buildings* account for about 40% of energy used in most countries. To save a significant portion of this energy, the IEA recommends action on:

- Building codes for new buildings.
- Passive energy houses and zero-energy buildings.
- Policy packages to promote energy efficiency in existing buildings.
- Building certification schemes.
- Energy efficiency improvements in glazed areas.

12. The publication *Implementing Energy Efficiency Policies: Are IEA Member Countries on Track?* measured progress in IEA member countries on the pace of implementing the 25 IEA Energy Efficiency Recommendations (see Box 2).

13.The 25 Energy Efficiency Recommendations will be revised by the IEA in autumn 2011.

Box 2. **IEA 25 Energy Efficiency Recommendations** (continued)

3. *Appliances and equipment* represent one of the fastest growing energy loads in most countries. The IEA recommends action on:

- Mandatory energy performance requirements or labels.
- Low-power modes, including stand-by power, for electronic and networked equipment.
- Televisions and set-top boxes.
- Energy performance test standards and measurement protocols.

4. Saving energy by adopting efficient *lighting technology* is very cost-effective. The IEA recommends action on:

- Best-practice lighting and the phase-out of incandescent bulbs.
- Ensuring least-cost lighting in non-residential buildings and the phase-out of inefficient fuel-based lighting.

5. About 60% of world oil is consumed in the *transport sector*. To achieve significant savings in this sector, the IEA recommends action on:

- Fuel-efficient tyres.
- Mandatory fuel efficiency standards for light-duty vehicles.
- Fuel economy of heavy-duty vehicles.
- Eco-driving.

6. In order to improve energy efficiency in *industry*, action is needed on:

- Collection of high-quality energy efficiency data for industry.
- Energy performance of electric motors.
- Assistance in developing energy management capability.
- Policy packages to promote energy efficiency in small and medium-sized enterprises.

7. *Energy utilities* can play an important role in promoting energy efficiency. Action is needed to promote:

- Utility end-use energy efficiency schemes.

Implementation of IEA energy efficiency recommendations can lead to huge cost-effective energy and CO_2 savings. The IEA estimates that, if implemented globally without delay, the proposed actions could save around 8.2 Gt CO_2 per year by 2030. This is equivalent to twice the European Union's current yearly emissions. Taken together, these measures set out an ambitious road-map for improving energy efficiency on a global scale.

Two excellent ways to improve the implementation of energy efficiency policies are to raise consumer awareness on energy efficiency and to build training capacity to enhance the technical know-how of key implementers. Although policies such as white goods labelling are well implemented in the Slovak Republic, consumer information on energy

efficiency is lacking in other sectors – notably regarding the energy performance of buildings. On a similar note, the government does not provide local implementers or industry actors with the technical training necessary to implement the aforementioned policies. Non-governmental organisations and industry organisations are trying to fill this gap, but the government should also support and/or conduct public awareness campaigns directed at general consumers on the one hand and technical capacity building at the implementer's level on the other hand.

In addition to addressing the deficit of awareness about energy efficiency, the Slovak government also needs to improve data collection and co-ordination between the various government bodies involved in energy efficiency policy design and implementation. Most notably, energy efficiency policy is not a priority for sectors that are outside of the Ministry of Economy's scope. Given the number of government actors involved in energy efficiency policy, improved co-ordination between the relevant ministries and agencies is necessary if projected energy savings are to be achieved.

Concerning policy coverage, important gaps in the buildings and transport policies can be identified. Regarding buildings, low-energy and passive buildings should be clearly defined and included in a future revision of the building codes, as mandated by the recast of the EU Directive on the Energy Performance of Buildings.[14] As for transport, energy efficiency should be an integral part of transport policy, especially in the context of a projected rise in fossil fuel use in the transport sector. Policy measures aiming at improving the fuel efficiency of the Slovak vehicle fleet should be implemented. In particular, the government could consider introducing a vehicle tax that is differentiated according to carbon dioxide emissions per kilometre travelled.

Governments, which are large buyers of products and services, can also play an important role in promoting best practices to other end-users. Procurement schemes are generally recognised as cost-effective and important drivers for promoting energy efficient technologies and services. Until now, this instrument has not been used in the Slovak Republic. The government should be encouraged to implement this to the extent possible.

RECOMMENDATIONS

The government of the Slovak Republic should:

- ☐ *Take concrete actions to implement the existing legal framework on energy efficiency, ensuring an increased level of funding to accelerate the implementation process.*
- ☐ *Increase consumer awareness and build the technical expertise of key implementers in public and private sectors through training programmes.*
- ☐ *Improve data collection at the sectoral and end-use levels, and evaluate the impact and cost-effectiveness of energy efficiency measures.*
- ☐ *Include energy efficiency requirements in all public procurements.*

14. According to the Recast of the EPBD, all new buildings must be low-energy from 2019 and 2021. This significant change needs to be carefully prepared (standards, awareness-raising, education of the workforce, verification mechanisms, etc.).

PART II
SECTOR ANALYSIS

5. RENEWABLE ENERGY

Key data (2010 estimates)

Share of renewables: 6.9% of TPES and 22.2% of electricity generation (IEA average: 7.7% and 17.7%), compared to 4.6% and 15.1% in 2000

Hydropower: 2.7% of TPES and 20.1% of total electricity generation

Biofuels and waste: 4.1% of TPES and 2% of total electricity generation

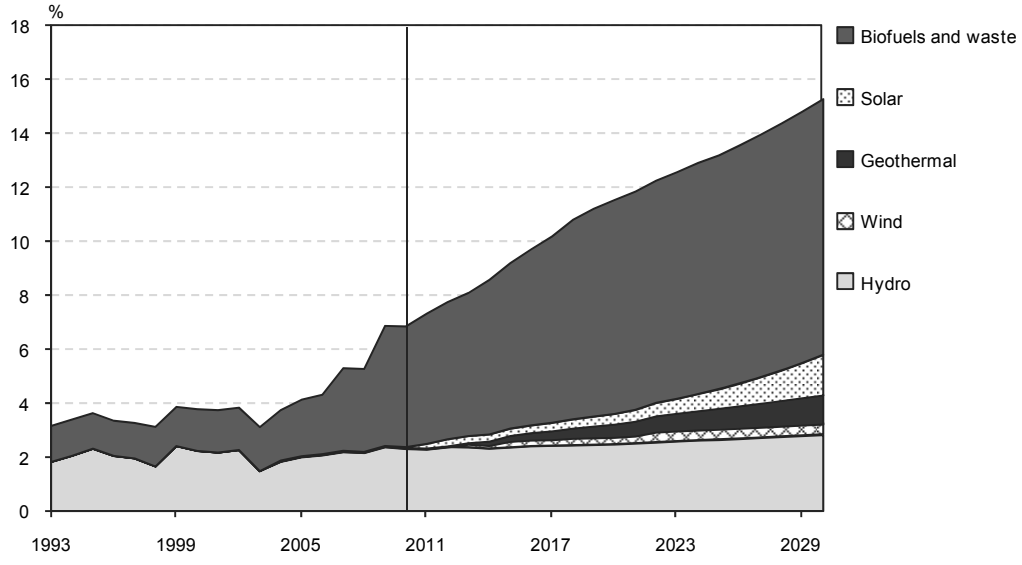
Other renewables: 0.1% of TPES and 0.2% of total electricity generation

SUPPLY AND DEMAND

PRIMARY ENERGY SUPPLY

In 2010, total renewable energy supply in the Slovak Republic amounted to 1.2 Mtoe, or 6.9% of total primary energy supply (Figure 17). This share is below the average share for IEA countries (7.7% in 2010).

Figure 17. **Renewable energy as a percentage of total primary energy supply, 1993 to 2030**



Note: This graph shows historical data until 2010 and government projections from 2011 to 2030.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2011 and country submission.

Demand for renewable energy has increased sharply, by more than 40% since 2004, when renewables represented only 4% of TPES. Combustible renewables, *i.e.* biomass, and waste, accounted for most of the growth, and represent almost two-thirds of total renewable energy supply. Biomass and waste consists of primary solid biofuels (48% of total renewables), liquid biofuels (5%) and waste (6% of renewable supply). Hydropower is the second-largest renewable energy source, accounting for around 40% of renewable supply. Its contribution has remained rather constant over the last decade. The other renewable energy sources, *e.g.* solar, wind and geothermal, have negligible shares.

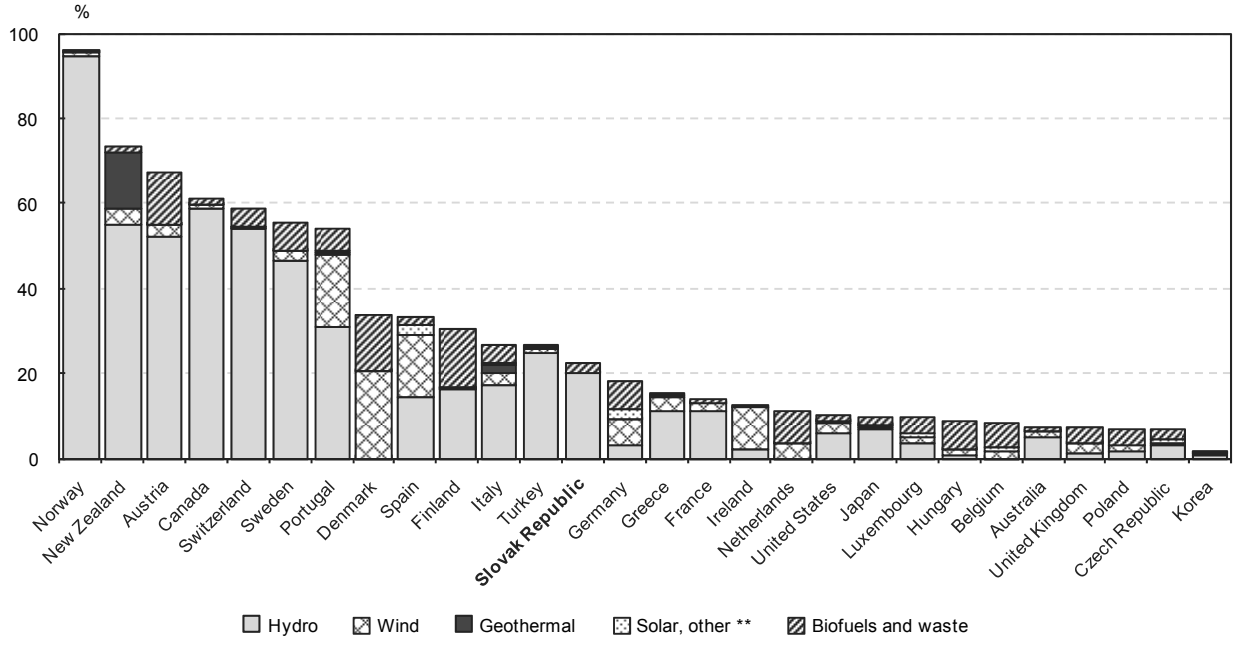
The government expects the share of renewable energy sources to double and reach around 15% of TPES by 2030. The largest projected increase is for biomass and waste over this period.

ELECTRICITY GENERATION

In 2010, electricity generated from renewable energy sources amounted to 6 TWh, or 22.2% of the total electricity generation in the country. Hydropower, with 5.5 TWh in 2010, is the main contributor, with the remainder from solid biofuels and waste (0.5 TWh) and wind power (0.1 TWh).

Among IEA member countries, the Slovak Republic is ranked 13th in terms of percentage of electricity generated from renewable energy sources, slightly above the IEA average (Figure 18).

Figure 18. **Electricity generation from renewable energy as a percentage of total generation in IEA member countries, 2010***



* Estimates.

** other includes ambient heat used in heat pumps.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2011.

Table 2. **Installed capacity for electricity generation from renewable energy sources in 2009**

Capacity (MW)	2005	2006	2007	2008	2009
Total	**2 569**	**2 634**	**2 665**	**2 712**	**2 663**
Hydro	2 512	2 513	2 515	2 548	2 487
Of which pumped storage	916	916	916	916	916
Geothermal	-	-	-	-	-
Photovoltaic	-	-	-	-	-
Wind	5	5	5	5	3
Industrial waste	-	-	2	2	2
Municipal waste	6	6	6	6	6
Solid biomass	44	108	134	147	160
Biogas	2	2	3	4	4
Solar collectors surface (1000 m^2)	64**	72	80	89	98
Capacity of solar collectors (MW_{th})*	45**	50	56	62	69

* Converted at 0.7 kWth/m^2 of solar collector area, as estimated by the IEA Solar Heating & Cooling Programme.

** Estimated data.

Source: *Renewables Information*, IEA/OECD Paris, 2010.

HEAT PRODUCTION

In 2009, total amount of heat produced from renewable energy sources in combined heat and power (CHP) and heat-only plants in the Slovak Republic was around 2 900 terajoules (TJ) or 6.8% of total heat produced, about the same level as in 2008. The share of renewable energy sources in heat production is low compared with the IEA average of 16.2%. The share of renewable energy sources in the Slovak Republic is greater in heat-only plants (10% of total fuels for heat generation) than in CHP plants, where renewable energy sources represent 5%.

Wood and wood waste is by far the main renewable fuel used for heat generation, representing 83% of total renewable heat production in 2009. Industrial and municipal waste is the second-largest source, representing 11% of total renewable-heat production, and geothermal 5%.

BIOFUELS FOR TRANSPORT

According to the government, biofuels accounted for 3.4% of motor fuels sold on the Slovak market in 2009 (as a percentage of energy content). This represents strong growth compared to previous years when the share of biofuels was 2.6% (2007) and 2.7% (2008).

RENEWABLE ENERGY POTENTIAL AND CURRENT USE

As stated in the Energy Security Strategy of the Slovak Republic, the country has significant renewable energy potential, particularly biomass (147 petajoules), followed by solar (35 PJ), hydro (24 PJ) and geothermal.

BIOMASS

Biomass and waste account for about two-thirds of total renewable energy supply, mainly for heating. Expanding the use of biomass is the key priority in the government's renewable energy policy (see below). The Slovak Republic has rich biomass resources. The forestry and agriculture sectors produce large quantities of biomass for energy purposes. The use of biomass has good prospects for expansion in the heating sector, mainly in the form of wood chips, hay for central heating systems, and pellets and briquettes for households. Biomass can also be co-fired with fossil fuels in thermal power plants and combined electricity and heat plants.

The wider use of biomass for electricity and heat production is hindered today by issues related to biomass supply. Companies operating in the electricity/heat sector report difficulties in securing stable, long-term supplies of biomass from the state-owned company, Forests of the Slovak Republic. To secure supplies, some heat and power companies have widened their portfolios to include agricultural and forestry businesses. The government has adopted several policies with the objective of increasing biomass supply for energy purposes (see below).

HYDROPOWER

Hydropower is the main renewable energy source used for electricity generation. The Slovak Republic has 2.7 GW of installed hydropower capacity of which nearly 1 GW is pumped storage capacity. Pumped storage capacity can be used for load balancing, thus improving the flexibility of the electricity system (see Chapter 9). The large share of hydropower, in particular the comparatively large capacity of pumped storage, could potentially improve the reliability and security of the electricity transmission system for further integration of intermittent renewable electricity. The government estimates that only about half of the existing technical potential is utilised today. Therefore, there are significant opportunities for further hydropower development, especially for small plants.

As of 2009, planned new hydroelectric capacity was reportedly around 690 MW.[15] One of the largest projects is a joint Slovak-Austrian project for the construction of a hydropower plant on the Danube River at Wolfstahl, with installed output of 78 MW and annual production of about 450 GWh. The project has been on hold for many years but the Slovak government is keen to renew work on it.

GEOTHERMAL

The Slovak Republic is situated on the Pannonian Basin with large geothermal resources of moderate temperatures (between 18°C and 129°C). These resources are suitable for use in district heating systems and for recreational purposes. Geothermal waters are

15. Utility Data Institute, "World Electric Power Plants Database", June 2009.

being utilised in 38 localities offering an aggregate heating capacity of 143 MW_{th}. Total geothermal energy potential in the Slovak Republic is estimated by geologists to be 5.538 MW_{th}.

Moreover, the Slovak Republic has 26 prospective areas of geothermal resources with temperatures up to 150°C and at depths up to 5 km. The most abundant of these is the Kosice area, where temperatures are high enough for so-called "binary plants", *i.e.* power plants able to produce electricity from temperatures ranging from 100°C to 180°C. These binary plants can operate as CHP plants.

The Slovak Republic's first geothermal power plant is being developed by Geoterm, a joint venture of SPP (the Slovak gas company) and local players. The plant is expected to commence operation in 2013 and to have an installed power generating capacity of 3.5 MW. The investors also plan to use the waste heat for heating or recreational purposes. It is estimated that this geothermal source could cover up to 40% of the annual heat consumption of the city of Košice. The total cost of the project is estimated to be EUR 30 million. According to a feasibility study by the government, 9 MW of installed electricity capacity is feasible.

SOLAR

The government envisages significant opportunities for both solar thermal and photovoltaic (PV) technologies. PV projects boomed in 2009-2010 following the introduction of generous feed-in tariffs (see below).

WIND

According to the Energy Security Strategy, wind energy potential is lower than that of other renewable energy sources, although some players argue that the potential has not yet been accurately measured.[16] Construction of wind turbines is prohibited in many locations because bird sanctuaries comprise 23% of the Slovak Republic's territory.

At the end of 2010, there was only 3 MW of installed wind power capacity, down from 5 MW in 2008. These first wind turbines were controversial, because of their relatively low quality and their location in or near protected areas and because they were constructed without serious environmental impact assessments.[17] Members of the Slovak Wind Power Association plan to build approximately 290 wind power units with total installed capacity of 670 MW.

The development of wind resources is not a government priority and is further hindered by complex administrative procedures (including environmental impact assessments) and a complicated planning/permitting process.

16. The Slovak Hydro-meteorological Institute has assessed the wind energy potential in the country. However, some players argue that these measurements made at 10 metres above the ground do not show true potential because wind turbines are generally higher.

17. World Wide Fund for Nature.

POLICIES AND MEASURES

INSTITUTIONS

The Ministry of Economy has the main responsibility for the development of renewable energy policy, in co-operation with the Ministries of Agriculture and Environment. The Slovak Innovation and Energy Agency (SIEA) is responsible for the implementation of renewable energy policies and measures as well as monitoring of renewable energy development (see Chapter 2).

POLICTY DIRECTIONS, TARGETS AND OBJECTIVES

The Slovak renewable energy policy gives priority to mature, cost-effective technologies, mainly biomass. This is driven by the willingness to keep final energy prices down and avoid placing an excessive financial burden on consumers.

In addition to the 2006 Energy Policy and the 2008 Energy Security Strategy, discussed in Chapter 2, the Slovak Republic has the following strategic policy documents in the area of renewable energy.

- National Programme for Biofuels Development (December 2005);
- Strategy for Greater Utilisation of Renewable Energy Sources (April 2007);
- Biomass Action Plan (2008);
- Long-term Strategy for the Use of Agricultural and Non-agricultural Crops for Industrial Purposes;
- National Renewable Energy Action Plan (October 2010).

The key national legislation for the sector is Act 309/2009 on the Promotion of Renewable Energy Sources and High-Efficiency Cogeneration, adopted in 2009 and amended in December 2010.

In the framework of the EU Climate-Energy Package, discussed in Chapter 2, the Slovak Republic has a target for renewable energy to reach 14% of gross final energy consumption by 2020. As all other EU member states, the Slovak Republic has a separate target for the transport sector, where renewable energy must provide 10% of energy consumption by 2020. The 2010 National Renewable Energy Action Plan sets intermediary targets for different sectors – electricity, heat and transport – towards reaching the overall 14% target by 2020, according to the minimum trajectory stipulated by the EU Directive on Renewable Energy (Table 3).

The Slovak Republic is on track to meet its overall target for 2020. In 2008 renewables accounted for 8.4% of gross final energy consumption, up from 7.4% in 2007. Eurostat, the EU statistical agency, annually reports on the progress of EU member states in meeting the target. The share of renewables in “gross final energy consumption” is not directly available in the IEA statistics because of methodological differences (see Box 3).

The Slovak Republic also has an indicative target set by Directive 2001/77/EC: 31% of electricity consumption from renewable energy sources by 2010. However, the government recognised that this target was too challenging and proposed a more realistic target of 19%.

Table 3. **National targets for renewable energy sources to 2020**

Year	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
RES – heating and cooling (%)	6.1	7.6	8.0	8.5	9.2	10.2	10.9	11.7	12.5	13.3	14.1	14.6
RES – electricity generation (%)	16.7	19.1	19.3	20.2	21.0	21.5	23.0	23.3	23.3	23.7	23.9	24.0
RES – transport (%)	0.6	4.1	4.2	4.3	4.4	5.0	6.0	6.3	6.8	8.3	8.5	10.0
Total share of RES in gross final energy consumption (%)	6.7	9.5	8.2	8.2	8.9	8.9	10.0	10.0	11.4	11.4	13.2	14.0

Note: RES = renewable energy sources.

Source: *National Renewable Energy Action Plan*, Bratislava, 2010.

Box 3. **Final energy consumption: statistical differences between IEA and EU data**

The EU Directive 2009/28/EC introduced a target for all EU countries combined to increase the share of renewable energy to 20% of gross final energy consumption by 2020 and set specific binding targets for each EU member state. While the IEA annually publishes detailed energy statistics and energy balances for all EU countries, it uses different statistical methodologies compared with the EU directive. The IEA publications, including this study, report the countries' *net* total final energy consumption (TFC). Therefore, the share of renewables in "gross final energy consumption" is not directly available in the IEA statistics. By the definition of the EU directive, "gross final consumption of energy" means the energy commodities delivered for energy purposes to industry, transport, households, services including public services, agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy branch for electricity and heat production and including losses of electricity and heat in distribution and transmission. By contrast, the IEA's TFC does not include transmission and distribution losses and own use of electricity and heat by the energy transformation sector and consumption for international aviation. On the other hand, IEA statistics do include non-energy use. More information about the IEA statistics can be found at www.iea.org/stats/index.asp.

COST-BENEFIT ANALYSIS

A detailed analysis of socio-economic costs and benefits of renewable energy deployment has not been carried out in the Slovak Republic. There is a lack of information on the impacts of renewable energy use on employment, local and regional economic development and GHG and air pollutant emissions, among other issues.

PUBLIC AWARENESS

In order to stimulate the development of renewable energy sources, SIEA created the programme "To live with energy", which is financed by EU resources. This educational programme commenced in January 2009 and is expected to be completed by the end of 2015.

ELECTRICITY

The key mechanism for supporting electricity from renewable energy sources is the system of feed-in tariffs introduced in 2006 and modified in 2009 and in December 2010. A number of additional measures complement the feed-in tariff system. There is an obligation on distribution system operators (DSOs) to buy renewable-based electricity to cover their network losses. If the amount of renewable-based electricity exceeds the amount needed to cover losses, the DSO is entitled to sell it at a market price. In 2007-2013, renewable energy projects benefit from investment aid, such as structural funds. Electricity produced from renewable sources is also exempt from excise duties, as discussed in Chapter 2.

For the feed-in tariff support scheme, the Regulatory Office for Network Industries (RONI) sets tariffs for different technologies which vary according to the installed capacity of the system (Table 4). DSOs are obliged to buy all electricity generated from renewables at the so-called "price to cover losses" which is set by RONI.[18] Moreover, renewable power producers receive an additional payment which is calculated as the difference between the feed-in tariff and the price to cover losses. In other words, the feed-in tariff is the sum of the "price to cover losses" and the additional payment. However, only systems with installed capacity below 10 MW (below 15 MW for wind) are eligible for this additional payment. If the plant capacity exceeds 10 MW (or 15 MW in the case of wind), electricity produced above the limit will be purchased at the "price to cover losses" only.

Renewable electricity producers are entitled to benefit from the fixed feed-in tariff for 15 years after the initial operation, reconstruction or modernisation of a facility. The level of the feed-in tariff is set for the entire support period, with some adjustments allowed every year. RONI can increase this tariff by the inflation coefficient and by a coefficient reflecting the technology used. RONI can also decrease the tariff as the technology becomes more mature but not more than by 10% a year (with the exception of wind and PV, as discussed below). The costs of the feed-in tariffs are borne by all final consumers.

Table 4. **Feed-in tariffs**

From hydropower with the total installed electric capacity of the electricity producer's facility	up to 1 MW including	109.08 EUR/MWh
	from 1 MW to 5 MW including	97.98 EUR/MWh
	more than 5 MW	61.72 EUR/MWh
From solar energy with the total installed electric capacity of the electricity producer's facility	up to 100 kW including	259.17 EUR/MWh
From wind energy	79.29 EUR/MWh	
From geothermal energy	195.84 EUR/MWh	
From combustion of	purposely growing biomass	112.24 EUR/MWh
	biomass sewage	122.64 EUR/MWh
	bioliquid	115.00 EUR/MWh

18. The "price to cover losses" is calculated by RONI as the arithmetic average of the prices of electricity to cover losses of all regional DSOs.

Table 4. **Feed-in tariffs** (continued)

From combustion of biomass/ sewages with fossil fuels	123.27 EUR/MWh	
From combustion of	landfill gas or gas from sewage water treatment plant	93.08 EUR/MWh
	biogas generated by anaerobic fermentative technology with the total electric capacity of the facility up to 1 MW	145.00 EUR/MWh
	of biogas generated by anaerobic fermentative technology with the total electric capacity of the facility of more than 1 MW	129.44 EUR/MWh
	thermochemical gasification in the gasification generator	159.85 EUR/MWh

Source: Country submission.

Planned measures

In 2012, the government plans to introduce a system of tenders for the construction of power plants using intermittent renewable energy sources, *i.e.* wind and solar. At the beginning of the auction, its duration will be set with the maximum purchase price the buyer is willing to pay. The institution organising the auction will set the limits for installed capacity for each year, consistent with the objectives set out in the National Renewable Energy Action Plan. Investors will submit their bids for construction of power plants and those who submit the lowest feed-in tariff will win.

A special case: solar PV

Like many other countries, the Slovak Republic has seen a "PV boom" because its generous support system could not adapt quickly enough to reductions in technology costs. Applications for connecting PV plants totalled around 700 MW of installed capacity in late 2010. SEPS, the transmission system operator, was concerned that the growing number of applications for PV projects could endanger the stability and safety of the electricity system. The experience in the neighbouring Czech Republic also illustrated to the Slovak government that strong growth in PV installations could put upward pressure on final electricity prices.

Therefore, throughout 2010, the Slovak government and Parliament took a number of measures to limit the growth of PV installations. The administrative rules for the construction of solar power plants were tightened. Starting in May 2010, all investors have to obtain a certificate of compliance with the government's long-term energy policy to build a solar power plant with capacity above 100 kW (the previous limit was 1 MW). In June 2010, SEPS stopped issuing favourable decisions for connecting new PV plants to the system. Without a favourable decision from SEPS, no Certificate of Compliance could be issued by the Ministry of Economy. SEPS plans to evaluate the influence of all types of renewable energy sources on the electricity grid, to revise the situation at the beginning of 2012 and possibly to introduce new rules for the issuance of favourable statements.

In December 2010, Parliament adopted amendments to the legislation on renewables, which came into effect as of 1 February 2011 (apart from some provisions effective as of 1 April 2011). According to this new legislation, only solar rooftop facilities or solar facilities on the exterior wall of buildings with capacity not exceeding 100 kW may receive additional payment. The transfer of liability for deviations (difference between generation and demand) from producers to DSOs was reduced to 100 kW of installed capacity for PV (and to 1 MW for other renewable sources) from a previous 4 MW. Further, RONI will now be allowed to reduce feed-in tariffs for solar and wind energy facilities without limitation, *i.e.* by more than 10% in the next regulation period. The changes in the promotion scheme will not affect projects under development, with a building permit effective before 1 February 2011 and with a use permit issued before 1 July 2011.

HEATING AND COOLING

State support for renewable energy use in the heating (and cooling) sector has been quite limited. District heating companies are obliged to purchase heat from renewable energy sources or cogeneration but only if this heat is not more expensive than heat from other sources. Since April 2009, the Slovak Republic has had in place a Programme for Higher Utilisation of Biomass and Solar Energy in Households that provides state aid for the installation of biomass-fired boilers and solar collectors.[19] The total budget of the programme is EUR 8 million for the period 2009-2013. The amount of the grant for individual households ranges between EUR 50 and EUR 200 per m^2 depending on the maximum installed surface. The amount of the grant for apartment buildings is EUR 100/m^2 for maximum installed surface 3 m^2/flat. In the framework of this programme, between April 2009 and September 2010, 729 households installed solar collectors in their apartment and 2 708 households in individual dwellings, with the total installed area of collectors 526 m^2 and 14 757 m^2 respectively.

The grant for biomass boilers covers 30% of the purchase price of one boiler installed in an individual dwelling, but not exceeding EUR 1 000. Financial state support is supplemented by a private-public partnership programme called “Subsidy 3 x 1000”. In the framework of this programme, *i)* the Ministry of Economy provides a subsidy of up to EUR 1 000 to households for the purchase of a biomass boiler, *ii)* the biomass supplier BIOMASA provides a EUR 1 000 discount from the price of wood pellets and iii) suppliers of boilers provide EUR 1 000 in the form of price discounts or free service of the boiler.

Additional measures are stipulated in the National Renewable Energy Action Plan, notably in the housing and energy sectors. New regulations are considered, such as introducing an obligatory use of renewables in new and reconstructed buildings and in heating/cooling in public buildings, establishing a minimal share of heat supply from renewables in district heating, and amending legislation on urban planning and construction. Tax exemptions for heat production from renewables as well as for renewable energy equipment are also being discussed.

19. The programme was approved in 2007 but the funding was made available only in 2009.

TRANSPORT

The Slovak Republic started implementing its biofuels programme – in line with EU requirements – in the second half of 2006. The use of biofuels is stimulated by *i)* an obligation on producers and vendors to include a specified percentage of biofuels or other renewable sources in the total amount of diesel and petrol placed on the market; and *ii)* reduced excise duties.

An obligation on the minimum quantity of renewables in transport fuels has been in effect since May 2006. The obligatory share increased over time: 2% in 2006-2008, 3.4% in 2009 and 3.7% in 2010. This obligation has been extended to 2020 with an increasing minimum energy share as shown in Table 5.

Table 5. **Obligatory share of renewables in transport fuels**

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
3.8%	3.9%	4.0%	4.5%	5.5%	5.5%	5.8%	7.2%	7.5%	8.5%

Source: Country submission.

Reduced excise duties apply to fuels that contain a minimum volume of biofuels as defined in Act 309/2009.

BIOMETHANE

Legislation adopted in December 2010 extended support to biogas. Like renewables-based electricity, biomethane now benefits from priority access to the gas network and guaranteed prices set for 15 years by the energy regulator.

GRID ACCESS AND STABILITY

Renewable electricity producers benefit from priority connection to the distribution and transmission grids. Transmission and distribution system operators are legally obliged to connect such plants to the system where this is technically possible.

As discussed above, the Slovak transmission system operator, SEPS, is concerned that rapid penetration of intermittent PV systems might endanger the stability and safety of the grid. SEPS will stop issuing favourable decisions on connections of new PV installations until the end of 2011. Reportedly, SEPS conducted a study looking at the impact of wind and solar power plants on the reliability and security of the electricity transmission system in 2008 but the results of this study were not made public.

CRITIQUE

In compliance with EU requirements, the Slovak Republic has set targets and adopted measures to foster renewable energy deployment. Since the last in-depth review (2005), the share of renewable energy in total energy supply has been steadily increasing.

In its renewable energy policy, the government gives priority to biomass because of its high potential and relatively low cost. Support for other, more expensive and intermittent renewable energy technologies, such as solar and wind, has been recently reduced in order to avoid placing a heavy financial burden on final consumers and to deal with issues related to the safety of the electricity grid. The government has also indicated that expensive renewable energy sources are not at the core of its climate change strategy which aims to reduce GHG emissions at least cost, using a mix of technologies, including nuclear.

The government's strategy is understandable, particularly in the context of the recent economic slow-down and budget constraints. However, two elements should be taken into account when the renewable energy policy is amended in the future.

First, the climate change challenge is not the only reason for supporting renewables. Renewable energy sources also contribute to enhancing energy security. Their use also improves local air quality, creates jobs, thus boosting the economic development of regions, and expands the domestic scientific and industrial base. All these potential benefits of renewable energy deployment – as well as full lifetime costs – should be carefully and systematically analysed. Such cost-benefit analysis is necessary for taking an informed decision on whether or not it is in the Slovak Republic's interest to exploit the potential of a larger basket of renewable energy technologies over time and take advantage of the environmental and social benefits.

Second, climate change is a very long-term issue, and mitigation efforts need to be extended over many decades. While in the short term some renewable energy technologies do not appear to be cost-effective in reducing GHG emissions, as compared to other options, their early deployment will drive costs down (as illustrated by PV technology). Therefore, support for less mature technologies today may lead to cost-effective climate change mitigation options tomorrow.

Biomass represents a significant local and low-carbon energy resource for the Slovak Republic, particularly for communal energy systems, given its distributed availability. However, strict rules and controls on biomass production may prevent the country from reaching its envisaged target. At present, energy market players interested in biomass utilisation cannot always ensure stable and reliable supplies of biomass. From this point of view, agriculture and forestry policies should be aligned with energy policy to achieve the national goals in the most effective manner.

The share of wind power has not increased under the existing promotion mechanism and environmental legislation. While the current installed capacity is around 3 MW in the Slovak Republic, neighbouring Austria has seen a much more dynamic development of wind power. The Slovak transmission system operator and distributors could gain valuable experience from efforts made in countries, such as Germany or Spain, that have integrated electricity from renewable sources to the grid in a reliable and cost-effective manner. This experience could particularly be applied to integrating hydropower in the Slovak Republic.

In its long-term projections, the government foresees a moderate increase in hydropower. Efforts should be made to utilise the remaining hydro potential, including to resolve the dispute with Austria about the construction of the Wolfstahl-Bratislava dam.

The government has introduced feed-in tariffs designed to encourage investment in renewable electricity technologies. Such investments are beneficial from many perspectives, including energy security, environmental protection and developing new

industries. However, in order to avoid excessive upward pressure on final electricity prices, it would be helpful to establish, as a condition of programme design, the annual maximum uptake of a particular technology. This should be determined in consultation with SEPS, so that system security concerns can be adequately considered and the impact on rate structures can be effectively managed. Rate impact and system reliability concerns need to be reflected in the programme design before public commitments are made in this regard. It is vital to avoid retroactive reduction of support as this would severely damage investor confidence. On the other hand, it is important to develop and apply a predictable and transparent monitoring process to analyse regularly the cost-effectiveness of the feed-in tariffs and to adjust them accordingly for new projects, in order to encourage investment while avoiding placing an excessive burden on consumers.

Current electricity producers using renewable energy sources benefit from preferential access to the network. In addition, distribution companies are obliged to purchase electricity from renewable energy sources but are only allowed to use it to cover distribution losses. Under certain conditions, this arrangement can oblige distribution system operators to buy power that they do not require and to resell it at market prices. Thus, the design of this support mechanism should be reassessed.

The government should also enhance its efforts to reduce barriers to the development of renewable energy, including administrative hurdles (*e.g.* building permits and environmental permits) especially for small-scale projects, obstacles to grid access, insufficient technical experience, lack of public awareness and social acceptance issues.

Social acceptance of renewable energy sources in the Slovak Republic has been damaged recently by the fact that public debate has mainly focused on the higher prices associated with the inadequate design of support measures. Public debate should be extended to broader issues, and various stakeholders should be involved in a discussion of the costs and benefits of renewable energy technologies mentioned above.

The government should continue to develop a strategy for the use of renewable energy in the transport sector, particularly through assessing the impacts of policy instruments and measures to reach the 10% target.

RECOMMENDATIONS

The government of the Slovak Republic should:

- ☐ *Implement the National Renewable Energy Action Plan to meet binding EU targets for renewable energy sources and strengthen the incentive structure for the use of these resources in the electricity, heat and transport sectors, as necessary.*
- ☐ *Monitor the cost-effectiveness of the promotion mechanisms for renewable energy sources, including the feed-in tariff system, and revise them periodically, in a transparent way, to reflect the technology learning curve, ensuring investor confidence while avoiding an excessive burden on the economy.*
- ☐ *Simplify the administrative procedures to shorten the lead time to obtain the necessary permits for renewable energy technology deployment, in particular for small-scale projects.*
- ☐ *Conduct analyses of costs and benefits of renewable energy sources and the supporting policies to encourage their deployment; and make the results of these analyses public.*

6. NATURAL GAS

Key data (2010 estimates)

Production: 0.1 bcm

Share of natural gas: 30% of TPES and 7% of electricity generation

Net imports: 6 bcm (Russia 99%, other 0.7%)

Inland consumption: 6.3 bcm (residential 27%, power and heat generation 20%, industry 23%, commercial and agriculture 14%)

SUPPLY AND DEMAND

Gas supply in the Slovak Republic amounted to 5.1 Mtoe in 2010. Since 1996, gas has been the largest energy source in the country and its importance has been steadily growing in the energy mix. Government forecasts predict that total gas supply will continue to increase until 2030.

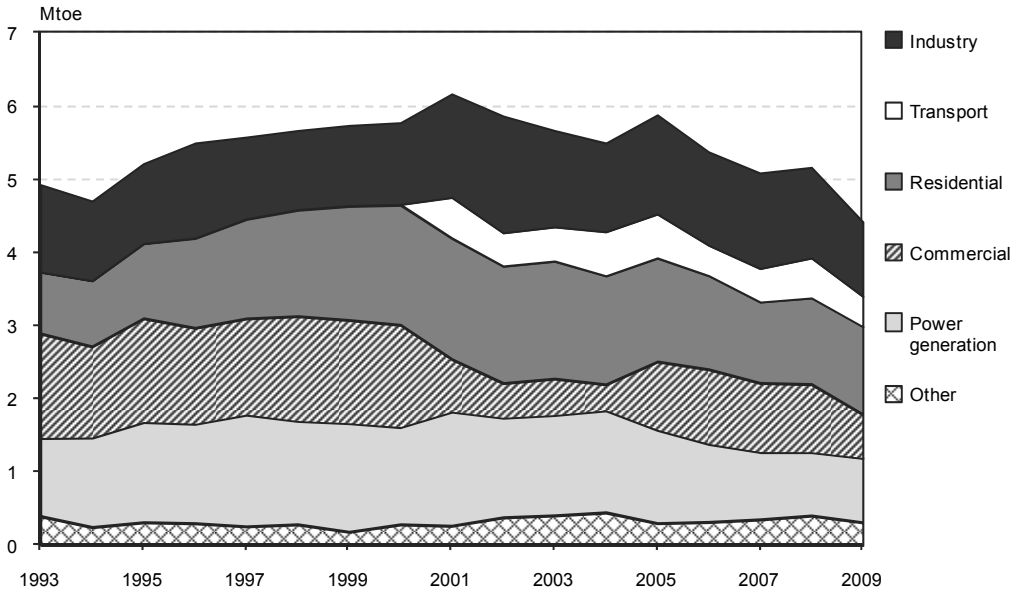
Only a tiny fraction of the Slovak Republic's natural gas demand is met from domestic production. Gas is imported almost exclusively from Russia. In 2010, some 100 million cubic metres (mcm) of gas was produced domestically, meeting less than 2% of total demand. Production is expected to decline rapidly, dropping to roughly one-third of current output by 2014.

In 2009, demand for natural gas was some 5.4 bcm (6.2 bcm in 2010). Gas is widely used across all the consuming sectors in the Slovak Republic. Industry, the transformation sector and residential users each account for nearly a quarter of total gas used in the country. Services and agriculture sectors together account for 14% of gas supply. The transport sector represents 9%. Slovenský plynárenský priemysel (SPP), the dominant Slovak gas company, has started a programme which supports the development of compressed natural gas (CNG).

Natural gas represents only some 7% of total electricity generated in the Slovak Republic. However, the development of combined-cycle gas turbines (CCGTs) is expected to increase the quantity of natural gas used in the transformation sector, with CCGT projects to 2014 potentially adding more than 1 bcm to gas demand. The government expects total gas demand to rise to 7.6 bcm by 2020.

Daily gas consumption in 2009 ranged from some 5 million cubic metres per day (mcm/d) in the summer to around 25 mcm/d in the winter (inferring a 1:5 seasonality of gas demand). The maximum daily consumption was 32.5 mcm in 2009. The highest average daily demand over the coldest 30-day period was reached in early 2006, at 35.9 mcm/d (when temperatures averaged -7.4°C). The historically highest daily peak was reached in December 2001, when daily gas use reached 46.9 mcm/d (with a temperature of -12.2°C).

Figure 19. **Gas supply by sector*, 1993 to 2009**



* TPES by consuming sector. *Other* includes other transformation and energy sector consumption. I*ndustry* includes non-energy use. *Commercial* includes commercial, public services, agriculture/ forestry, fishing and other final consumption.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

INDUSTRY STRUCTURE

Transmission and distribution activities were unbundled on 1 July 2006. SPP, the dominant importer of natural gas into the Slovak Republic, remains the parent company of the transmission system operator (TSO), Eustream, and the main distribution system operator (DSO), SPP distribúcia. The National Property Fund holds a majority of 51% in SPP, with E.ON Ruhrgas and GDF Suez holding the remaining 49%.

Eustream, a fully owned subsidiary of SPP, is one of the largest transmission operators in Europe, focusing mainly on the transit of Russian gas towards Western and Southern Europe. SPP distribúcia, also a fully owned subsidiary of SPP, is the biggest distribution network operator in the Slovak Republic, while a number of small independent local distribution companies are also active in the country's gas distribution.

There are two storage system operators (SSOs) in the Slovak Republic: Nafta and Pozagas. Nafta also operates the country's domestic gas production and is partially owned by SPP (56%) and E.ON Ruhrgas (40%). Pozagas is partially owned by SPP (35%), Nafta (35%) and GDF (30%).

SPP is also the leading supplier of natural gas on the Slovak gas market with a share of more than 80% in 2010. The company is 51% state-owned and 49% owned by a consortium of E.ON Ruhrgas and GDF. Other companies active in the Slovak gas supply market are local branches of international companies, including RWE Gas, VNG and Shell. Some additional companies have recently begun supplying consumers with gas or have indicated their intention to enter the Slovak gas supply market (*i.e.* Lumius Slovakia, ČEZ Slovakia, Vemex).

The number of shippers trading gas in the Slovak Republic has been increasing steadily since 2005. At the end of 2009 Eustream had twenty shippers, three times the number in 2005, with portfolios of different entry-exit contracts. Physical nodes in the transit gas network (*e.g.* Veľké Kapušany, Lanžhot, Baumgarten) or domestic off-take points can be used for trading of natural gas. In most cases it is over-the-counter type trading because, with the exception of the Baumgarten node, no gas exchanges are established on these points.

MARKET REFORM

In July 2004, the market was open to all customers except households. The market was fully liberalised in July 2007. Despite this, there is still a very limited number of competitive suppliers – RWE Gas Slovensko, Shell Slovakia, VNG Slovakia and Lumius Slovakia – so that switching is very limited. None of these companies has a market share higher than 5%. New gas suppliers focus mostly on industrial or wholesale consumers. Households are currently supplied by only one supplier. The number of gas users switching reached 58 in 2009.

Table 6. **Gas supplier switching**

Category of gas consumers	Number switching gas supplier	Total number of off-take points*	Switching rate (%)
Wholesale consumers	39	886	4.4
Middle consumers	14	3 389	0.41
Small consumers	5	70 794	0.01
Households	0	1 407 846	0

* Does not include off-take points of local gas suppliers in local distribution networks.

Source: Report of the regulator to the EC, 2010.

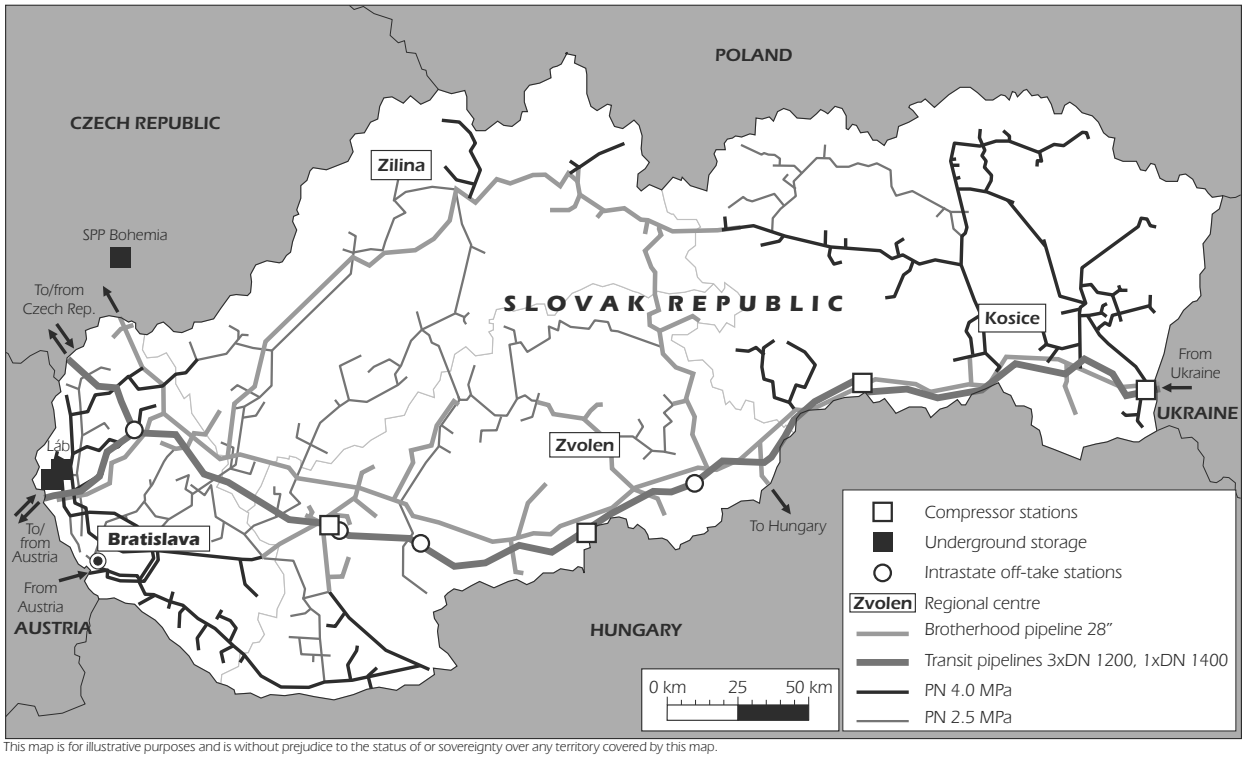
INFRASTRUCTURE

PIPELINES

Eustream, the Slovak Republic's transmission system operator (TSO) manages a domestic and transit pipeline network with three interconnection points. The network is used to transport natural gas for consumption in the Slovak Republic and for transit of Russian gas to other end-user markets further west. The annual capacity of the system exceeds 90 bcm. Only about 80% of this capacity was utilised in 2009, as 66.4 bcm transited the country and 5.4 bcm was for domestic consumption. Transit gas arrives at the incoming transfer station of Velké Kapušany on the Ukraine border (279 mcm/d capacity) and departs from outgoing transfer stations in Lanzhot at the Czech border (117 mcm/d) and Baumgarten at the Austrian border (137 mcm/d).

The physical reversal of flows is possible at the interconnection points at the Czech and Austrian borders. The reversal at Lanzhot could be implemented within two hours, with a capacity to bring 25 mcm/d of gas from the Czech network. Reversal of flows at the Baumgarten interconnection was achieved in October 2010, making it possible to bring 17 mcm/d of gas into the Slovak Republic from Austria.

Figure 20. **Natural gas infrastructure**



This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Source: IEA.

A project to construct an interconnection with Hungary is under way, with Open Season procedures conducted in 2010 to assess market demand. This would consist of a pipeline connection between Veľký Krtíš in the Slovak Republic and Vecses in Hungary. It is currently expected that the line would have an annual capacity of some 5 bcm and be operational in 2014. The interconnection would be part of the V4+ countries north-south corridor (see below).

The Polish gas transmission operator Gaz-System S.A. and Eustream A.S., its Slovak counterpart, announced the signature of a letter of intent to co-operate on the development of a gas pipeline between Poland and the Slovak Republic.

The Slovak Republic has a very well-developed gas distribution network: 77% of municipalities, accounting for 94% of the population, are connected to gas.

STORAGE

Total storage capacity in the Slovak Republic is currently 2.77 bcm, with a maximum withdrawal rate of 34.35 mcm/day, slightly higher than average winter gas demand. All capacity is in underground storage facilities at the Láb complex in the west of the country. A new storage facility, within the Láb complex at Gajary-Baden, is currently under construction and is expected to raise the total capacity to 3.12 bcm and the maximum withdrawal rate to over 40 mcm/day by 2014.

Additionally, a storage facility in the Czech Republic, at Dolní Bojanovice, and directly connected to the Slovak system, is used for the purposes of physical balancing of the

Slovak distribution network and security of supply for households. Storage capacity at this site is 0.57 bcm and the maximum withdrawal rate is 8.8 mcm/day. Part of the Slovak storage facilities (0.5 bcm) is also used for supplying the Czech market.

GAS SECURITY POLICY

REGIONAL INITIATIVES

The V4 initiative – north-south gas corridor – aims to connect LNG terminals in Poland and Croatia. This north-south corridor has been identified as one of the three EU priority projects in the gas sector. Within the High Level Group on North-South Energy Interconnections, a Gas Working Group was established at the beginning of 2011. Its meetings are chaired by the European Commission. The aim of the Group is to deliver an Action Plan on the development of infrastructure to ensure security of supply by the end of 2011. The Gas Working Group includes representatives from Bulgaria, the Czech Republic, Hungary, Poland, Romania and the Slovak Republic. Croatia is an observer.

The Slovak Republic participates in the EU's Gas Regional Initiative (GRI) launched in 2006. The South South-East (SSE) region in this initiative includes Austria, Italy (two co-chairs), Bulgaria, the Czech Republic, Greece, Hungary, Poland, the Slovak Republic, Slovenia and Romania. Given that nearly half of the European transit capacities are transported through these countries, this region plays an important role in enhancing energy security in the EU. The main priorities for the SEE Gas Regional Initiative include monitoring the proper implementation of European gas regulation, analysis of the regional market and its challenges, transparency in access to storage and hub services, and inter-operability issues, such as gas quality, infrastructure interconnection agreements and operational balancing.[20]

EMERGENCY RESPONSE POLICY

The Energy Act (no. 656/2004 Coll. as amended) sets the standard for security of gas supply for suppliers. Concerning emergency response policy for natural gas, the government requires all suppliers operating on the Slovak gas market to meet security of supply standards under circumstances related to weather conditions or to the disruption of normal supplies. Suppliers must be able to guarantee the supply to their customers for 30 days, using measures including gas in storage, domestic production contracts and backup deliveries from other countries. The Ministry of Economy receives and reviews the plans from each of the industry participants having a supply standard obligation. These plans must show in detail how the company would be able to comply with the supply standard for 30 days, including providing information on supply contracts.

Following the January 2009 gas crisis in Europe, the government launched several initiatives in order to improve security of supply and to be able to deal with similar future crises. These include investments in infrastructure to increase capacities, improve inter-operability between storage and transmission networks, and enable the

20. http://www.energy-regulators.eu

reversibility of physical gas flows. The Slovak government also passed an amendment to the Energy Act (in February 2009), which requires all suppliers operating on the domestic market to meet specific security of supply standards.

EMERGENCY RESPONSE MEASURES

The main long-term gas supply contract for the Slovak market, signed in 2008 for 20 years, is between SPP and Gazprom Export. In order to reduce dependence on one source, as well as in an effort to diversify its portfolio, SPP concluded in 2009 gas supply contracts with E.ON Ruhrgas and GDF SUEZ for 0.5 bcm each. In case of disruption of supplies from the east, these supplies can be obtained following the flow reversal of the gas pipeline system.

Other suppliers active on the Slovak gas market are local branches of major companies. These local branches have their supplies covered by the diversified portfolio of the mother companies or via contracts with Nafta, the domestic producer and storage operator.

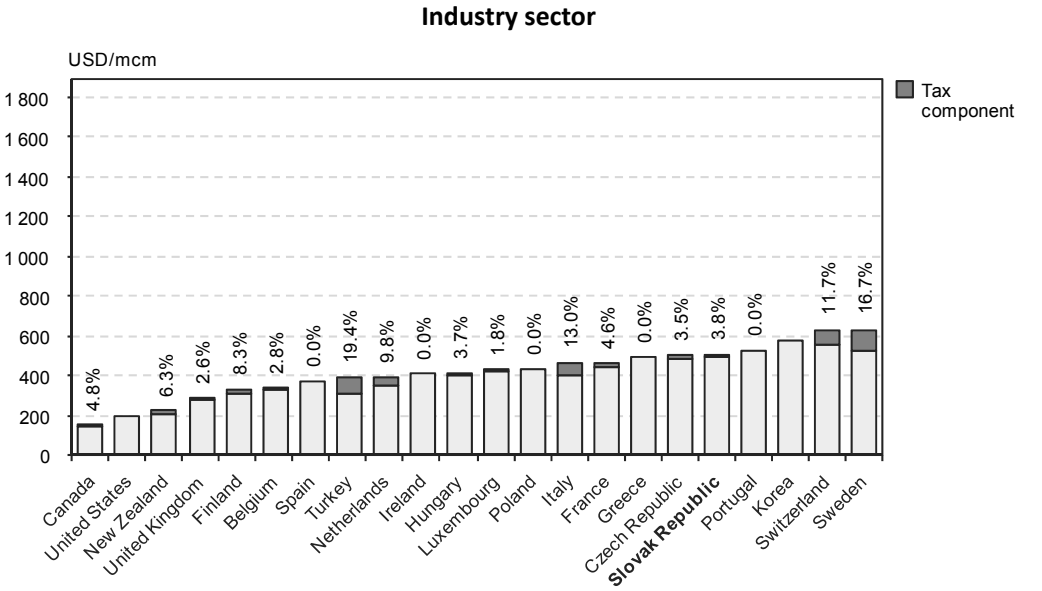
The dispatching centre of the distribution system operator (DSO) is responsible for announcing an emergency situation, imposing restrictive measures (off-take levels and heating curves) and managing emergency situations. Other gas infrastructure operators (the TSO, the two storage operators and other DSOs) are obliged to co-operate with the dispatching centre to eliminate the state of emergency as soon as possible.

PRICES AND TARIFFS

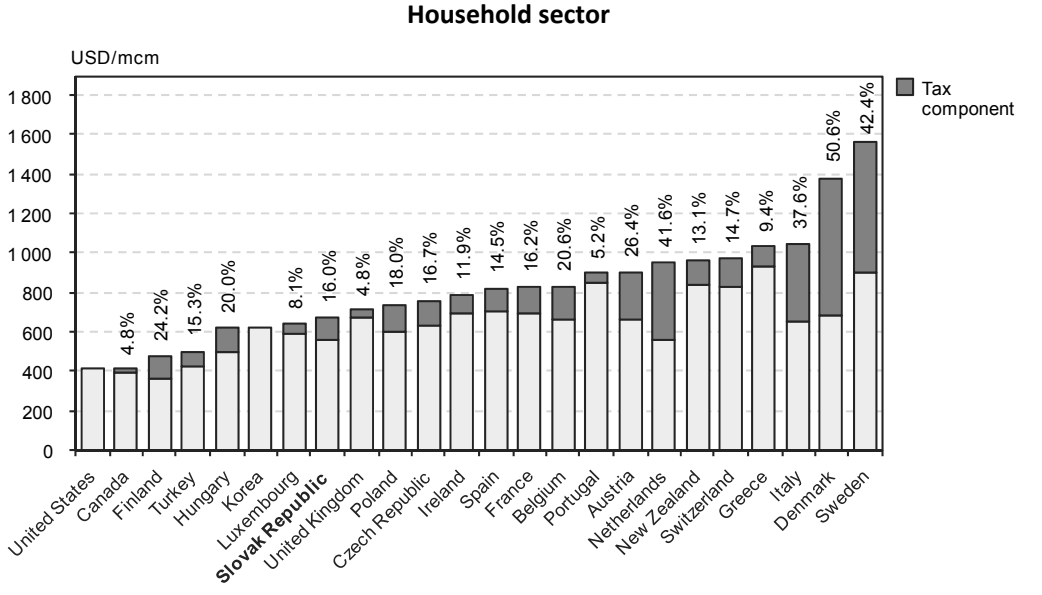
Gas tariffs for households and for district heating companies that produce heat for households are regulated by the Regulatory Office for Network Industries (RONI). The regulated tariffs are supposed to cover all the costs of gas supply, including the cost of gas purchase or production, transportation and storage. Regulated tariffs are published on the website of gas suppliers. Gas tariffs for other consumers are not regulated. There are no “social” gas tariffs for vulnerable customers.

Compared with many IEA countries, natural gas prices for households in the Slovak Republic are low, both pre-tax prices and the final tariffs with the tax component. Gas prices for industry are above the IEA average.

Figure 21. **Gas prices in IEA member countries, 2010**



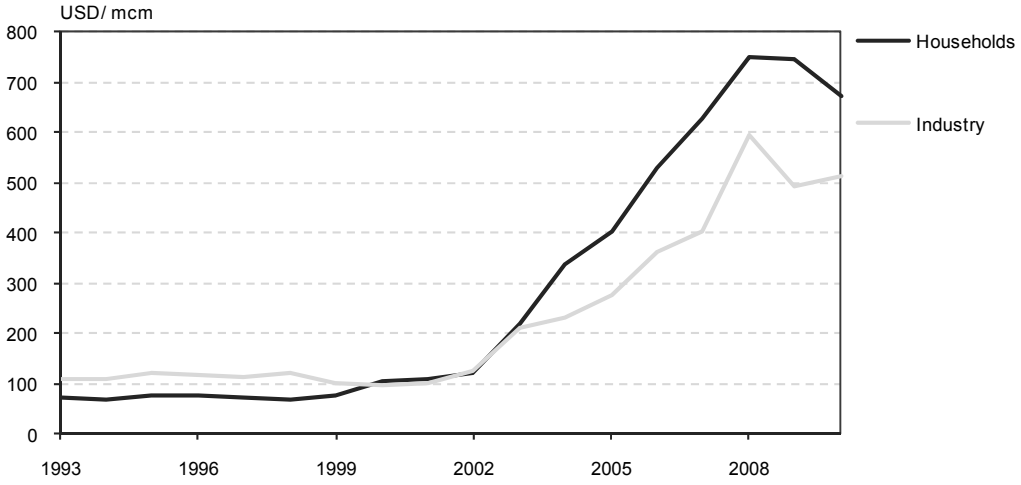
Note: Tax information not available for Korea and the United States. Data not available for Australia, Austria, Denmark, Germany, Japan and Norway.



Note: Tax information not available for Korea and the United States. Data not available for Australia, Germany, Japan and Norway.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2011.

Figure 22. **Gas prices in the Slovak Republic, 1980 to 2010**



Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2011.

CRITIQUE

As a EU member state, the Slovak Republic is committed to implementing EU legislation. The country has implemented the second EU Gas Directive and liberalised its gas market. It is now in the process of implementing the third EU Energy Market Liberalisation Package. Much progress has been made since the last in-depth review, particularly in the regulatory framework, *e.g.* the legal unbundling and third-party access to transmission and distribution pipelines as well as the improvement of the security of supply situation by realising the reverse flow options for the pipelines from the Czech Republic and from Austria. The gas network of the Slovak Republic is well established and very important for the transit of gas from Russia via Ukraine to the European market.

Security of supply is particularly important for the gas sector because natural gas is currently the most significant energy source in the Slovak Republic, accounting for about 30% of the country's primary energy supply. A considerable proportion of households (1.4 million) depend on natural gas for heating. Consumption during the winter months in 2009 was up to five times that of summer. Gas demand is expected to increase in the next decades and to reach a volume of 7.6 bcm by 2020.

Domestic gas production is minimal and will decrease further. Unconventional gas is not expected to be produced in the future. Thus, import dependence, which is already very high, will remain high in the future. Because of the country's geographical and historical situation, gas is supplied mainly from Russia under long-term import contracts. Reliance on a single supplier makes the Slovak Republic vulnerable to supply disruptions. This was clearly shown during the Russian-Ukrainian gas crisis in 2009. The reverse flow projects with Austria and the Czech Republic will reduce this vulnerability significantly. The combined capacity of the two projects would counter a potential supply cut from Russia. Also the supply contracts with GDF Suez and E.ON Ruhrgas in case of emergency will improve security of supply.

The government's proactive approach to improve the security of gas supplies following the January 2009 gas crisis is noteworthy. The team assembled to respond to the crisis, which included industry participants, provides a good basis for crisis response in the

future. The emergency response organisation should be formalised by officially establishing a gas National Emergency Strategy Organisation (NESO) which creates a framework for regular dialogue between the government and gas industry participants. Other actions taken following the gas crisis, including expanding storage capacities and enabling reverse flows at the country's two western interconnectors, has significantly improved the ability to respond to a gas disruption. The government should continue with plans to further expand storage capacity and develop an interconnector with Hungary.

Enhanced regional market integration is central to encourage competition and improve security of supply. The support of the Slovak government for the construction of a north-south connection linking the planned LNG terminals in Croatia and Poland, including an interconnector to Hungary in the framework of the collaboration of the V4 countries, is the right approach and will significantly contribute to regional market integration.

Storage capacity covers more than 40% of consumption and thus can cushion supply disruptions. Government plans to encourage the increase in storage capacities and to upgrade storage technology to bring more gas in the network could improve the situation with regard to security of supply. All gas suppliers must ensure at least 30 days gas supply to their customers; and they are obliged to hold in storage 5 % of the gas needed to fulfil this obligation. The government should consider whether the obligation to hold gas in storage could be a barrier for new market entrants against the background of a potential lack of free storage capacity and high costs. The security of supply standard could be fulfilled with other means offered by the relevant EU legislation.

With increasing interconnections, the Slovak gas storage market needs to be competitive *vis-à-vis* its regional competitors. The existing lengthy and burdensome regulatory procedures may hamper the development of new, mainly short-term, storage products and subsequently the gas market as a whole.

The legal framework opening the gas market was put in place in 2006, and competition really commenced in 2009 and 2010. Even though the number of consumers switching supplier is still low, the share of gas supply by non-dominant suppliers did increase in 2010. At present, there are a few active suppliers on the gas market. The supply to households is done exclusively by the incumbent supplier. The import of gas via long-term contracts, transmission, distribution and supply are dominated by SPP. The government is encouraged to establish conditions to enhance competition on the supply side.

End-user prices for households and district heating companies that produce heat for households are regulated. This could jeopardise necessary private investment in the market, particularly if the regulated market expands in the future. Considering the need for investment in maintaining and refurbishing the networks, RONI should assess whether network fees are sufficient to cover these costs. Fair and transparent access to storage capacity is also crucial for suppliers seeking to supply households. There appears to be a dearth of information about the gas market available to market participants. The government and the regulator should make information on the market publicly available.

Well-functioning, flexible markets are the best way to assure security of natural gas supply. The development of a spot market for trading gas would significantly improve the market's ability to respond in a crisis. The government is encouraged to consider ways of facilitating the establishment of a spot market for gas, for example by establishing the regulatory framework for such trading, in collaboration with neighbouring countries.

RECOMMENDATIONS

The government of the Slovak Republic should:

- *Continue efforts to improve security of supply by diversifying supply routes and sources, promoting new interconnections with neighbouring countries and the creation of a regional gas market.*
- *Ensure that the regulatory framework promotes competition in the gas market and encourages new suppliers to enter the market, and gradually deregulates gas prices as competition grows.*
- *Consider ways of facilitating the establishment of a spot market for gas, for example by establishing the regulatory framework for such trading.*
- *Formalise the emergency response organisation by officially establishing a gas National Emergency Strategy Organisation which creates a framework for regular dialogue between the government and gas industry participants.*

7. OIL

Key data (2010 estimates)

Crude oil production: 5.1 kb/d

Net crude oil imports: 78.1 kb/d, -3.4% compared to 2009

Oil products: refinery output 6.1 Mt (130 kb/d), net exports: 71 kb/d

Share of oil: 20.7% of TPES and 2.2% of electricity generation

Inland consumption: 83.2 kb/d (transport 50%, industry 31%, transformation sector 16%, residential, commercial and agriculture sectors 4%)

Consumption per capita: 0.6 t per capita (OECD average: 1.6)

SUPPLY, DEMAND AND IMPORTS

Total oil supply in 2010 was 3.9 million tonnes (Mt) or around 83 thousand barrels per day (kb/d), making up 20.7% of total primary energy supply. This share is the lowest among OECD member countries and has remained stable over the last decade. In nominal value, however, the amount of oil is increasing, at an average annual growth rate of 1% since 1995. It is estimated that oil supply will increase by 20% by 2030 and reach 4.6 Mt. The Slovak Republic does not have significant natural reserves of crude oil, with production averaging less than 500 barrels per day. Producing fields are located in the west of the country, in the Gbely area of the Vienna basin. Crude production is expected to continuously decline in the coming years, potentially ceasing after 2017. Total indigenous production, including additives and other hydrocarbons, averaged nearly 10 kb/d, or 492 thousand tonnes, in 2010.

The Slovak refinery processed some 5.5 million tonnes (Mt) of crude oil, or roughly 110 kb/d, in 2010. All but a fraction of the supplies going to domestic refining comes from imports of Russian crude oil delivered via the Druzhba pipeline.

Oil demand in the Slovak Republic totalled some 3.9 Mt in 2010, or an average of 83 kb/d. The transport sector accounts for half of all oil used. The industry sector is the second-largest oil-consuming sector with 1.3 Mt, or one-third of total oil supply, while the other sectors consumed the remaining 15%.

Oil peaked in 2008, at 86 kb/d, following an average annual growth of 3% per year from 2005 to 2008. This was primarily driven by growth in demand for transport diesel, which grew by nearly 10% per year. Oil demand is expected to return to this trend as the economy recovers. The government expects a doubling of motor fuel demand by 2025. This implies a growth in total oil demand averaging around 4% to 5% in the coming decade, reaching around 100 kb/d by 2015, and 130 kb/d by 2020.

Table 7. **Oil demand in the Slovak Republic (kb/d)**

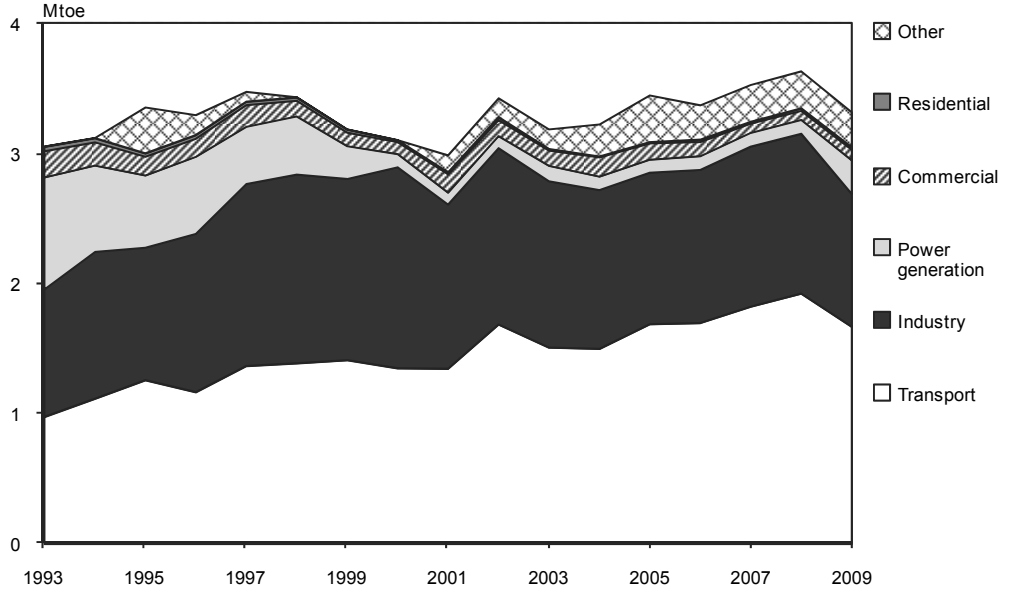
	2005	2008	% change per year	2010
LPG and ethane	5.5	5.3	0.0%	4.4
Naphtha	13.7	12.8	-2.1%	13.1
Gasoline	14.9	15.5	1.4%	14.5
Kerosene	0.8	1.3	17.8%	0.9
Diesel	22.3	29.4	9.5%	32.0
Heating/other gasoil	0.5	0.6	4.5%	1.0
Residual fuels	6.1	6.2	0.5%	5.7
Other products	14.6	14.8	0.4%	11.6
Total products	**78.5**	**86.0**	**3.1%**	**83.2**

Source*: IEA Monthly Oil Statistics.*

In 2010, diesel demand was 32 kb/d, representing nearly 40% of total oil demand and nearly two-thirds of all transport fuels consumed in the country. The Slovak government's outlook for a doubling of transport fuel demand in the coming 15 years implies demand for diesel reaching some 40 kb/d by 2020.

According to the government's reports, biofuels accounted for 3.4% of motor fuels sold on the Slovak market in 2009 (as a percentage of energy content). This represents strong growth compared to previous years when the share of biofuels was 2.59% (2007) and 2.65% (2008).

Figure 23. **Oil supply by sector*, 1993 to 2009**



* TPES by consuming sector. *Other* includes other transformation and energy sector consumption. *Industry* includes non-energy use. *Commercial* includes commercial, public services, agriculture/ forestry, fishing and other final consumption.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

All but a fraction of the crude oil refined domestically comes from imports, while domestic sources of additives and other hydrocarbons provide additional supply to refinery intake. The small amounts of domestically produced crude oil are exported to Austria. Crude oil imports are entirely supplied by Russia via the Druzhba pipeline. The Slovak Republic has a government-to-government agreement with the Russian Federation to supply up to 6 million tonnes per year (120 kb/d) until the end of 2014. Crude oil imports from Russia amounted to 5.4 Mt (110 kb/d) in 2010.

Total output of finished products from domestic refining was nearly 6.1 Mt in 2010, or an average of 130 kb/d, well in excess of domestic demand and allowing for the Slovak Republic to be a net exporter of finished products. In 2010, the country exported some 71 kb/d of refined products, the bulk of which in the form of diesel (39 kb/d), to neighbouring countries, primarily the Czech Republic and Austria.

INFRASTRUCTURE

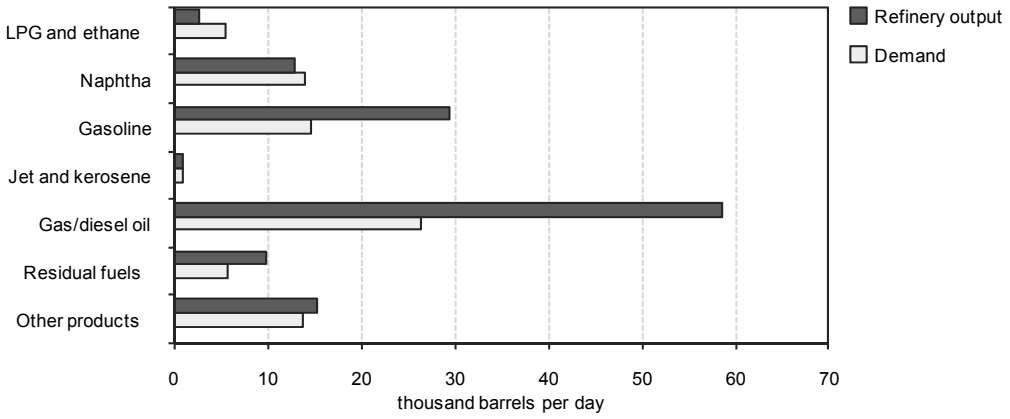
REFINING

There is one operating refinery in the Slovak Republic, Slovnaft's facility in Bratislava, with crude atmospheric distillation capacity of 6.1 Mt per year (123 kb/d). A second refinery, Dubová, which had a capacity of 3 kb/d and processed mostly domestic crude supplied by non-pipeline routes, was closed in 2007.

The Bratislava refinery processes Russian Export Blend crude oil delivered via the Druzhba pipeline. The refinery was upgraded over the decade to 2006 in order to increase the yield of light products, which accounted for 61% of total production before improvements started. In 2010, more than 80% of total production was of light products, including motor gasoline (25%) and gas/diesel oil (45%).

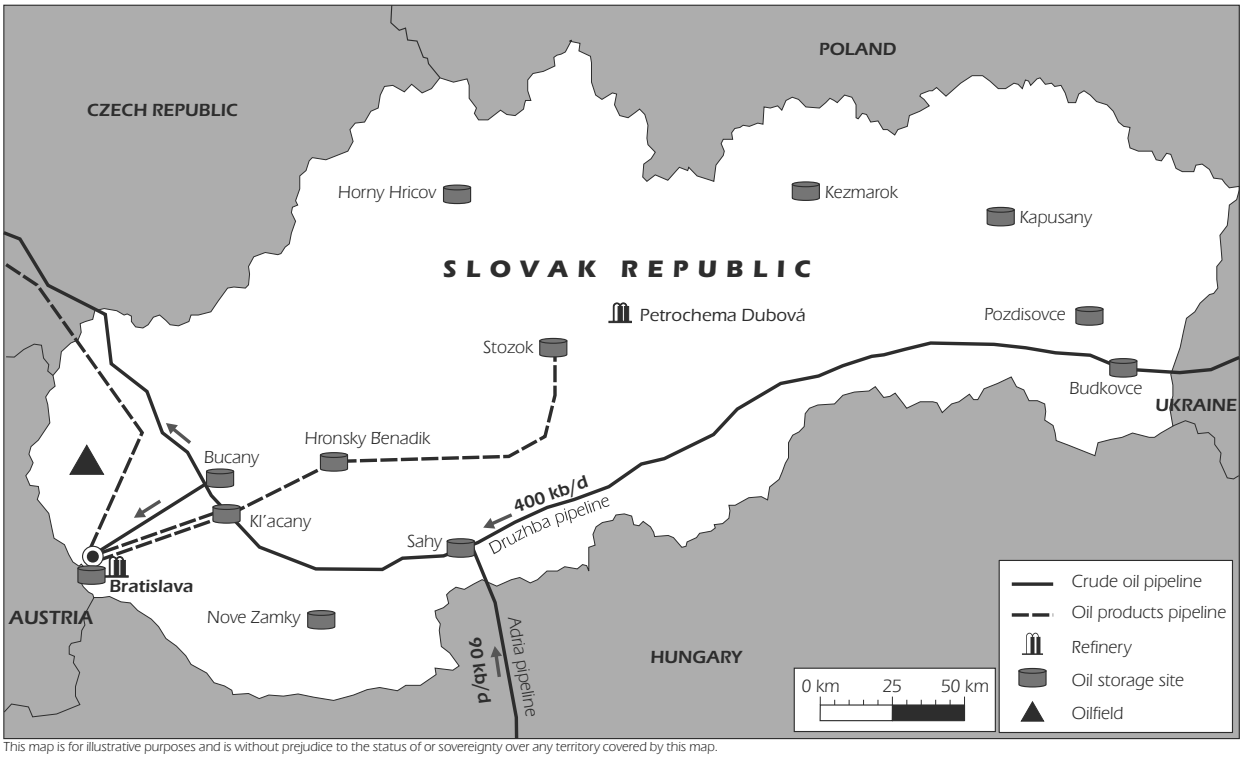
As total domestic refining capacity exceeds oil demand in the country, the Slovak Republic is a net exporter of refined products. In 2010 the Bratislava refinery exported nearly 60% of its refined product output, primarily to neighbouring IEA member countries.

Figure 24. **Refinery output vs. demand in the Slovak Republic**



Source: *IEA Monthly Oil Statistics.*

Figure 25. **Oil infrastructure in the Slovak Republic**



This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Source: IEA.

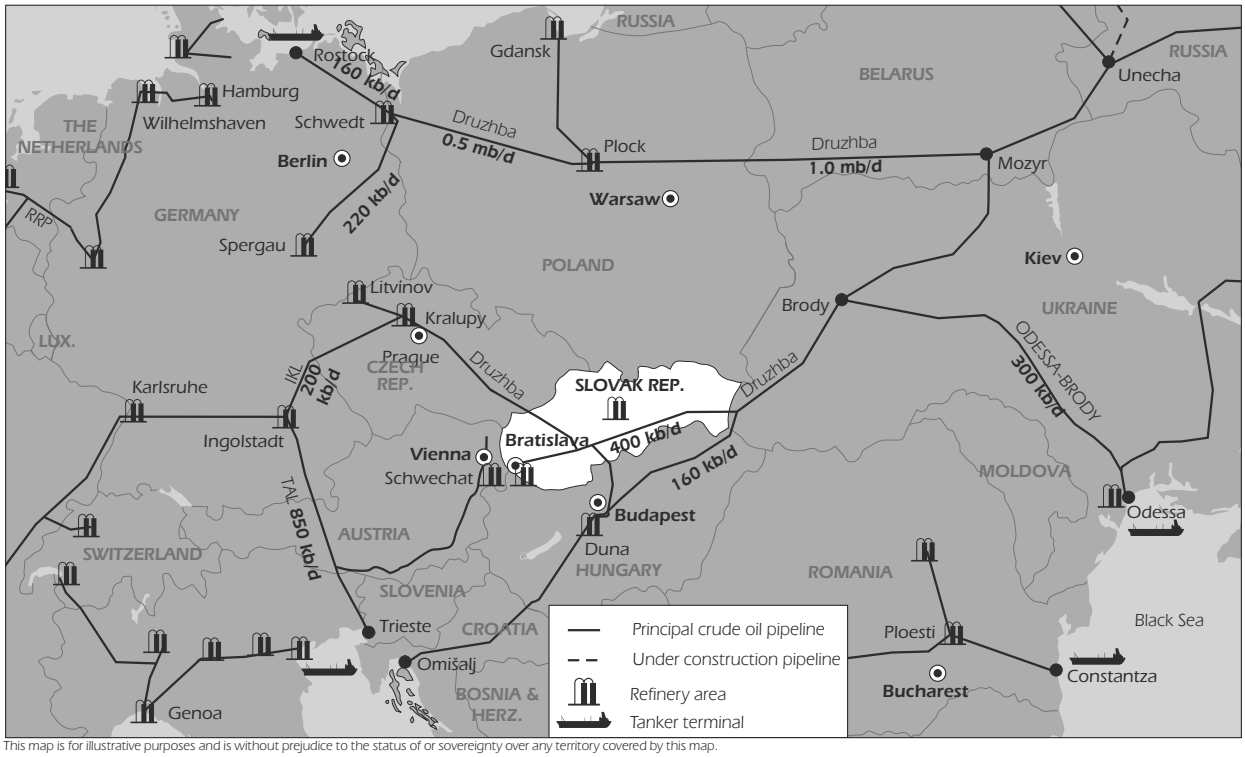
PIPELINES

An oil products pipeline network operated by Slovnaft connects its refinery in Bratislava to three of the main product terminals which hold public stocks of the Administration of the State Material Reserves (ASMR). The pipeline system is used by Slovnaft for commercial purposes and connects to the Czech Republic's pipeline network. The network has a maximum transport capacity of 240 cubic metres per hour, or some 36 kb/d.

The main crude oil supply channel is the Druzhba pipeline, which originates in Russia and transits Belarus and Ukraine before continuing on to the Czech Republic. The section within the Slovak Republic, part of the Druzhba's southern branch, has five pump stations and consists of two parallel lines for nearly all its length. While the Slovak section of the pipeline has a total capacity to transport 20 Mt per year (around 400 kb/d), slightly more than half of this capacity is currently utilised to supply both Slovak and Czech refiners. In 2009 this pipeline delivered all of the 5.7 Mt of crude imports noted above to the Slovnaft refinery as well as around 5.1 Mt of Russian crude to the Czech Republic.

There are concerns about Russia's future use of the Druzhba pipeline as an export route, as the country seeks alternative outlets such as the Baltic Sea. Projects such as the Baltic Pipeline System 2 (BTS-2), planned for operation in 2012, could potentially lead to a significant reduction or abandonment of Russia's use of the Druzhba pipeline.

Figure 26. **Regional oil pipelines**



This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Source: IEA.

STORAGE

Total oil storage capacity is just over 1.4 million cubic metres, or 9 mb. The vast majority of oil storage facilities in the country is operated by Transpetrol and Slovnaft.

The bulk of the total crude storage capacity in the country (5.2 mb) is owned and operated by Transpetrol. At end-2009, Transpetrol's three storage facilities, all located along the Druzhba pipeline, had a combined total capacity of 4.2 mb. At the same time, the Slovnaft refinery in Bratislava had just over 1 mb of crude storage capacity.

The majority of the Slovak Republic's total product storage capacity (3.8 mb) is operated by Slovnaft. In addition to storage at its refinery in Bratislava, Slovnaft operates five main storage sites, including four facilities along the product pipeline network. The ASMR holds most of its emergency oil product stocks in these terminals, either in state-owned tanks which are located within the terminal facilities and managed by Slovnaft or utilises Slovnaft-owned capacity on the basis of stockholding contracts.

At the end of 2010, total public stocks of the ASMR were 4.9 mb, composed of 2.9 mb of crude oil and 2 mb of refined products (see Emergency Oil Reserves below). This equated to utilising nearly 460 of the total 830 thousand cubic metres in available crude storage capacity, and 325 of the some 600 thousand cubic metres in available product storage capacity.

MARKET STRUCTURE

The company Nafta a.s. operates domestic crude oil production. Nafta is also involved in natural gas production and the building and operating of underground gas storage facilities.

Two companies, Transpetrol and Slovnaft, operate the bulk of the oil market infrastructure of the Slovak Republic. Transpetrol is the sole operator of the crude pipeline network in the Slovak Republic, and its operations also include crude storage for both its customers and the ASMR. The company is fully state-owned, after the State's re-purchasing of the remaining 49% of the company shares in March 2009.

Slovnaft, a member of the MOL group of Hungary, operates the country's refinery and product pipeline network. Its operations also include petrochemical processing and product storage as well as wholesale and retail distribution and product exports. Slovnaft holds a dominant position on the domestic market, supplying nearly two-thirds of all transport fuels distributed in the country, one-third of this amount via its own network of 209 petrol stations in the country. The other main oil companies operating on the Slovak retail and wholesale oil market include Eni Slovensko, Jurki Hayton, Lukoil Slovakia, MOL-Slovensko, OMV Slovensko, Shell Slovakia, Unipetrol Slovensko, and Tesco stores.

The Slovak Association of Petroleum Industry and Trade (SAPPO) represents all of the main companies operating on the Slovak retail and wholesale oil market. Roughly 500 of the country's 700 petrol stations are operated by members of SAPPO, which collectively represent over 80% of all oil products sold on the Slovak market.

EMERGENCY RESPONSE POLICY AND EMERGENCY ORGANISATION

EMERGENCY RESPONSE POLICY

Recognising the inherent risk of the country's high dependence on a single source for import of primary fuels, energy security is a dominant theme of the government's energy policy. The long-term energy security policy of the Slovak Republic is outlined in the *Energy Security Strateg*y, which was adopted in November 2008. This sets objectives and priorities for enhancing energy security in all energy sub-sectors in the period to 2030. Lessons learned from the 2009 gas supply disruption that severely affected the Slovak economy served to underline the necessity of having an energy security strategy focusing on diversification of both primary supply sources and routes.

In the case of emergency response policy for oil supply disruptions, publicly held emergency crude and product stocks are central to the country's emergency policy, and the Slovak Republic would likely contribute to an IEA collective action with the release of these strategically held oil stocks.

EMERGENCY ORGANISATION

The Administration of the State Material Reserves (ASMR) is responsible for emergency response for oil disruptions, while emergency response to a natural gas crisis is under the responsibility of the Ministry of Economy.

The ASMR is responsible for stockpiling and supply security of the main resources considered essential for the protection of public interests during crises. While ASMR reserves include such items as raw materials, food stuffs and industrial equipment, oil reserves are treated separately and constitute one of ASMR's main priorities. The ASMR functions as an independent body which reports directly to the government through the Council of Ministers.

The chair of the ASMR serves as the head of the National Emergency Strategy Organisation (NESO) and is responsible for initiating and co-ordinating a response to an oil supply disruption. The Oil Security Commission, which includes representatives from various ministries as well as from industry and the petroleum association, acts as a permanent advisory body of the ASMR chair in his capacity as NESO head. Within the ASMR, the Oil Emergency Department has the lead role in co-ordinating the measures for oil emergency solution.

Act 170 of 2001, on Emergency Stocks of Crude Oil and Oil Products and Managing Crude Oil Emergency, is the legal basis for emergency policy, providing the principal statutory authority for the ASMR's role in an oil crisis and recognising the Slovak Republic's treaty obligations under the International Energy Program (IEP) Agreement.

EMERGENCY OIL RESERVES

The Slovak Republic uses the public stocks of the ASMR to fully meet its minimum stockholding obligation as a member of the European Union and the IEA. There are no stockholding obligations on industry; however, the Administration has statutory powers over industry stocks in a declared state of emergency.

Act 170/2001 is the legal basis for the ASMR's oil stockholding practices. This Act clearly defines conditions and types of oil which the ASMR is to hold for emergency purposes and the methodology for calculating the minimum levels required to meet both the IEA and EU stockholding commitments. Public stocks are financed by the state budget where it appears as a separate line item.

LOCATION, QUALITY OF CRUDE AND PRODUCT TYPES

Total public stocks of the ASMR at the end of 2010 were 4.9 million barrels. Nearly a quarter of this was in the form of gas/diesel oil, while some 60% was held as crude oil, Russian export blend.

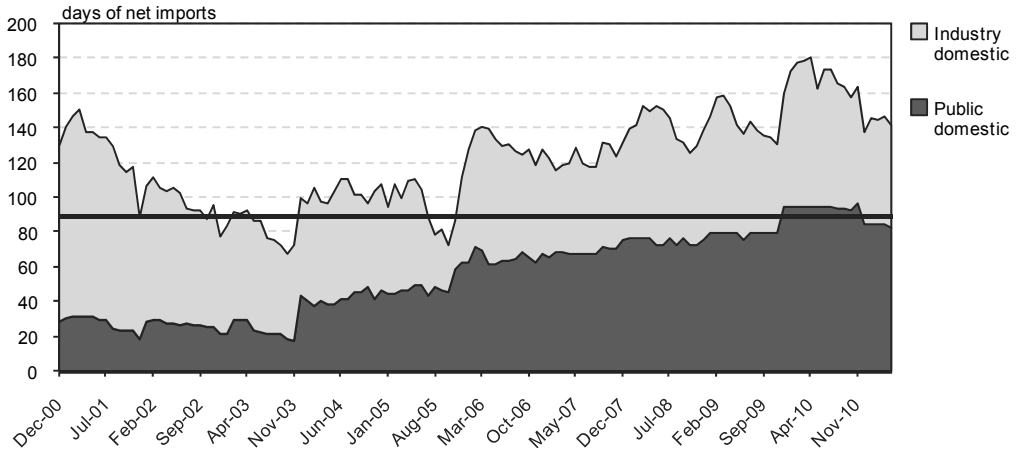
ASMR stocks of crude oil are for the most part held at the Transpetrol terminals located on the Druzhba pipeline; roughly 10% is held at the refinery in Bratislava. The public reserves of motor fuels (gasoline, gas/diesel and jet kerosene) are located at the three terminals connected to the Slovnaft product pipeline, as well as at other two Slovnaft storage sites.

Public stocks held by private companies under contract with the ASMR are not allowed to be combined with commercial stocks but must be kept in separate tanks that are clearly marked as state emergency reserves. The product stocks are refreshed every three to five years by the company holding the stock, according to the contract agreement. The stockholder must keep detailed records. Regular inspections of both the records and storage terminals are carried out by the ASMR.

In addition to the public stocks held by ASMR, industry stocks at the end of 2010 stood at 3.3 mb, with approximately 2.1 mb of this amount being held in the form of refined products.

The combined total of public and industry stock levels at end-2009 was equivalent to 160 days of 2009 net imports (roughly 95 and 65 days, respectively).

Figure 27. **Slovak compliance with stockholding obligations under the International Energy Program**



Source: *IEA Monthly Oil Statistics.*

Since becoming a member of the IEA in 2007, the Slovak Republic has consistently exceeded its minimum 90-day IEA stockholding obligation, with total stock coverage ranging between 120 and 180 days. Public stocks of the ASMR have represented a growing share of the total, representing over 90 days of net imports in 2010. In terms of demand cover based on the EU stockholding methodology, these same public stocks equated to nearly 92 days.

OIL DEMAND RESTRAINT

In the event of an emergency, demand restraint measures would be specified by the chair of the ASMR to the government, likely in parallel with the release of public stocks. The level of the demand restraint measures would depend upon the severity of the crisis. In the initial stages, measures would consist primarily of a mass media campaign calling for voluntary reductions in oil consumption.

Additional measures available to the Slovak government include the ability to limit motor vehicle speed, limit motor vehicle use on certain days or for specific kinds of transportation and impose usage restrictions based on odd/even licence plates. The government could also limit the opening hours of petrol stations, and regulate or otherwise direct the actions of oil importers and exports. The government also has the power to order private companies to drawdown their stocks in an emergency.

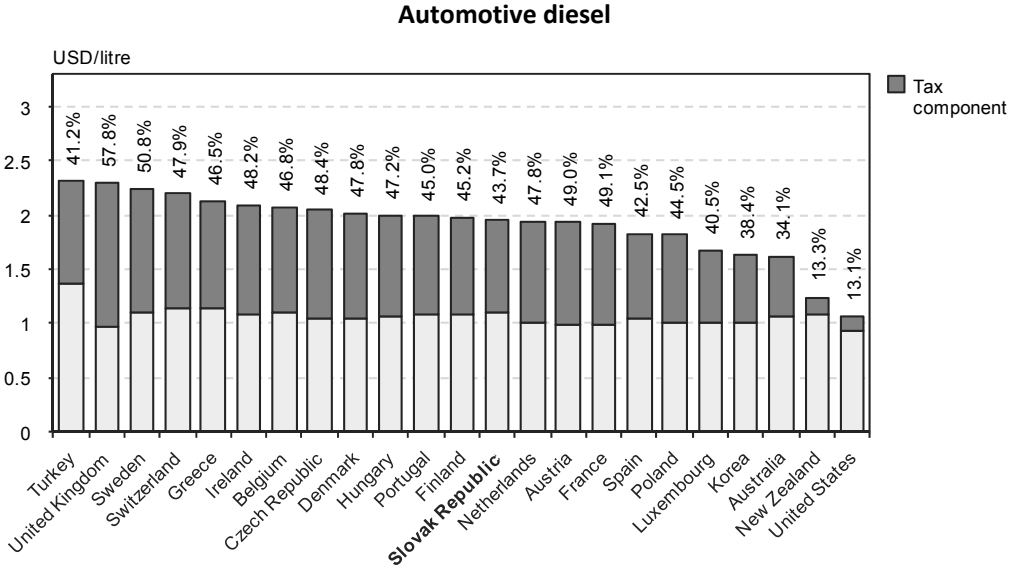
Legislation (Act 170/2001) assigns responsibility for ensuring compliance with these different measures to various components of the Slovak government and sets fines for non-compliance. Industry and other bodies of the state administration would be obliged to provide all data deemed necessary by the ASMR for the monitoring and evaluation of the measures. The NESO would meet regularly to evaluate the effectiveness of the

measures on the basis of current and past data, which could be collected on a weekly, bi-weekly or monthly basis. Depending on the results, the measures would be modified as deemed appropriate.

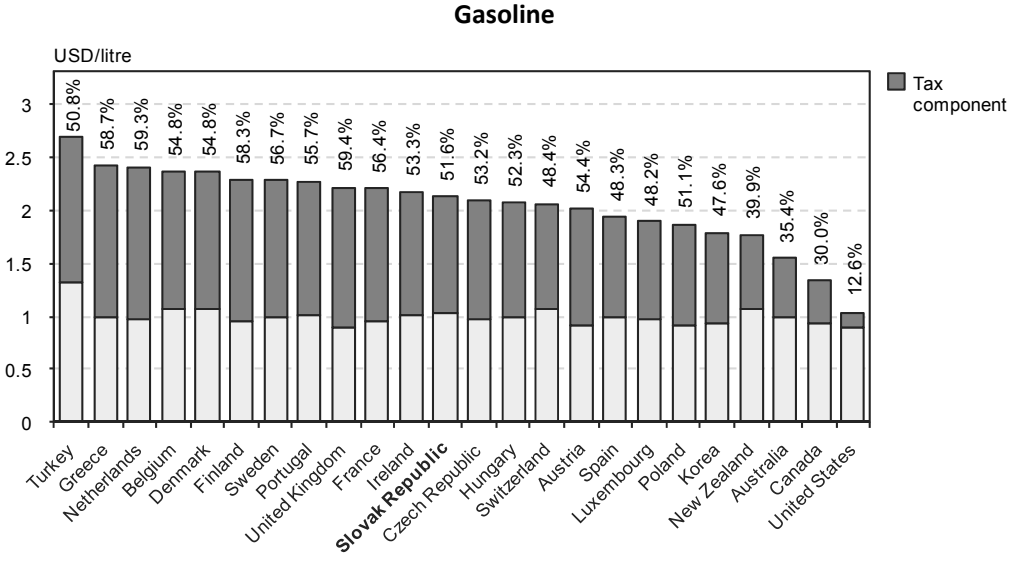
PRICES AND TAXES

Automotive diesel has a lower tax rate compared to gasoline. The government maintains an excise duty on diesel (EUR 0.386/litre in 2011) which is much lower than the duty on motor gasoline (EUR 0.551/litre).

Figure 28. **Fuel prices in IEA member countries, second quarter 2011**



Note: Data not available for Canada, Germany, Italy, Japan and Norway.



Data not available for Germnay, Italy, Japan and Norway.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2011.

CRITIQUE

Ninety nine per cent of the crude oil used within the Slovak Republic is imported from the Russian Federation via the Druzhba pipeline. The government is understandably concerned about diversifying oil supply routes. The various potential pipeline projects to interconnect the Slovak pipeline network with other supply sources would improve supply security, particularly in light of the possible redirection of Russian exports via alternative routes in the coming years. The government should prioritise these projects and accordingly take tangible steps to promote and advance their development. It should also co-ordinate with industry and neighbouring countries on issues of reversibility and capacity expansions.

The Slovak Republic's only refinery, operated by Slovnaft, has been upgraded to meet European fuel quality standards. However, it is still only technically possible to refine the heavier crude oil delivered from the Russian Federation. In line with the goal of the Slovak Republic to diversify oil supplies, the refinery owners should consider conducting cost-benefit assessments on upgrading the refinery to be able to take crude oil of higher quality from other sources in the medium to long term.

More efficient use of oil is one of the policy goals of the Slovak government. By 2025, however, the Slovak Republic is expecting a 100% increase in transport fuel consumption and by 2030, a 150% increase over the current level, as the number of vehicles on the road is expected largely to increase over the next 20 years, leading to a rapid rise in fuel consumption. On the one hand, such a development is understandable in a country which started its transition to a market economy only two decades ago. However, although the *Slovak Energy Policy* states that energy efficiency, energy savings and a reduction in energy intensity are important goals which could reduce dependence on imports of crude oil and oil products, only minimal effort in this respect can be detected. The government should more actively encourage the use of less carbon-intensive transport fuels, such as biofuels. The use of electricity could also be promoted more actively.

The expected growth in oil demand means that additional storage capacity will be needed for strategic storage requirements. The government is encouraged to carefully monitor medium-term growth in oil demand and assess the country's overall storage requirements, in order to ensure sufficient expansion of capacity for strategic storage.

RECOMMENDATIONS

The government of the Slovak Republic should:

- ☐ *Continue efforts towards diversification of oil supplies, both in terms of routing and sources of supply.*
- ☐ *Accelerate current efforts to increase the use of alternative, less carbon intensive transport fuels.*
- ☐ *Enhance efforts to limit the increase in oil demand through demand-side management, particularly in the transport sector.*
- ☐ *Carefully monitor medium-term growth in oil demand and assess overall storage requirements, in order to ensure sufficient expansion of capacity for strategic storage.*

8. COAL

Key data (2010 estimates)

Production: 2.4 Mt of brown coal[21]

Net imports: 0.6 Mt of brown coal (Czech Republic 83%), 3.4 Mt of hard coal (Czech Republic 48%, Russia 27%, Poland 16%, United States 7%)

Share of coal: 19.9% of TPES and 15.2% of electricity generation

Inland consumption: Power and heat generation 33%, other transformation and energy sector 31%, industry sector 22%, commercial and residential 13%

SUPPLY AND DEMAND

Over the last decade, coal consumption in the Slovak Republic has been declining in both absolute and relative terms. Coal supply in 2010 was 3.4 Mtoe or 20% of total primary energy supply. Supply has declined by 14.2% since 2008. Over a longer timeframe, coal use has decreased by 43% since 1993, and it is expected to decline even further, following the same trend until 2020.

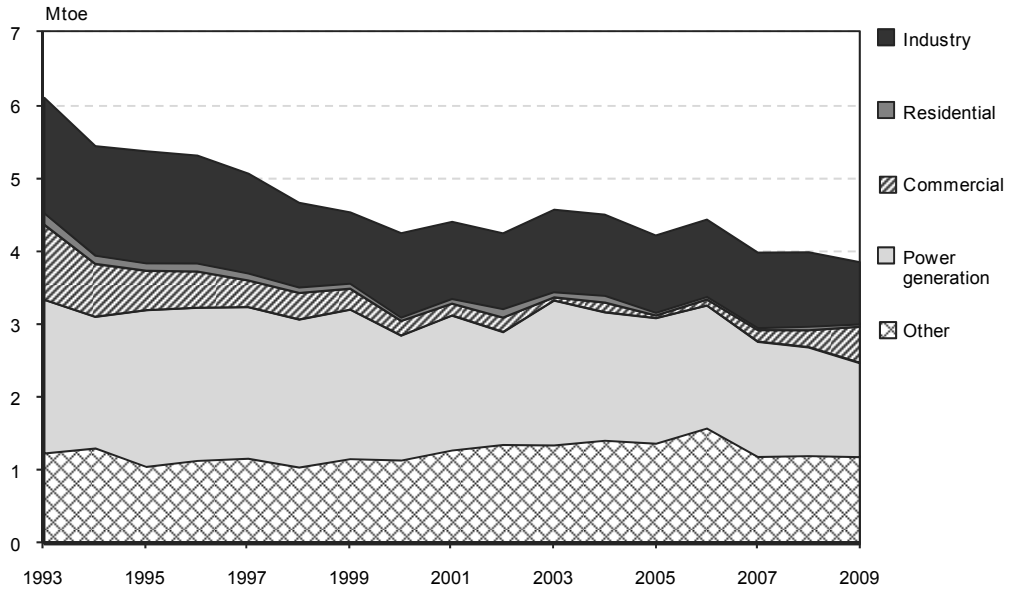
Total coal supply consisted of 3.5 million tonnes (Mt) of hard coal and 3 Mt of brown coal (mostly lignite and partially sub-bituminous coal) in 2010. The Slovak Republic produced 78% of its total brown coal supply but hard coal supply was entirely imported. The Czech Republic was the largest coal supplier, providing 83% of brown coal imports and 48% of hard coal imports in 2010. Russia is the second-largest import source of hard coal, with 27%, Poland, the United States and to a lesser extend Ukraine are the other coal supplying countries to the Slovak Republic. Security of coal supply has not been an issue in the past.

Power generation is the largest coal-consuming sector, using 33% of total coal supply in 2009, and generating 16.5% of gross electricity. Steel, iron and non-ferrous metallurgical industries are the main direct users of steam and coking coal. About 6% of total lignite and 14% of hard coal are still used directly in the residential and service sectors, especially in areas outside the gas network. This direct use of coal has created indoor and outdoor pollution problems. The decrease in coal use over the past decades has mainly occurred in the commercial sector (Figure 29). The government expects coal use to decline in the industry, power and energy sectors.

The share of coal in TPES in the Slovak Republic is similar to the IEA average (21% in 2010) but its share in total electricity generation is lower than the IEA average (35%).

21. In IEA methodology, brown coal is defined as all coal with a gross calorific value less than 5700 kcal/kg (23.9 GJ/t) on an ash-free but moist basis.

Figure 29. **Coal supply by sector*, 1993 to 2009**



* TPES by consuming sector. *Other* includes other transformation and energy sector consumption. *Industry* includes non-energy use. *Commercial* includes commercial, public services, agriculture/forestry, fishing and other final consumption.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

LIGNITE MINING

Lignite, the only significant fossil fuel indigenous to the Slovak Republic, has been mined since the 18th century. Industrial mining, however, commenced in the 20th century. According to the State Mining Authority, there are 18 deposits of brown coal, and one deposit of hard coal in the Slovak Republic. In 2010, five brown coal deposits were exploited. The Slovak Republic has 97 Mt of hard coal reserves and 83 Mt of brown coal. Domestic lignite mining is underground and faces some geological difficulties. Production costs are therefore higher than in the neighbouring Czech Republic where lignite is extracted from opencast mines.

Production of lignite has been steadily declining and is now around 2.4 to 2.5 Mt. It is expected to decline further after 2015 to some 1.8 to 2.0 Mt. Figure 31 shows actual and expected mine closures, as well as those mines that are projected to remain in operation until 2030.

The lignite industry is composed of three underground mining complexes. In Central Slovakia, the mining complex Hornonitrianske bane Prievidza, a.s. (HBP) is the largest lignite producer in the country, accounting for over 80% of total production. The nearby SE-owned Novaky 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 the National Property Fund (NPF) sold its remaining stake.

The Baňa Čáry (previously Baňa Záhorie) mine, located near the western town of Holíc, sells its output to a nearby CHP plant and to the Novaky power plant. The NPF has sold its stake in the company, and it is now owned 51% by its managers and employees and 13.5% by HBP (with the remainder owned by individuals).

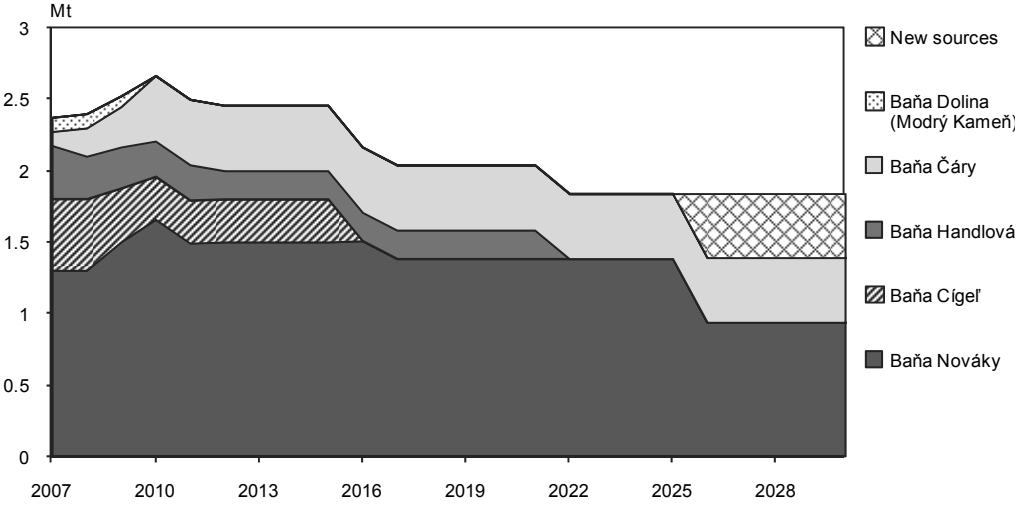
Figure 30. **Brown coal reserves**

This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

1. Nováky, 2. Cigeľ, 3. Handlová, 4. Modrý Kameň, 5. Ľuboriečka, 6. Žihľava, 7. Horné Strháre, 8. Veľký Lom, 9. Červeňany, 10. Štúrovo-Obid, 11. Gbely, 12. Kúty-Čáry, 13. Štefanov, 14. Lakšárská Nová Ves, 15. Beladice, 16. Pukanec, 17. Kosorín, 18. Hnojné.

Source: Country submission.

Figure 31. **Estimated extraction of brown coal until 2030**



Source: Ministry of Economy.

Mining at the Baňa Dolina mine in southern Slovakia was phased out between 2002 and 2009. The mine receives subsidies for decommissioning and for redundant workers (see below). The workers and employees own 63% of the company's capital.

In August 2009, there was a severe accident at the Handlova mine, causing the death of 20 miners. State institutions are in the process of investigating the sources and causes of the accident. The Ministry of Economy and the mining company argue that safety standards are similar to those in other European countries and that the Slovak Republic's overall safety indicator (number of deaths per 1 million tonnes exploited), 0.911 in 2010, is in the upper range of EU countries and in the world. In an attempt to avoid future coal mining accidents, the Slovak government has adopted Resolution no. 114/2008 "Concept of security and protection of health at work in years 2008-2012". The aim is to decrease the number of accidents by 25% by 2012 compared with the 2006 level.

COAL-FIRED POWER PLANTS

The main user of domestic lignite is the thermal power plant Novaky (90%). Around 10% of lignite is delivered to other clients (*i.e.* cogeneration and heating). Novaky currently produces about 8% of electricity in the country. A retrofit of this power plant is planned. Imported black coal is used for power generation in the Vojany thermal power plant. The capacity factor at coal-fired plants is between 35% and 40%, which is relatively low compared with other IEA member countries.

Compliance with SO_2 (sulphur dioxide) and NO_x (nitrogen oxides) emission limits required by EU Directives on Large Combustion Plants (LCP) and on Integrated Pollution Prevention and Control (IPPC) is the main environmental requirement for coal-burning units. Flue gas desulphurisation (FGD) for SO_2 control has been installed in some SE power units in Vojany and Novaky. There is a fluid bed combustion (FBC) unit at Novaky.

Table 8. **Operating coal-fired power plants**

Plant (units)	Company	MW	City	State	Year
NOVAKY	SLOVENSKE ELEKTRARNE AS (SE)	518	Zemianske Kostolany	Trencin	
NOVAKY-A NO 3		32			1957
NOVAKY-B NO 1		110			1964
NOVAKY-B NO 2		110			1964
NOVAKY-B NO 3		110			1976
NOVAKY-B NO 4		110			1976
NOVAKY-A NO 11		28			1996
NOVAKY-A NO 12		18			2004
KOSICE WORKS	US STEEL KOSICE SRO	193	Kosice	Kosice	
KOSICE	TEPLAREN KOSICE AS (TEKO)	121	Kosice	Kosice	
KOSICE 1		55			1967
KOSICE 2		66			1980
STUROVO PLANT	JCP STUROVO AS	50	Sturovo	Nitra	
SAL'A PLANT	DUSLO AS	46	Sal'a	Nitra	
RUZOMBEROK SCP	MONDI BUSINESS PAPER SCP	45	Ruzomberok	Zilina	
RUZOMBEROK SCP 1		18			1998
RUZOMBEROK SCP 2		18			1998
RUZOMBEROK SCP 3		9			2008
STRAZSKE PLANT	CHEMKO AS	43	Strazske	Kosice	
ZVOLENSKA	ZVOLENSKA TEPLARENSKA AS	40	Zvolen	Banska Bystrica	
ZVOLENSKA A2		2			1954
ZVOLENSKA A4		4			1980
ZVOLENSKA A5		9			
ZVOLENSKA B1		25			1996
VRANOV PLANT	BUKOZA AS	37	Vranov nad Toplou	Presov	
ZSNP PLANT	ZSNP AS	35	Ziar nad Hronom	Banska Bystrica	
HUMENNE PLANT	CHEMES AS	24	Humenne	Presov	

Source: Country submission.

COAL POLICY AND SUBSIDIES

Government policy in the coal sector is articulated in the Raw Materials Policy adopted in 2004, as well as in the *2006 Energy Policy* and *2008 Energy Security Strategy* (see Chapter 2). The key policy objective is to support domestic lignite production, which is driven by the following considerations:

- reducing high dependence on imports of primary energy sources;
- maintaining jobs in the mining areas where unemployment is high;
- using domestic lignite for electricity generation thus contributing to *i)* the flexibility of the electricity grid and *ii)* security of electricity supply through diversification of fuels.

Over the last decade the government has restructured the lignite mines leading to their modernisation and acquisition by the employees. Direct state subsidies for residential lignite stopped in 2003. Remaining subsidies are: *i)* for the phasing-out of the Baňa Dolina mine in accordance with EU regulation and *ii)* for electricity generation from domestic coal.

The direct subsidies for lignite mining are mainly aimed at the reduction and liquidation of mining and social inherited liabilities (social payments to coal miners). The total amount of subsidy for the period 2005-2010 was approximately EUR 30 million.

The government also provides support for the generation of electricity from domestic lignite. Government resolutions adopted in 2005 and 2006 determined the amount of electricity that must be produced from domestic coal in the "general economic interest". A new resolution adopted in January 2010 extended this "general economic interest" until 2020 with the possibility of extension to 2035. The Regulatory Office for Network Industries (RONI) administers the subsidy and annually publishes decisions on prices through which a supplement (additional allowance) to every MWh of lignite-fired electricity supplied to the network is determined.[22] Up to 15% of total electricity generation can be subsidised. The price of domestic lignite is also set by RONI.

The *Energy Security Strategy* stipulates the maximum use of domestic lignite reserves. It discusses the possibility of resuming or opening lignite extraction at several deposits. The Strategy identifies the following priorities to ensure coal supply security:

- ensure the sale of extracted coal after 2010, while maintaining economic efficiency of the extraction by prolonging the general economic interest for the extraction from deposits until 2020;
- continually update the choice among suitable suppliers of (black) coal;
- promote the construction of water roads for the efficient transport of coal;
- co-ordinate the participation of the government in the technical education of workers in the mining industry.

22. The generator has to prove that electricity was produced from domestic coal in thermal power plants which are holders of permission for electricity generation. The thermal plant Novaky (owned by Slovenske elektrarne) is the only company holding such permission.

The Strategy recommends gasification at the following deposits: Vátovce, Ľuboriečka, Červeňany, Modrý Kameň-Horné Strháre, Handlová-východ and Beladice. Gasification of coal is envisaged to be included in policies to promote clean coal technologies, especially integrated gasification combined cycle (IGCC). Feasibility studies have being carried out on the potential for gasification of coal from Slovak deposits, including Nováky and Handlová. However, this method has not yet been tested in practice. The liquefaction of coal is not currently under consideration, although there is some potential.

There are no plans for carbon capture and storage (CCS) in the Slovak Republic, but a study on geological potential for carbon storage is being conducted. The Slovak government notified the European Commission on 4 August 2011 on the full transposition of the Directive 2009/31/ES on CCS by Act 258/2011 Coll.

CRITIQUE

Coal consumption has been declining in the Slovak Republic in both absolute and relative terms. Domestic production of lignite has been declining, and, although production has recently stabilised, it is expected to decline further after 2015. Some mines are being closed or will be closed soon. A few are projected to continue exploitation until 2030. Besides renewable energy sources, lignite is the only significant domestic primary energy source, and the government is keen to maintain domestic lignite production and lignite-fired electricity generation.

The Slovak Republic provides support for electricity generation from domestic lignite. This support is considered to be in the "general economic interest" and is in place until 2020, with the possibility of extension to 2035. The support mechanism – which guarantees the purchase price for lignite and the power generated from it – provides no incentive for both the mine and the power plant to invest in efficiency improvements. Given the high cost of lignite mining in the Slovak Republic compared to neighbouring countries, as well as the need to retrofit the Novaky plant, the government is encouraged to conduct a detailed assessment of the cost-effectiveness of the support measures. On the basis of the results of this assessment, the government could reconsider the merits of maintaining lignite production and subsidised lignite-fired power generation.

The rationale for government support for coal gasification is questionable. Coal-to-chemicals, coal-to-liquids or coal gasification plants are currently not competitive with alternative sources of chemicals or fuels. Application of these technologies in the past has always been in unique situations where alternative sources were not available.

RECOMMENDATIONS

The government of the Slovak Republic should:

- ☐ *Continue to close uneconomic mines.*
- ☐ *In co-operation with the regulator, periodically assess the costs and benefits of support for domestic lignite production, making the results publicly available, and on the basis of this assessment, reconsider the merits of maintaining lignite production and subsidised lignite-fired power generation.*

9. ELECTRICITY

Key data (2010 estimates)

Installed capacity: 7.8 GW

Net electricity generation: 27.3 TWh, -11.3% since 2000

Peak demand: 4.3 GW

Electricity generation mix: nuclear 53%, hydro 20%, coal 15%, gas 7%, oil 2.2%, biofuels and waste 2%

SUPPLY AND DEMAND

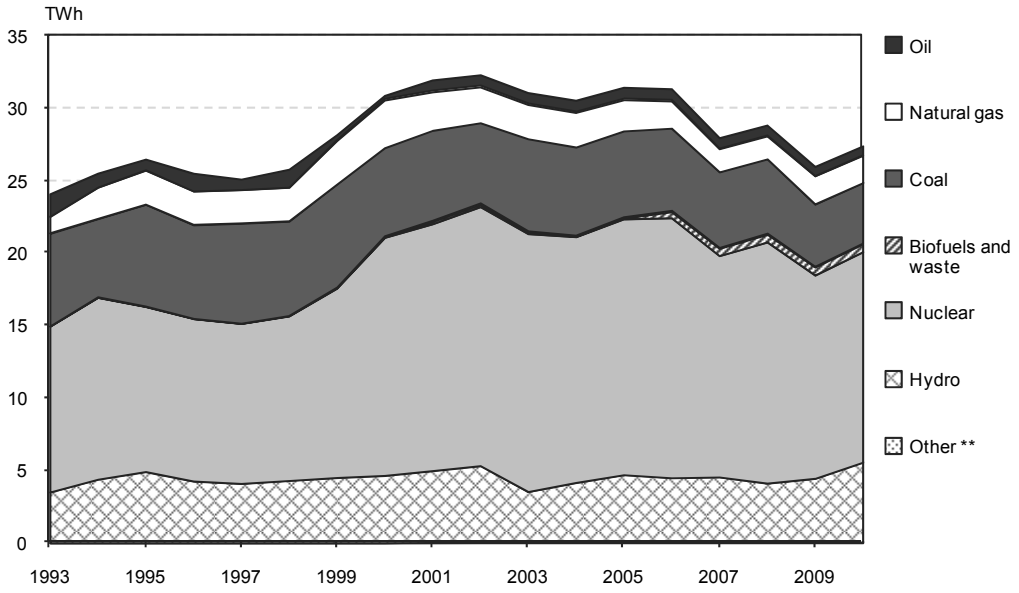
GENERATION, IMPORT AND EXPORT

In 2010, net electricity generation in the Slovak Republic was 27.3 TWh, slightly higher than in 2009 but down 1.4 TWh from its level in 2008. Net generation declined markedly in 2009; it was 11% lower than the level generated in 2008 while demand was 8.2% lower. The decline was due to the global economic recession which had a particularly negative impact on the Slovak economy. Despite this recent decline, demand for electricity has grown at an average annual rate of 0.9% since 1993. The Slovak government forecasts that electricity demand will continue to increase at a similar rate until 2020. Figures 32 and 33 show the historical shares of gross generation by fuel in the Slovak Republic and the comparative shares of fuel for power generation among IEA member countries. Table 9 provides information on generating capacity, production and capacity utilisation for the Slovak Republic in 2009.

The Slovak Republic's electricity generation mix is dominated by nuclear power. In 2010, net production from nuclear power was in excess of 14.6 TWh, representing 53% of indigenous generation. The share of nuclear in the generation mix is among the highest among OECD countries, second only to France. Coal and hydro are the other primary energy sources which account for significant shares of indigenous generation, and in 2010 they held market shares of 15% and 20% respectively. In 2010, natural gas accounted for 7% of indigenous generation, oil and biomass and waste each accounted for 2%. Other renewable energy sources had negligible shares. The carbon intensity of the Slovak power sector, with more than 70% of generation from nuclear and hydro, is one of the lowest among IEA member countries.

While the Slovak Republic has historically been a net exporter of electricity, that trend reversed in 2007 with the decommissioning of two nuclear units at Jaslovske Bohunice. Since then, the country has been a net importer of power. Another two generation units at the same nuclear power plant were decommissioned at the end of 2008. In 2009, the Slovak Republic imported in excess of 9 TWh from the Czech Republic and Poland, and exported 7.5 TWh to Hungary and Ukraine (for more details see section on Trade below).

Figure 32. **Gross electricity generation by source, 1993 to 2010***

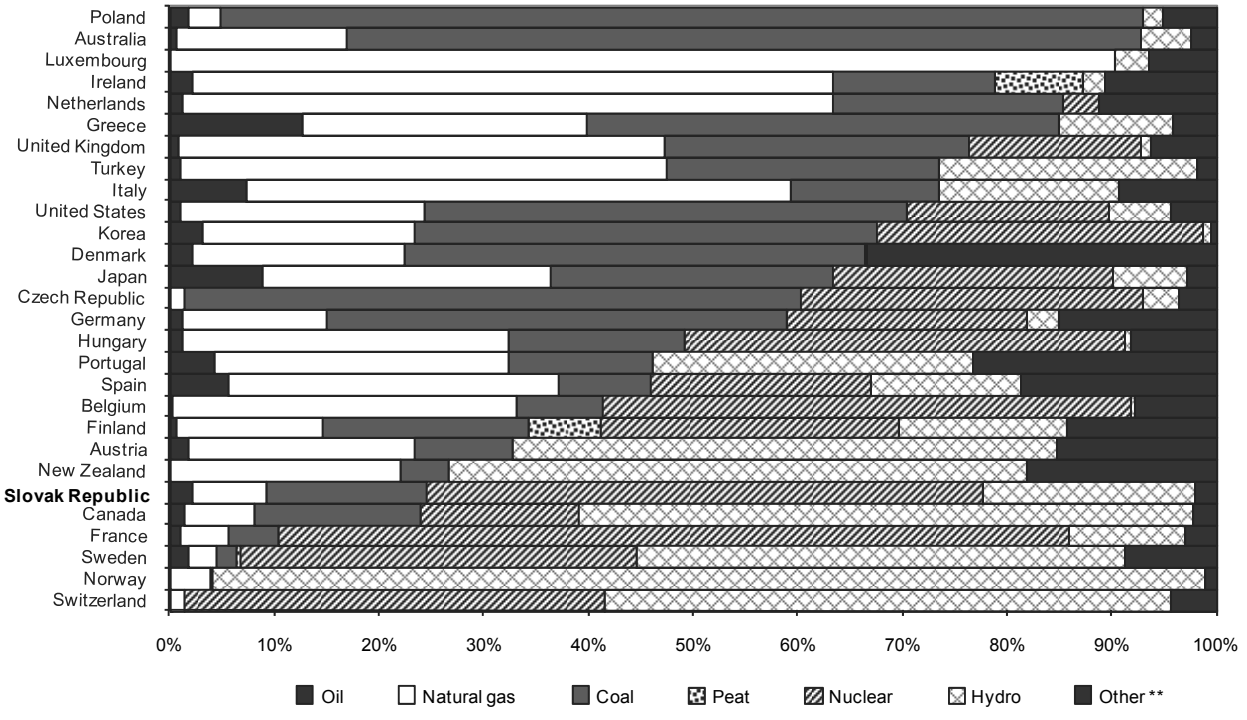


* Estimates for 2010.

** *Other* includes wind and solar (negligible).

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2011.

Figure 33. **Electricity generation by source in IEA member countries, 2010***



* Estimates.

** *Other* includes geothermal, solar, wind, and ambient heat production.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2011.

Table 9. **Slovak generating capacity, production and capacity utilisation, 2009**

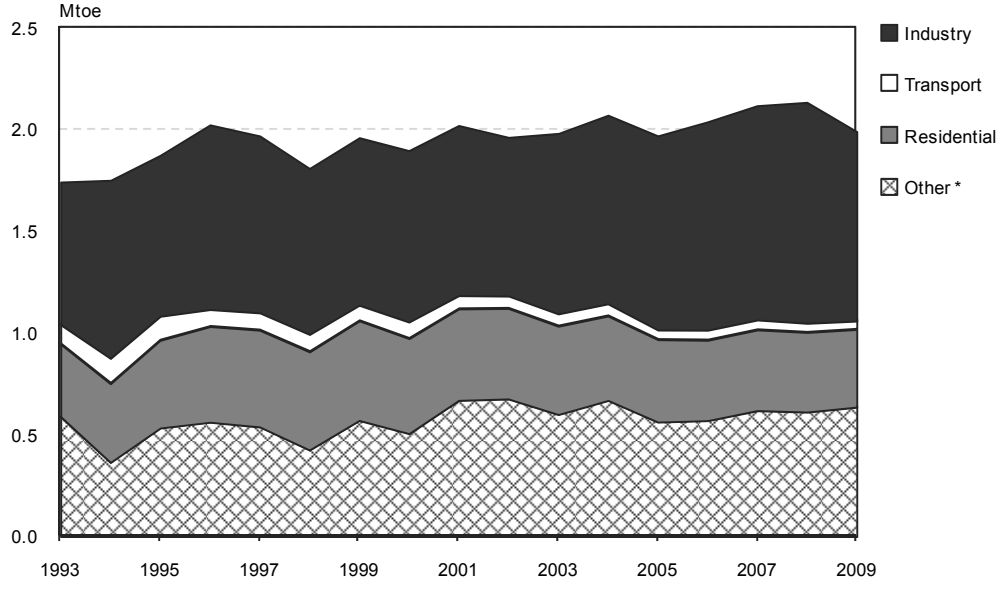
	Capacity (MW)	Capacity share	Production (GWh)	Generation share	Utilisation
Nuclear	1 820	25.6%	14 081	51.4%	88.3%
Fossil	2 009	28.3%	4 768	17.4%	27.1%
Hydro	2 478	34.9%	4 662	17.0%	21.5%
Other	794	11.2%	2 563	9.4%	36.8%
Net imports	0	0.0%	1 312	4.8%	-
Total	**7 101**	**100**	**27 386**	**100**	**-**

Source: IEA Electricity information, 2010.

DEMAND

As noted above, Slovak electricity demand fell sharply in 2009, by roughly 8% from the previous year's level. In 2009, the industry sector consumed about 50% of electricity demand, while 30% was consumed in the commercial and public services and transport sectors, and 19% in the residential sector. Electricity demand in the agriculture and fishing sectors accounted for the remaining 1%. Industrial demand has generally represented between 40% and 50% of Slovak power demand over the past two decades, with the share over the last five years being close to 50%. Demand in the commercial and services sector has been trending upwards over the past decade, while residential demand has been trending downwards. The historical shares and anticipated shares of power demand by sector to 2030 are provided in Figure 34. The Slovak government is forecasting that there will be some growth in power consumption in both the commercial and residential sectors.

Figure 34. **Electricity demand by end-use sector, 1993 to 2009**



* *Other* includes commercial, public services, agriculture, fishing and other non-specified sectors.

Source: *Energy Balances of OECD Countries,* IEA/OECD Paris, 2010.

While the annual load curve for the Slovak Republic is relatively flat over a 12-month cycle, peak demand occurs during the winter. In 2009, peak demand was 4 101 MW, down nearly 5.5% from peak demand in 2008. Peak demand over the past decade has not risen above the maximum system peak of 4 400 GW experienced in 2002. Average load on the system was 3 126 MW in 2009, down more than 6% from the average load over the previous four years.

SUPPLY

While the Slovak electricity system has recently become reliant on power trade to meet total demand, its peak demand is relatively low in relation to its domestic supply capability. Reliance on imports is likely to end when two new nuclear units, which are currently being built by Slovenske Elektrarne a.s. (SE), enter into service by 2013 (see Chapter 11). While the incremental capacity will further the country's ability to supply low-carbon power to an increasingly carbon-sensitive market place, it will most likely require SE to periodically supply baseload power to regional and perhaps more distant markets. SE is also investing in new pumped storage facilities. Nevertheless, with peak demand at around 4.2 GW, there is unlikely to be sufficient flexibility within the domestic network to manage the output of nearly 3 GW of nuclear capacity, without relying on load-following capability across the nuclear fleet. Slovak domestic system flexibility will be further diminished by 2015 as a number of older fossil-fuel-fired units are likely to be decommissioned under the EU's tightening emission requirements for large industrial plants. While these plants do not operate at significant capacity factors, they do have dispatch capability and help balance system operation.

INDUSTRY STRUCTURE

GENERATION

The supply industry includes a major utility, Slovenske Elektrarne a.s. (SE), more than 260 independent district heating and power facilities, a number of industrial cogeneration facilities and a merchant generator. Total system capacity was 7.8 GW at the end of 2010. SE owns and operates some 5.6 GW of generating capacity, including a balanced mix of nuclear, fossil-fuel and hydro plants and, in 2009, accounted for more than 82% of generation. This is down from the 90% to 95% market share it held in 2003. SE is a share capital company, with Enel, the Italian-based utility, owning 66% of voting shares and the Slovak government, through the Slovak National Property Fund, owning the remaining 34%. Within the CHP segment of the industry, some 260 installations represent 2 460 MW of thermal capacity and provide the vast majority of residual production. Autoproducers accounted for 10% of supply while independent generators supply the remaining 8%.

DISTRIBUTION AND RETAIL

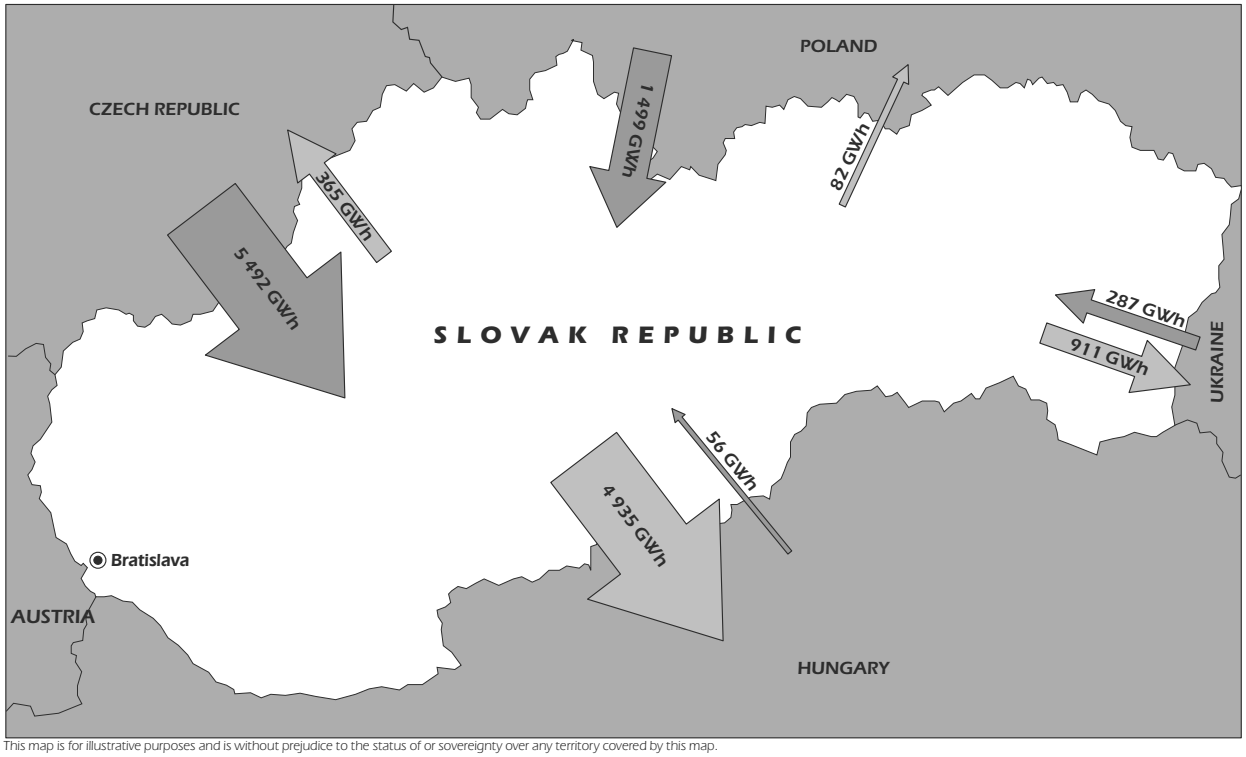
In 2002, the Slovak government started to develop strategic partnerships with several major European utilities to modernise and strengthen the management of their power sector. Through this initiative, Enel purchased majority ownership of SE while E.ON, RWE and EDF acquired large minority interests in the three regional distribution companies.

These regional distribution companies are 51% state-owned with the major private sector partners owning the remaining 49% of shares. They are also regulated as distribution system operators. In addition, they purchase production from a small but growing number of solar, biomass and other special regime generators under contractual arrangements overseen by the network system regulator (see Chapter 5 on Renewable Energy).

TRANSMISSION

The transmission system is owned and operated by SEPS, which acts as power system operator. SEPS is 100% owned by the Slovak National Property Fund; shareholder rights are exercised by the Ministry of Economy. SEPS has invested heavily to upgrade and expand transmission capacity through a EUR 437 million investment programme over the past decade. SEPS invested roughly EUR 72 million in 2009 as part of its grid modernisation initiative. The transmission system consists of 1 776 km of 400 kV lines and 962 km of 220 kV lines. Distribution companies also have interconnected capacities with neighbouring countries, at 110 kV levels. The Regulatory Office for Network Industries (RONI) approves the operation of the 110 kV lines**.**

Figure 35. **Cross-border power flows, 2010**



This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Source: SEPS Annual Report 2010.

TRADE

While the Slovak Republic has stated that it intends to be self-sufficient in electricity supply, it has taken steps to become a regional electricity player and has engaged in regional energy planning with Hungary, Poland and the Czech Republic. In many respects, the Slovak Republic serves as a transit country for power flowing south from the Czech Republic and Poland to Hungary (around 5 TWh) and Ukraine (around 1 TWh). Relatively small amounts of power are exported back to the Czech Republic and Poland and imported from Ukraine (Figure 35). In 2010, the Slovak Republic was a net power importer of some 1 000 GWh, or roughly 3.6% of Slovak demand. While considerable Slovak supply capacity was underutilised in 2009 and 2010, the net importation of power generally reflected regional market opportunities rather than supply limitations. Capacity factors for Slovak-based thermal plants are well below theoretical capability.

POLICY DIRECTIONS AND REGULATORY FRAMEWORK

The *Energy Policy of the Slovak Republic* outlines a number of key objectives related to electricity, including: ensure domestic production matches demand; adopt measures to save energy and increase end-use efficiency; utilise domestic primary energy for electricity and heat in a cost-effective way; increase the use of combined production of heat and electricity; fully and safely exploit nuclear energy for electricity production; increase the share of renewable energy sources in electricity and heat production; and build new transmission trunks to strengthen interconnections to the EU grid. These domestically oriented policies complement the EC directives related to progressing towards a pan-European internal energy market for both natural gas and electricity, the principal aims of the EC for reducing GHG emissions and accelerating the share of electricity from renewable energy sources by 2020. The EC has a non-binding target to lower energy demand by 20% by 2020 through encouraging greater energy efficiency, thereby strengthening security of supply and economic competitiveness.

The EC has also identified four “priority corridors” in the electricity sector as part of its energy infrastructure priorities for 2020 and beyond (see Chapter 2). One of these priorities is enhancing connections and thus strengthening the regional network in Central-Eastern and South-Eastern Europe.

MARKET LIBERALISATION

While there has been ongoing liberalisation within the Slovak electricity market over the past decade, progress is being made at a moderate pace. SE still heavily dominates electricity supply and, while consumers are now able to exercise their choice in selecting electricity suppliers, on a percentage basis, few have actually done so. Moreover, consumers who would be willing to pay a small premium for green power are unable to exercise that choice. In 2008, eight households and 1 462 other electricity consumers switched suppliers. In 2009, 7 700 households and 3 000 other electricity consumers switched. With electricity and heat tariffs fixed by regulation, there is little incentive for households and small business consumers to seek out new suppliers, particularly where there is no differentiation in the delivered product.

MARKET COUPLING

In May 2006, the Slovak and Czech electricity markets were coupled to enable intra-day trading across the Czech-Slovak border. This was the first example of cross-border intra-day market in Central-Eastern Europe. In September 2009, the two trading areas were further coupled into a common market area. Market coupling is intended to make better use of low-cost generation and transmission assets across the region, and thereby to lower market prices for consumers. Market coupling requires the effective co-operation of transmission system operators and power exchanges as well as the allocation of cross-border transmission capacity through non-discriminatory and transparent processes. This enables lower-cost generation to be accessed by customers across the combined market. This coupling represents a significant development in each power market's evolution towards regional integration. This development is in line with the European Commission's objective of ultimately having a single pan-European electricity market.

DEMAND-SIDE MEASURES

As noted above, one of the European Union's key energy-related objectives is to reduce energy demand by 20% by 2020. Concerning electricity, this would entail encouraging the uptake of more efficient appliances and equipment by household consumers and small businesses, as well as switching to compact fluorescent lighting, among various other initiatives. Fuel switching can also contribute, for example if natural gas boilers are substituted for electric and oil-fired boilers in situations where the end-use service is provided at a lower effective cost.

The Slovak government has introduced a series of measures to improve electricity end-use efficiency. This is commendable since end-use efficiency gains are often much higher than savings from reducing primary energy use, depending on the technology and fuel used to generate the electricity.

Demand-side measures encourage better utilisation of generation and transmission assets. Encouraging consumers to spread their demand for power throughout the day lowers peak levels of demand. A good example is when consumers use high-load devices, such as dishwashers and washing machines, after the peak demand in the evening or over the weekend when the demand for power is generally lower. In order to encourage these changes in consumer behaviour, incentives, frequently in the form of preferential pricing tariffs, are commonly used. Consumers drawing power at peak periods pay more for power than those who use power during off-peak periods. In order to facilitate peak load management, smart meters and time-of-use pricing rate structures are required. Such differentiated pricing for peak and off-peak electricity is not commonly used in the Slovak Republic.

The Slovak government has not yet put forth a proposal to support smart meters or time-of-use pricing. At present, the Ministry of Economy, the Regulatory Office for Network Industries and relevant stakeholders, including the TSO and DSOs, are working on a cost-benefit analysis of smart metering implementation as requested by EU Directive 2009/72. The analysis includes qualitative assumptions of benefits for market participants (consumers, DSOs, suppliers, grid as a whole) and quantification of these benefits compared to costs of smart meter roll-out. Accompanied by pilot projects in three major

DSOs, the ministry and regulator are to decide on binding time plan until 2020 as well as tariffs by September 2012. SEPS is also monitoring the developments related to smart grid technology, but it is not considering such investments in the near term.

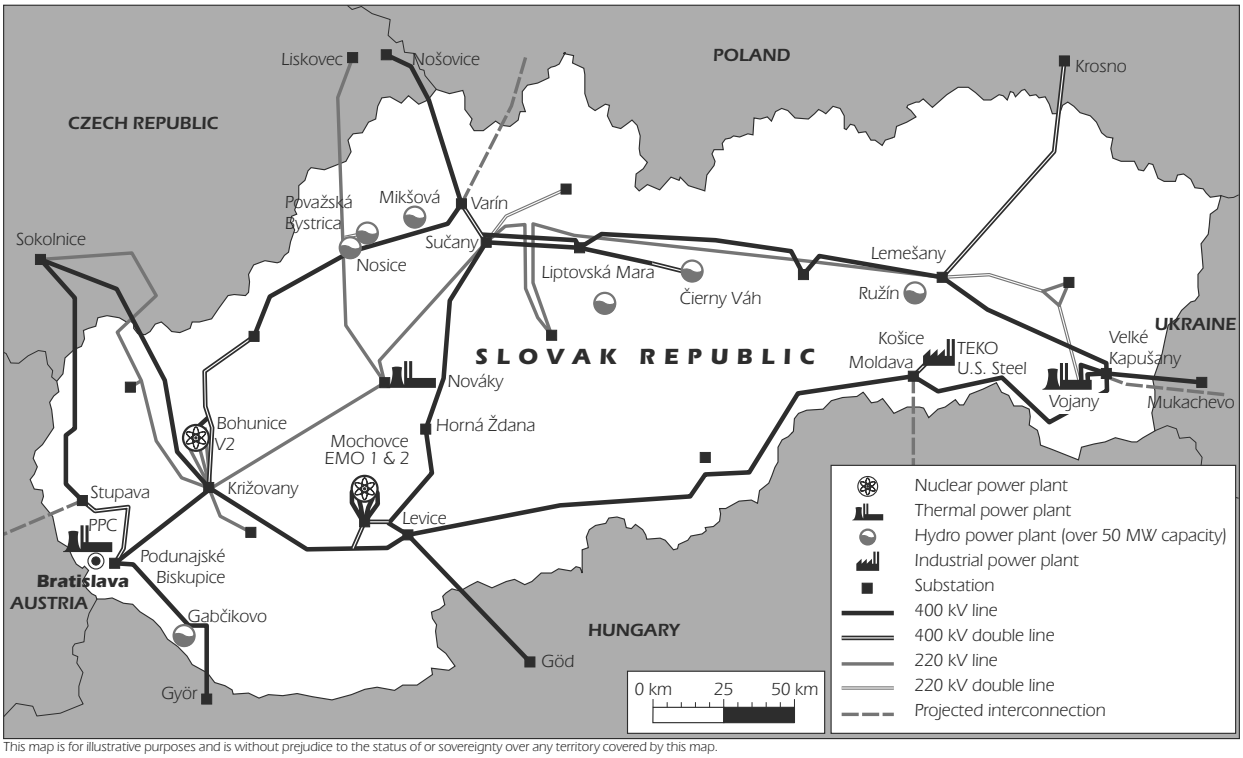
NETWORK INFRASTRUCTURE AND OPERATIONS

INFRASTRUCTURE

The Slovak transmission grid forms an integral part of the Western European transmission system with interconnections to the Czech Republic, Poland, Hungary and Ukraine (*i.e.* the interconnected part of Ukraine, called Burstyn Island). In total, the Slovak Republic can, under certain conditions (*e.g.* ignoring internal network constraints and the adequacy of assets on both sides of the border), deliver some 3.3 GW of power through its interconnections, roughly ten times the level stipulated by the European Council's 2002 Barcelona Declaration. All neighbouring countries have interconnections with the Slovak Republic with the exception of Austria. While discussions have been under way for years with the Austrian TSO to strengthen the transmission network in this part of Europe, the lack of progress reflects key political differences between the two countries. Related discussions on interconnection expansion are under way with the Hungarian TSO to resolve grid congestion at the southern border of the Slovak Republic − caused by high electricity flows from the north of Europe towards the south − although progress towards capacity expansion has also been slow. Given that the existing Slovak-Hungary interconnections are heavily loaded, line capacities are auctioned to market participants in a manner that ensures that available capacities are most effectively utilised. Figure 36 illustrates the Slovak transmission system.

The Slovak Republic's domestic transmission network is advanced under a long-term development plan that makes incremental adjustments through a series of annual investment projects. The Programme of Development of SEPS looks forward 15 years and focuses on specific time horizons. It is updated annually. SEPS aims to ensure that the capacity of the Slovak internal network remains adequate to effectively balance generating capacity and demand.

Figure 36. **Slovak transmission system**



This map is for illustrative purposes and is without prejudice to the status of or sovereignty over any territory covered by this map.

Source: SE and SEPS.

ELECTRICITY FROM RENEWABLE ENERGY SOURCES

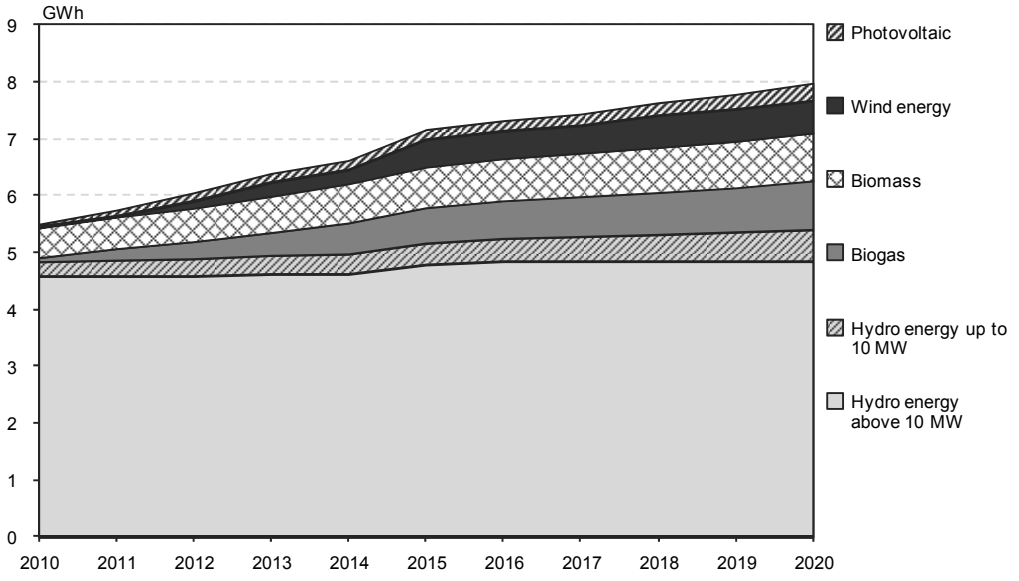
One of the Slovak government's key policy objectives is to increase the share of renewable energy sources (RES) in power and heat generation and other sectors (see Chapter 5 on Renewable Energy). Producers of electricity from renewable energy sources are entitled to favourable connection arrangements and priority dispatch to the regional distribution system. Distribution utilities, by law, are obligated to purchase renewable energy production to make up for their technical losses. Figure 37 shows the planned production levels as outlined in the 2010 National Renewable Energy Action Plan.

The Slovak government carries out periodic reviews of the country's renewable energy potential as part of its planning for renewable energy development. These assessments have identified biomass as the most promising indigenous renewable resource for exploitation. Governing legislation, however, does not set an overall goal or objective for each specific technology, other than aiming to comply with the EU negotiated target of having renewable energy sources account for 14% of the Slovak gross final energy consumption by 2020.

In establishing their support scheme for renewable energy sources, the Slovak government has not established fixed capacities for each qualifying technology, but has set fixed feed-in tariffs by technology type on an annual basis for a 15-year period. As discussed in Chapter 5, during 2009, the incentives that were established for PV installations were far more generous than required – as other countries within the EU experienced. The programme was flooded with applications, and SEPS, the Slovak TSO,

was obliged to limit the number of systems that could be installed, citing their concern over reliable and safe integration of these intermittent sources into the grid. SEPS plans to conduct studies on grid integration issues and will revaluate the situation in 2012.

Figure 37. **Outlook for electricity production from renewable energy sources**



Source: National Renewable Energy Action Plan.

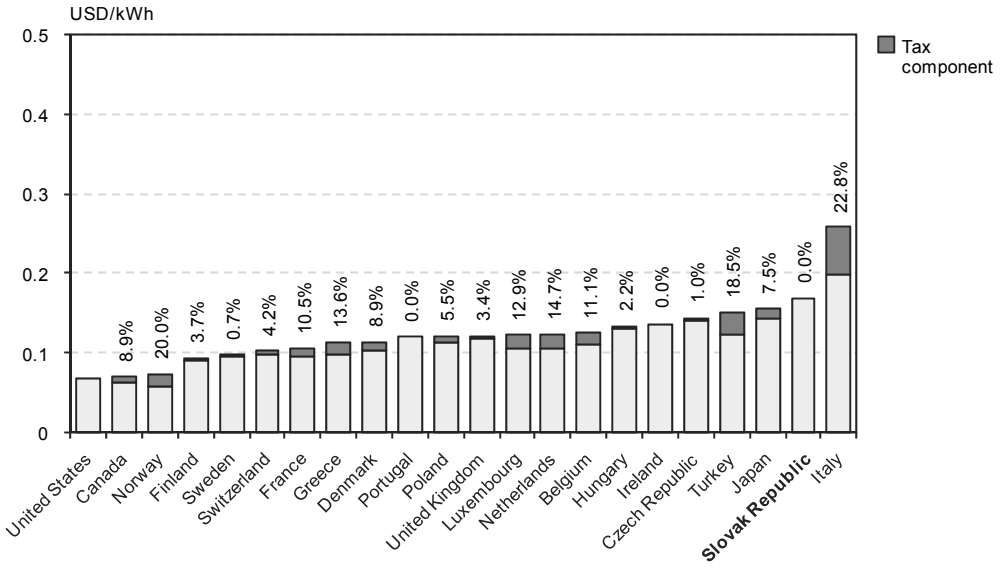
PRICES AND TARIFFS

As noted above, electricity prices for residential and small commercial clients are regulated by RONI. While the enabling act governing this regulation has been amended several times over the past five years, it still empowers the Regulatory Office for Network Industries to set rules for the functioning of the Slovak electricity market.

Subject to the regulation are *i)* the operation of both electricity and gas transmission and distribution companies; *ii)* the production of electricity from qualifying renewable sources; *iii)* the combined production of electricity and heat; *iv)* the production of electricity from domestic coal; and *v)* the maximum prices of ancillary services. Further, the regulation obliges SE to sell up to 6 TWh of electricity at a regulated price to electricity suppliers for households and small enterprises.

Slovak power prices, in relation to those of IEA member countries for which 2010 data are available, are higher than all neighbouring countries and are well above the EU average. Power prices for industry are second only to those of Italy, at just under EUR 130 per megawatt-hour. For residential and commercial clients, electricity prices are closer to the IEA average, at just below EUR 160 per megawatt-hour.

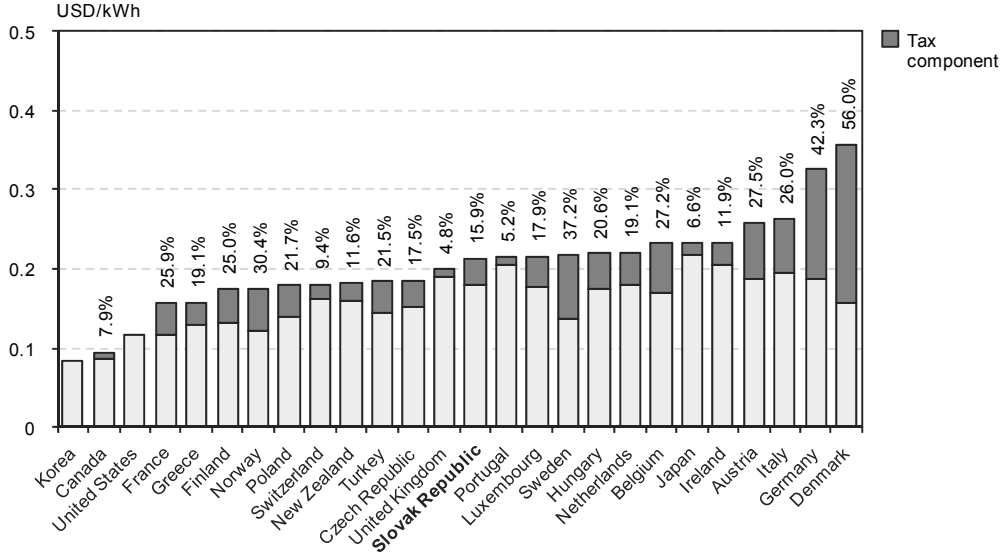
Figure 38. **Industrial electricity prices in IEA member countries, 2010**



Note: Tax information not available for the United States. Data not available for Australia, Austria, Germany, Korea, New Zealand and Spain.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2011.

Figure 39. **Residential electricity prices in IEA member countries, 2010**



Note: Tax information not available for the United States. Data not available for Australia and Spain.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2011.

CRITIQUE

In line with the European Community's goal to develop a pan-European energy market, the Slovak Republic has moved forward with market coupling with the Czech Republic and has taken progressive steps to plan regionally with neighbouring countries. Following the strategic decision on the part of the Slovak government several years ago to acquire managerial and operational expertise by partnering with leading power companies across Europe (*i.e.* Enel, EDF, RWE and E.ON), the electricity sector is much more effective in serving the needs of residential, commercial and institutional customers. This expertise is welcome and will benefit all market participants.

The Slovak power system, principally though its major generating company, SE, is being enhanced through generation fleet investments and upgrades that will position the utility favourably within the regional market place. With the planned commissioning of two new nuclear units at the Mochovce nuclear facility in 2012 and 2013, the SE generating portfolio will be strategically positioned with a fleet of low-carbon capacity. While the majority of the operating portfolio under SE's control will be carbon-free, it will be heavily skewed towards baseload nuclear and run-of-river facilities for an electricity market of about 30 TWh per year. With such a heavy reliance on nuclear and must-run hydro, strengthened interconnection capability, more storage facilities and greater co-operation across regional markets will be needed to facilitate system balance, particularly during periods of quickly changing demand and low domestic demand.

The current generation mix of SE does include a number of thermal plants that run on coal and oil, but these units have recently seen low rates of utilisation because of both plant and market conditions. While these reserve capacities can be drawn on to help with load balancing, the spare capacity that they represent is a considerable barrier to entry for potential new investors in the Slovak generation market. This idle capacity could also discourage new investment by existing regional CHP players in the residential and commercial heating markets. Both SE and the operators of district CHP facilities need to articulate their capital investment plans for the future. The ageing fossil-fuel plants have low thermal efficiencies and poor emission controls. Thus, much of this underutilised capacity will not meet the emission standards in the EU after the 2015 implementation of the Directive on Large Combustion Plants.

There are considerable investment challenges facing both SE and the owners of the regional CHP plants. The key challenge for SE is ensuring that it has a generating fleet of sufficient flexibility so as not to have to ramp down the output of its nuclear fleet to follow load. The key challenge for CHP owners is to invest in highly efficient capital facilities in the face of considerable revenue constraints, rising fuel prices and declining market shares for district heating. Under the current rate structures, these participants in the heating and power market are in a challenging situation, as there are few options for financing upgrades to their plant and equipment. A thorough review of the Slovak district heating system is needed to determine the optimal way forward (see Chapter 10).

The ability of SE to meet the majority of Slovak electricity needs and to play a role regionally is being facilitated by capital investments on the part of SEPS, the state-owned transmission company. SEPS has been upgrading its transmission system at the 400 KV level and strengthening its interconnection capability over the past decade; it has clearly defined investment plans extending out to 2020 to ensure a fully capable bulk

transmission system. While this regional approach is to be encouraged, SEPS would likely benefit from closely monitoring developments in smart grid technology development and deployment and should look to develop a plan for the Slovak system that best reflects the Slovak Republic's long-term needs and capabilities. Without the broad deployment of advanced metering infrastructure in the commercial and residential sectors and other smart grid-related technology that enhances system transparency and the integration of more distributed generation, Slovak efforts to advance energy efficiency within the electricity sector will be severely constrained.

Over the past decade, considerable advances in both electrical and communications technology have emerged that can greatly facilitate wide-area monitoring of transmission systems and equipment performance. This technology also enables automated responses to many transmission and distribution system disturbances. Considerable efforts are currently being made across many IEA member countries to selectively deploy these advanced technologies as a cost-effective means of strengthening grid capability and improving customer service. As part of its regular foresight and planning activities, the Slovak system operator may wish to monitor developments in relevant smart grid-related technologies and their deployment by utilities and other system operators across Europe through its involvement in the European Network of Transmission System Operators (ENTSO) and its various technical committees.

Smart grid-related investments, such as transmission line and equipment sensors, digital communication technologies and advanced metering infrastructure, among others, along with transmission system interconnection strengthening will add considerable flexibility to the Slovak power system, which will help manage increasing supply intermittency and potentially surplus reserves, once the two additional nuclear units are commissioned. These investments would result in increased reliability, improved transfer capacity and greater operational flexibility as the new nuclear units and additional renewable generating capacities are added to the Slovak generation mix.

Box 4. **What is a smart grid?**

A smart grid is an electricity network that uses digital and other advanced technologies to monitor and manage the transport of electricity from all generation sources to meet the varying electricity demands of end-users. Smart grids co-ordinate the needs and capabilities of all generators, grid operators, end-users and electricity market stakeholders to operate all parts of the system as efficiently as possible, minimising costs and environmental impacts while maximising system reliability, resilience and stability.

Source: IEA *Smart Grid Roadmap*.

Depending on the commissioning dates for the two new reactors currently under construction (which would provide surplus baseload power around 2014) and the accuracy of the forecast increase in demand for transmission services across both residential and commercial sectors, there could be considerable market opportunities to accelerate the electrification of the Slovak light-duty vehicle fleet and encourage a modal shift from road to rail for industrial and commercial transport services. The government may wish to examine its electricity and road pricing and taxation policies, in order to exploit potential synergies between the power and transport sectors and encourage more sustainable and less oil-reliant forms of transportation.

While efforts have been made to discuss energy plans and outlooks regionally, formally engaging in long-term electricity system planning at the regional level (V4+ countries) would greatly facilitate investment decisions in incremental generation, storage and transmission assets to the benefit of all neighbouring countries. With growing shares of intermittent renewables entering the market place, a regionally focused investment strategy will help minimise investments aimed strictly at improving system reliability from a national perspective.

The Slovak government has introduced feed-in tariffs to encourage investment in renewable energy technologies for electricity generation and highly efficient combined heat and power. Investment in these technologies is beneficial from many perspectives, including asset diversification, energy security, energy efficiency and environmental performance. It would be helpful to establish, as a condition of the support programme design, the annual maximum uptake of a particular technology. Rate impact and system reliability concerns need to be reflected in the programme design before public commitments are made (see also Chapter 5).

Under the current retail tariff and market structures in the electricity sector, there is little incentive for any of the distribution utilities to invest in end-use efficiency programmes to encourage residential and smaller commercial consumers to save electricity in a cost-effective manner. The current rate structure largely encourages throughput rather than efficiency. Given the long-standing interest of the Slovak government in energy security, there may be value in retooling the rate structures in electricity (and heat) in order to enable suppliers to share in the savings that are realised by consumers through enhanced end-use efficiency. This could be done without compromising the suppliers' profitability as efficiency gains are made. Such a restructuring would better position the economy so that the energy policy goals of supply sufficiency and enhanced end-use efficiency could be achieved. Ultimately, a more rational rate structure would ensure reasonable prices, a competitive market environment and reduced dependence on single suppliers.

RECOMMENDATIONS

The government of the Slovak Republic should:

- ☐ *Continue supporting the establishment of a regional electricity market in order to strengthen supply security and competition in the wholesale market.*
- ☐ *Remove barriers to competition in the electricity sector, encourage new providers to enter the retail market and gradually deregulate retail electricity prices as competition grows.*
- ☐ *Develop periodic and comprehensive long-term electricity system plans that broadly consider generation technology and fuel deployment pathways, trends in market developments and advances in end-use technology.*
- ☐ *Encourage the system operator to actively monitor developments in smart grid-related technology with the aim of deploying relevant technologies where cost-effective to do so.*

10. HEAT

Key data (2009)

Share of heat in final consumption: 50 % (OECD average 36%)

Heating mix: gas 47%, coal 25%, commercial heat 14%, biomass 9%, oil 4%

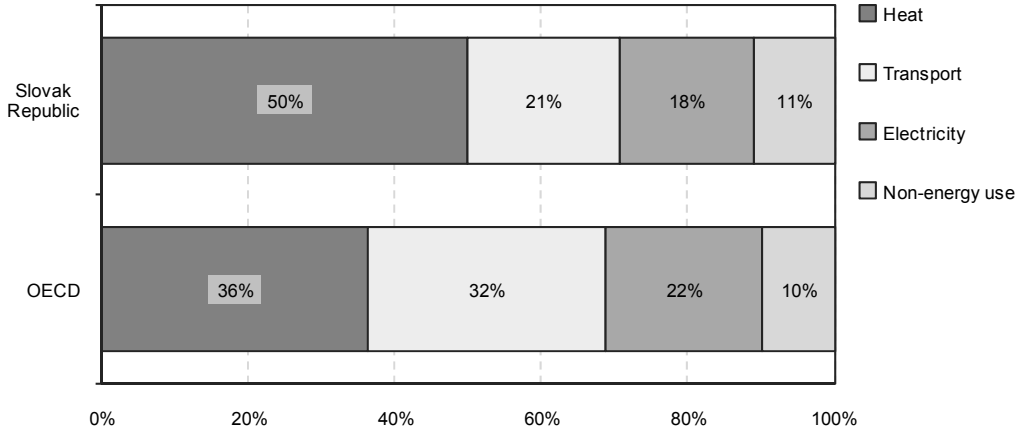
Share of CHP: 60% of total commercial heat production (OECD average 80%)

SUPPLY AND DEMAND

FINAL HEAT CONSUMPTION

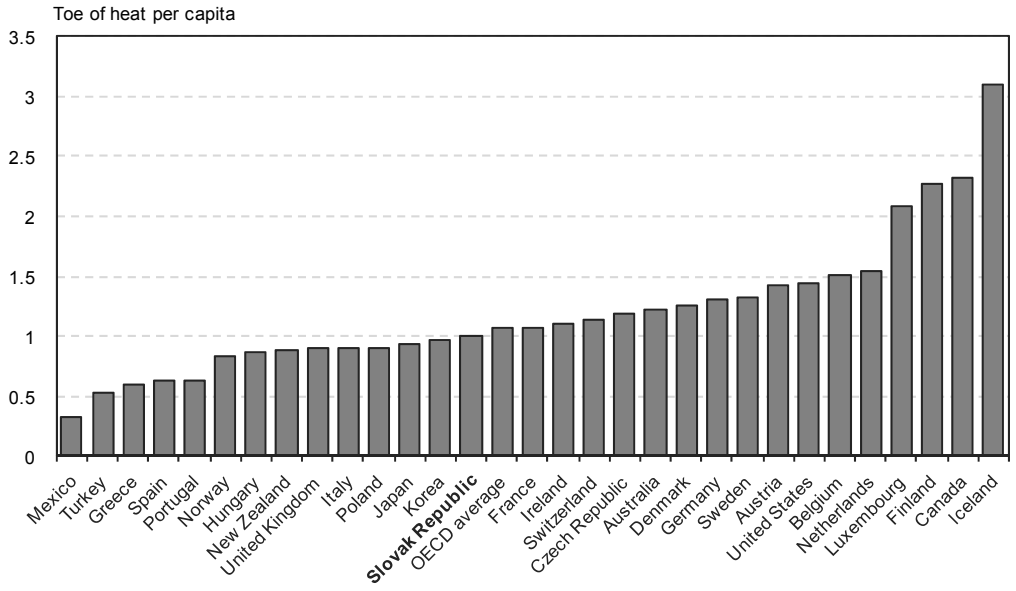
Energy consumption in the form of heat represents nearly half of total final energy consumption in the Slovak Republic (Figure 40). Final consumption of heat was 5.4 Mtoe in 2009, compared with final consumption in the transport sector of 2.3 Mtoe and in the electricity sector of 2.0 Mtoe (see Figure 6 in Chapter 2). The Slovak Republic ranks third among OECD countries in terms of share of heat in final energy consumption (Figure 7 in Chapter 2). Heat consumption per capita in the Slovak Republic is some 1 tonne of oil-equivalent, very close to the OECD average (Figure 41). According to government forecasts, the share of heat is expected to decline marginally over the next couple of decades.

Figure 40. **Final energy use breakdown, 2009**



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

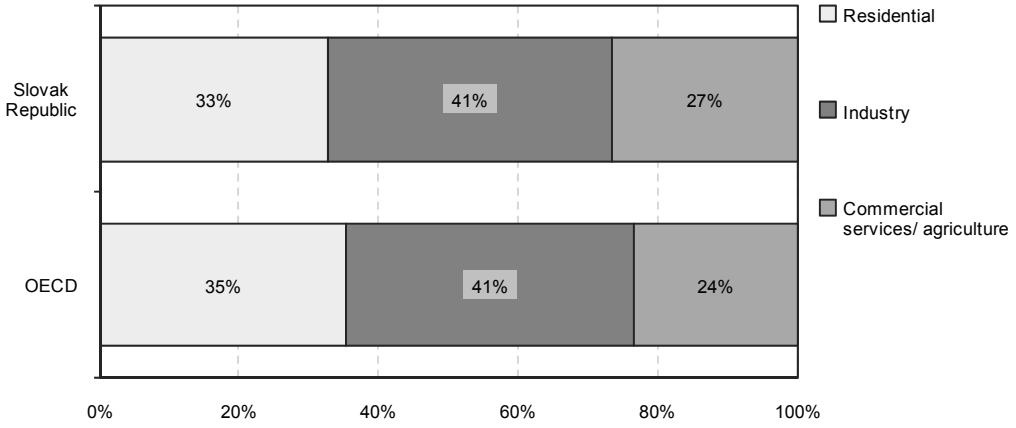
Figure 41. **Heat consumption per capita in OECD countries, 2009**



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010 and country submission.

The industry sector is the largest heat-consuming sector, with a 41% share in total heat consumption in 2009. The residential sector was the second-largest with 33% and the commercial and agricultural sectors consumed the remaining 27%. The distribution of heat consumption across sectors is similar to that of the OECD average (Figure 42).

Figure 42. **Final energy use of heat by sector, 2009**

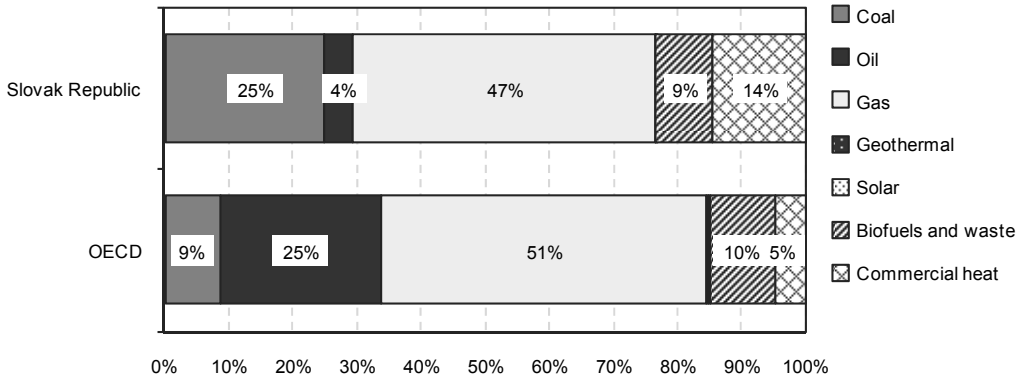


Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

As illustrated in Figure 43, the heat consumption fuel mix in the Slovak Republic is dominated by gas (47%), followed by coal (25%) and commercial heat (14%). In comparison, OECD countries on average have a lower share of coal (9%) and commercial heat (5%) but oil plays an important role (25%). In 2009, biofuels and waste used for the

production of heat accounted for 9% of total heat consumption in the Slovak Republic, slightly below the OECD average (10%), but up from an under 3% share in 2005. Heat from geothermal and solar energy sources is negligible.

Figure 43. **Fuel mix in final energy consumption of heat, 2009**



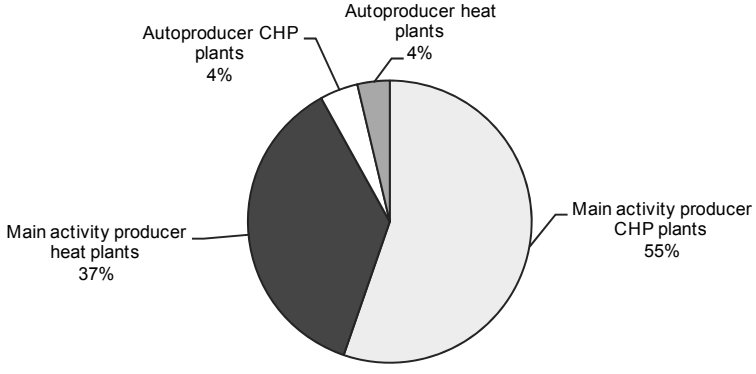
Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

DISTRICT HEATING

In 2009, district heating (also referred to as commercial heat) was 0.77 Mtoe (around 32 000 TJ) in the Slovak Republic, representing 14% of total heat consumption, up slightly on the 2008 figure. The share of heat produced in heat-only plants is 41% (Figure 44). The share of heat produced in CHP plants, at 60%, is much less than the OECD average share of 80%.

Heat-only plants are run almost exclusively on natural gas and biogases, whereas the largest part (37%) of the heat produced in CHP plants is from coal and coal gases (Figure 45). Heat produced in nuclear power plants amounted to 2 200 TJ in 2009 and heat produced from biomass and waste was 2 700 TJ.

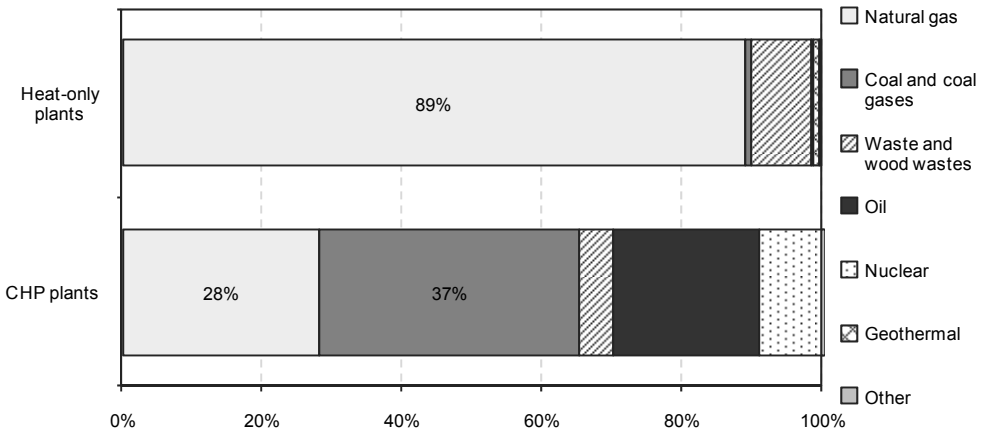
Figure 44. **Gross heat production by plant type, 2009**



Note: An autoproducer of electricity or heat as defined in IEA statistics is an enterprise which produces electricity and heat for its own use in support of its main business but not as its main business. The autoproducer may sell some of its output to public supply.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

Figure 45. **Gross heat production in the district heating system by source, 2009**



Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2010.

MARKET STRUCTURE

The Slovak Republic has some 500 district heating utilities.[23] The sector has a diverse ownership structure, with plants owned by the State, municipalities and private companies. Alongside more general energy sector reform in the Slovak Republic, the heat sector commenced privatisation in 2006. However, private sector interest was limited by the investment climate (which favoured short-term return on capital over the more long-term commitments necessary for district heating investments), and the privatisation of strategic companies was halted in 2009. Six large heating plants (Bratislava, Trnava, Zilina, Zvolen, Kosice and Martin, representing about 13% of the heat market) are still owned by the State.

Installed capacity is some 5 120 MW_{th} in the Slovak Republic, compared with 620 752 MW_{th} in Poland, although Poland has the same number of district heating utilities.[24] Installed capacity has been declining gradually in the Slovak Republic over the last decade, but at a slower pace than heat demand. Thus, the Slovak heating network is characterised by overcapacity which has further limited investment in new plant.

POLICY FRAMEWORK

EU POLICY

The EU Directive on Combined Heat and Power (2004/8EC) creates a framework for the promotion and development of high-efficiency cogeneration in the EU internal energy market, in order to increase energy efficiency and improve security of supply. The directive entered into force in February 2004 and member states have been obliged to begin its implementation in 2007. Member states must produce reports covering analysis of the state of CHP in their own countries, promote CHP and show what is being

23. The information in this section is based on 2005 data.

24. Euroheat & Power (2011), "District Heating and Cooling, Country by Country: Survey 2011", Brussels.

done to promote it, report on and remove barriers, and track progress of high-efficiency cogeneration within the energy market. The Directive on the Energy Performance of Buildings promotes the improvement of the energy performance of buildings within the EU through cost-effective measures (see Chapter 4). With respect to heat, this directive requires that regulation be set up to oversee the inspection of boilers and heating systems in member states.

The Directive on Renewable Energy sets a legally binding European target for 20% of all energy types − electricity, heat and transport fuels − to come from renewable sources from 2020. This directive became European law on 5 June 2009. Renewable heat had never been singled out for regulation by Europe before. Along with cooling, heat accounts for around half of all EU energy consumption, but only 10% comes from renewable sources at present. While the Directives on Combined and Heat Power (2004) and on the Energy Performance of Buildings (2003) promote efficient heating, there have been few real drivers for renewable heat. The current share of renewables in the heating and cooling market is dominated by small-scale domestic wood burning, but, according to estimates from the European Commission, biomass and CHP power stations and to lesser degree solar and geothermal sources, could double this proportion of renewables in heating and cooling by 2020.

Over the longer term, the European Commission is starting to formulate a low-carbon energy strategy for 2050, in which rationalising the heat market will be a priority. Until recently, EU policies have largely ignored the role of heat, instead focusing on electricity production and the transport sector. Cogeneration and district heating will be featured strongly in new energy action plans scheduled to be presented in 2011.

NATIONAL POLICY AND PRIORITIES

In order to comply with the EU Directive on CHP, in 2009 the Slovak Republic adopted the Act No. 309/2009 Coll. on the Promotion of Renewable Energy Sources and Highly Efficient Combined Heat and Power Production. The Act provides a support mechanism for combined heat and power through preferential treatment for grid access (see Chapter 9 on Electricity). This Act should also strengthen the legislative framework which was established in 2004 for heat planning at the municipal level. So far, the framework in place has been neither adequately implemented nor properly enforced.

With regard to the heat market, the Slovak government's priorities include:

- developing action plans to increase security of supply in the heat market;
- increasing the average annual efficiency of installations for heat generation and distribution;
- increasing the share of CHP;
- raising the share of solar energy in the water heating market to 6%;
- increasing the share of biomass to 12% in local heating systems;
- developing a set of legislative and institutional measures to enable the implementation of measures that will increase energy efficiency in the heat market;
- increasing the share of coal in CHP to 35% and the share of waste to 2%.

Funding for the heat market has been insufficient in the past and incentives lacking. However, the Slovak government intends to use EU Structural Funds and co-financing based on cost benchmarks related to a physical unit (*e.g.* installed power or exploitation intensity) to promote more efficient heat production. The government will also support public-private partnerships in the heat market. CHP will be supported through free allocation of allowances to avoid CO_2 leakage and subsidies for construction of new distribution networks.

Renewable energy sources

Slovak legislation does not set a goal for the production of heat from renewable energy sources or objectives for each technology to be achieved annually. Until recently, waste, biomass and other renewable energy sources had not benefited from government support schemes, and fossil fuels were much cheaper. In particular, the use of renewable waste for heat production in the Slovak Republic is the lowest among EU countries.

As part of an economic recovery package, however, the Slovak government agreed in 2010 to promote the installation of renewable energy sources (see Policies and Measures in Chapter 5). With regard to heat, the government allocated an additional budget of 100 million Slovak korunas (EUR 3.3 million) to support biomass boilers and solar collector installations. The first call for proposals began in April 2009. The partial budget for public funding in 2010 is EUR 8 million. Since the programme started, the Ministry of Economy has received 1 500 applications – over 80% of which have been for solar collector installations.

REGULATION

The main legal basis for the regulation of district heating and CHP in the Slovak Republic is Act No. 276/2001 Coll. on regulation in network industries. This Act lays out the rights and responsibilities of heat consumers and price regulations on the purchase of heat. The Regulatory Office for Network Industries (RONI, or URSO according to the Slovak acronym) is responsible for ensuring transparent, non-discriminatory and efficient economic competition in the heat network and determining and approving tariff methodologies and tariffs (see Chapter 2). It is also able to impose fines for infractions, and may issue orders, suspend or revoke licences.

There are several organisations assisting heat producers (*e.g.* the Slovak Association of Heat Producers, the Slovak Heating Society and others) and several organisations for heat and energy consumers (one is the Slovak Association of Consumers). These organisations take part in the preparation of new laws or amendments to existing laws. There are many conferences, seminars, courses and other activities, which enable stakeholders to consult with RONI staff. In particular, the Slovak Association of Heat Producers (SZVT) was set up in November 1998 to enhance public awareness and acceptance of district heating. It is the main partner to the government in setting legislation and tariffs.

RONI regulates the price of gas supplied to households for heat production, including generation, distribution and supply, as well as the price of gas for individual boilers. There is no obligation on the part on municipalities to supply district heating, and consumers are allowed to switch from the district heating network to other sources.

Low, regulated natural gas prices in the past have encouraged many consumers to switch to individual boilers. This has led to overcapacity in the district heating network and, thus, to higher costs for operators which have not been reflected in tariffs. Insufficient support of district heating at the government level and the current legislative framework have discouraged investment in maintenance of existing networks and the construction of new ones.

PRICES

Since 1 January 2003, RONI has been responsible for setting heat prices. The prices are available on the regulator's website: www.urso.gov.sk. They are set on a case-by-case basis and reflect the prices of fuel inputs. Since 2006, municipalities have been responsible for assessing the prices, but they have no control over the final prices administered.

Over the past decade the prices of fuel inputs have risen, but faster than the district heating tariff increases. The price of heat is still subsidised for consumers and there are still cross-subsidies between industrial and domestic consumers.

Because district heating competes with gas and electricity in the heat market, competition has been distorted by cross-subsidies that have benefited gas and electricity tariffs in the residential market. Despite a gradual elimination of these subsidies, district heating is still negatively impacted. Disconnections from the network have risen over the last several years and have complicated system operations and decreased energy efficiency. This, in turn, has pushed up prices and triggered new disconnections.

CRITIQUE

The Slovak Republic has a long tradition of district heating. According to the government, some 80% of private households rely on district heating, mainly in urban areas, where less than 60% of the population lives. Many rural households still depend on coal and biomass stoves for heating, although there are also small district heating networks serving some communities. The district heating network is well-developed and the fuel mix is relatively diverse: lignite, black coal and natural gas dominate. Over the past ten years, heat supply has fallen because of consumers switching to other hearing options and energy efficiency improvements. Although energy efficiency has certainly played a role, it is more likely that most of the decline in heat supply has been due to distortions in the tariff structure which has resulted in an increase in disconnections from the district heating network.

The heat distribution network in the Slovak Republic is in need of technical maintenance, and a general lack of residential metering leads to overconsumption of heat. Unfortunately, information concerning metering and technical losses in distribution is scarce, as current data collection methods are inadequate. There are indications that consumers are switching away from the district heating networks to individual boilers, fuelled by gas, electricity and coal, largely because of inefficiencies in the network and the regulated price framework. This framework has had an impact on investment, as current legislation does not provide for a fair allocation of the economic value of the

benefits to all parties, including the investor and operator. Renewable energy, mostly biomass and waste, has only recently begun to penetrate the heat market, thanks to government incentives.

The government should be commended for undertaking demand-side measures, including introducing metering for hot water and heat in some residential buildings and promoting building insulation. Nonetheless, there is low public awareness of the environmental impact of overheated dwellings. In the absence of meters, residents have little recourse but to open windows when the indoor temperature is uncomfortably high. This has resulted in tremendous heat losses and low energy efficiency. Low prices, a legacy of importing cheap energy from the former Soviet Union, encouraged this behaviour in the past. Changing the existing patterns of behaviour will require considerable effort on the government's part.

The establishment of a legislative framework for planning at the municipal level in 2004 did not have the desired results. In fact, weak enforcement of the laws has resulted in disconnections of heat customers and the unco-ordinated construction of new heat plants which are technically and environmentally unjustified as they are within reach of existing systems. Local communities should be encouraged to develop local energy plans that would identify least-cost options of providing heating services to households. Implementation of measures to facilitate these options should be enhanced.

In the Slovak Republic, consumers can switch between various heat supply options, *e.g.* from district heating to individual boilers. The recent consumer disconnections have led to overcapacity and losses because of the high costs of maintaining the heat network and ageing CHP plants. The energy regulator, RONI, sets the price of district heating to reflect costs. But the regulated price is set under the assumption that certain technical standards for heat production have been achieved by the heat operators, while in fact they have not. Thus, the cost of maintaining and improving the ageing district heating system are not reflected in the regulated price and district heating has had difficulty competing with other heating options. Electricity and gas prices for households are regulated and so is the price of natural gas used to produce heat for households. The effect of the combination of regulations in the heating sector has no doubt led to consumer switching but it is not clear whether this has increased energy efficiency. The government should consider phasing out price regulation for natural gas and electricity to households (as discussed in Chapters 6 and 9) and assess the function of price regulation in the district heating system and its consequences. It should enact legislation which does not encourage consumer switching *per se* but which aims to increase the overall efficiency of the heat market.

Insufficient funds have been channelled into the district heating system in the Slovak Republic, and private investment has been discouraged because the current tariff structure is unfavourable to the long-term commitments necessary to develop district heating systems. This is especially notable in the case of CHP. The share of CHP in overall heat production, at about half, is far below the OECD average. In order to develop the district heating sector, industry sector consumers will need to be courted. But the current pricing and investment climate again does not provide clear signals to encourage an increase in their share in the heating market.

Although the Slovak government has indeed recognised CHP as an efficient technology and is promoting it through structural funds, guaranteed dispatch and regulated prices, there are concerns that these efforts may not lead to the desired result. Most CHP plants

are over 20 years of age, with some considerably older, and heat losses, particularly in the distribution system, are high. The government should consider rationalising the entire heat supply chain, from generation to transmission and distribution. Moreover, the introduction of biomass, waste and other renewable energy sources will not be likely to reduce the environmental impact if the efficiency of the overall system is not improved. The government should first consider enhancing efficiency and then focus on developing and promoting alternative and renewable energy sources.

With the proper legislative and pricing framework in place, there could be significant opportunities to increase the share of renewable energy sources in the heat fuel mix in the Slovak Republic.

Given that heat is an important component of final energy consumption in the Slovak Republic, it is commendable that the government is developing a heat policy, as illustrated by the adoption of the 2009 Act which promotes the use of renewable energy for heat and more efficient CHP. This is a positive development, as reducing the share of fossil fuels in the heat mix and enhancing efficiency will do much to further environmental and energy security goals.

The government, however, is encouraged to give much more priority to heating issues in the energy policy agenda. As in most IEA member countries, in the Slovak Republic, improving the efficiency and lowering the environmental impact of heat production and consumption has been a low priority, compared with measures in the electricity and transport sectors. A successful strategy on heat should integrate the entire energy supply chain from generation to end-use, including measures impacting efficiency, infrastructure and planning. Such a strategy could build on the success of other IEA member countries which, with comprehensive and consistent policies, have dramatically increased efficiency in the heating market, *e.g.* Denmark, Sweden, Austria and Finland. Several components of these successful strategies that the Slovak government should consider are: collecting statistics on heating and cooling markets; creating an adequate policy and regulatory framework for the heat sector; supplying heat to consumers at a reasonable cost; developing a framework which provides long-term predictability for investors in district heating networks; and further promoting CHP, energy efficiency and renewable energy sources.

RECOMMENDATIONS

The government of the Slovak Republic should:

- *Give higher priority to heat on the national energy policy agenda and undertake a comprehensive review of the district heating systems taking into account costs, pricing policy, achievable efficiency levels and competing fuels.*
- *Based on this review, and in broad co-operation with relevant stakeholders, develop a strategy for the future of the heat sector, including CHP, and for the use of biomass and waste heat.*
- *Provide incentives to increase the overall efficiency of district heating systems at each level of the chain: production, distribution and consumption.*

11. NUCLEAR ENERGY

Key data (2009)

Number of plants and reactors in operation: 2 nuclear power plants (4 reactors) in operation, 2 reactors shut down and 2 additional reactors under construction

Installed capacity: 1.95 GW (+ 0.94 GW under construction)

Electricity generation: 14.1 TWh

Share of nuclear: 22% of TPES and 54% of electricity generation

BACKGROUND

Nuclear power plays a major role in the electricity supply of the Slovak Republic, providing 54% of all electricity generated in the country in 2009. Worldwide, it is currently second only to France in the proportion of its electricity supplied by nuclear energy.

The first nuclear power plant in the Slovak Republic (then part of Czechoslovakia) was built at the Bohunice site (about 55 km north-east of Bratislava) starting in 1958. Known as Bohunice A1, this 110 MW_e gas-cooled heavy-water reactor was built by Škoda Works (then a state-owned heavy engineering enterprise). The reactor operated only from 1972 to 1977.

Construction of two VVER-440 reactors, Bohunice V1 units 1 and 2, began at the same site in 1972. Supplied by Atomenergoexport of the Soviet Union in co-operation with Škoda, these used the first generation V-230 version of the VVER-440. They began operation in 1978 and 1980. They continued operating until 2006 and 2008, when they were shut down as a condition of the Slovak Republic's accession to EU membership.

A further two VVER-440s, Bohunice V2 units 1 and 2, were built starting in 1976. Škoda was the main contractor for these units, which used the later V-213 design of VVER-440. They entered operation in 1984 and 1985, and are still in service.

Work started in 1983 on a further two V-213 reactors at the Mochovce site (some 100 km east of Bratislava), with construction of units 3 and 4 at the same site beginning in 1986. Construction was delayed by the major political and economic changes that occurred after 1989, and was halted completely in 1992. Work on units 1 and 2, including safety upgrades from the original design, restarted in 1996 with the involvement of French and German companies. These two units eventually started up in 1998 and 1999.

INSTITUTIONAL ARRANGEMENTS

After the breakup of Czechoslovakia at the start of 1993, all Slovak nuclear plants were owned by *Slovenské Elektrárne* (SE), initially a state-owned utility. In 2006, the Slovak

government sold a 66% stake in SE to the major Italian utility Enel. The remainder of the stock remains in state hands.

The six nuclear units in operation and under construction remain under SE's ownership. The shut-down units (Bohunice A1 and V1-1 and V1-2) are now owned by the state-owned Nuclear Decommissioning Company, *Jadrová a vyraďovacia spoločnosť* (JAVYS), which was separated from SE before the sale to Enel. JAVYS also owns and operates facilities for the management and disposal of various types of radioactive waste.

The National Nuclear Fund, *Národný jadrový fond* (NJF), has the task of collecting and managing funds for decommissioning nuclear plants and for post-operation spent fuel and radioactive waste management and disposal. It was established by statute in 2006, replacing an earlier state fund. A Board of Trustees oversees the fund, and has an important role in devising strategy as well as financial planning for its implementation.

The Nuclear Regulatory Authority of the Slovak Republic, *Úrad jadrového dozoru* (ÚJD), is responsible for all aspects of nuclear licensing, inspection and enforcement, safeguards and physical protection, and international obligations. Reporting to the Office of the Prime Minister, it is funded through fees levied on licensees. Changes to the funding mechanism from 2008 resulted in a doubling of ÚJD's resources, in view of increased regulatory activity.

The principal nuclear engineering and research organisation in the Slovak Republic is VÚJE, with over 700 employees. Originally a state-owned nuclear research institute, in 1994 it became a joint stock company mainly owned by present and past employees. It provides support for nuclear plant construction, operation and maintenance, decommissioning and waste management, and training. There are also other institutions (RELKO, DECOM Slovakia, etc.) which support the nuclear programme.

PRESENT STATUS OF NUCLEAR POWER PLANTS

Programmes to upgrade the safety and performance of the four operating units have been carried out by SE over recent years, and completed in October 2010. This has included uprating the power output of the plants. The output of the Bohunice V2 units has been increased from the original 440 MW_e (gross) to 505 MW_e each. Power uprates to 470 MW_e (gross) have been implemented at the two operating Mochovce units. All four units have been performing well, achieving average load factors of 86% in 2009 and 2010.

A condition of the sale by the government of a majority stake in SE to Enel was the completion of the two-part built Mochovce units, and a firm decision to go ahead was taken in early 2007. The project is being financed from SE's corporate resources (mainly from cash flow) as part of its long-term investment plan.

Following the signing of contracts, full-scale construction work began in mid-2009. To a large extent, this is making use of the existing construction work and the major components already delivered and stored on site, which have been under care and maintenance since construction stopped in 1992. The two units are expected to enter operation in 2012 and 2013. Once in operation, the power output of the units is also expected to be uprated by 2015 to match units 1 and 2 at the site.

Table 50. **Nuclear power plants in the Slovak Republic**

Plant	Power (MW_e)		Present status	Owner / licensee	Start-up year
	Original	Uprated			
Bohunice A1	110	-	Decommissioning	JAVYS	1972
Bohunice V1	2 x 440	-	Shut down	JAVYS	1978-80
Bohunice V2	2 x 440	2 x 505	In operation	SE	1984-85
Mochovce 1 & 2	2 x 440	2 x 470	In operation	SE	1998-99
Mochovce 3 & 4	2 x 440	2 x 470	Under construction	SE	2012-13

Source: International Atomic Energy Agency.

NUCLEAR FUEL CYCLE AND RADIOACTIVE WASTE

All fuel for the operating reactors is supplied by the Russian company TVEL under long-term contracts. This covers the supply of uranium, enrichment and fabrication of fuel elements. Although some efforts have been made in the past to encourage alternative suppliers, currently TVEL is the only supplier of fuel for VVER-440 reactors. The Slovak Republic does have some uranium deposits in the east of the country, but these are not being exploited at present.

Spent fuel is initially stored for several years in the spent fuel pools at each reactor. Before 1987 it was returned to the then Soviet Union. Subsequently, it has been transferred to an interim spent fuel storage facility near Bohunice, now operated by JAVYS. This facility was upgraded and expanded between 1996 and 1999. A second interim storage facility will be constructed near the Mochovce site by 2018. Between them, these two facilities will have sufficient capacity to hold all the spent fuel from existing reactors, including the two units now under construction.

The interim storage facilities are designed to hold the spent fuel for at least 50 years. For the longer term, JAVYS began developing plans in 1996 to build a deep geological repository. Some work on site selection was carried out, with five candidate sites identified, but this was halted in 2001. The latest strategy for the back-end of the nuclear cycle, approved in 2008, considers international disposal options and an extended storage period as alternatives to building a repository. A final decision is not envisaged until 2020.

For low- and intermediate-level radioactive wastes, JAVYS operates treatment facilities at both nuclear sites and a near-surface waste repository at Mochovce. Its activities in respect of wastes from operating reactors are funded by the plants' owner, SE. JAVYS is also responsible for the decommissioning of the shut-down reactors Bohunice A1 and V1-1 and V1-2.

As noted above, the National Nuclear Fund (NJF) collects and manages funds for decommissioning and post-operation management, and disposal of spent fuel and radioactive waste. It receives payments from the operator of the nuclear power plants (SE), currently at the rate of EUR 11 618 per year per MW of installed capacity plus 5.95% of the sale price of electricity from the plants. These amounts are reviewed every

five years in the light of the latest cost estimates, with the first such review due in 2011. In 2010, NJF estimated the gap between expected revenues and costs at about EUR 7 billion, suggesting that contributions will need to rise.

Payments from the fund to JAVYS for decommissioning the A1 and V1 units have already begun. However, since payments into the NJF and its predecessor fund only started in 1995, there is an unfunded liability, estimated at EUR 2.7 billion, in respect of plants in operation before that date (*i.e.* all the costs for decommissioning Bohunice A1 and part of the costs for the V1 and V2 units). This is being made up by contributions from the transmission system operator (SEPS), from distribution system operators and from the government, but NJF's current estimations indicate that these may be insufficient.

POLICY AND FUTURE DEVELOPMENT

The *Energy Security Strategy* of 2008 aims to maintain the share of nuclear generation at over 50% in the period to 2030. On the assumption that the two Bohunice V2 units will close by 2025 (when they will have been in operation for 40 years), the Strategy includes the construction of a new unit (known as V3) at Bohunice before that date.

A joint venture between Czech utility ČEZ (49%) and JAVYS (51%), *Jadrová energetická* spoločnosť *Slovenska* (JESS), was formed in 2009 to proceed with the Bohunice V3 project. A feasibility study is currently under way. The government envisages that the plant will be built with private sector investment.

Following the recent upgrades to the Bohunice V2 plants, SE expects that they will be able to operate for longer than 40 years. In common with other light-water reactors, including similar VVER-440 units, an operating lifetime of up to 60 years may be technically and economically feasible. This would keep the share of nuclear generation at over 50% to beyond 2030 without the need for additional nuclear capacity in that timeframe.

Hence, the viability of the proposed V3 unit is likely to depend on having access to export markets. This would necessitate a strengthening of the Slovak transmission network and its international connections, and probably a greater degree of electricity market integration with neighbouring countries.

CRITIQUE

The four operating nuclear units are achieving high capacity factors, and the programme of power uprates has now been completed, adding some 190 MW_e to capacity. Hence, despite the closure of the two V1 units in 2006 and 2008, nuclear still accounts for more than half of national electricity production. This is a major contribution to the Slovak Republic's commendably low-carbon electricity generation mix.

The start-up of two additional units, expected in 2012 and 2013, will further boost the share of nuclear electricity. The completion and successful commissioning of these units will be the principal challenge over the next few years for SE and the Nuclear Regulatory Authority (ÚJD). This will be aided by the familiarity of both operator and regulator with the VVER-440 type plants.

Ageing management and lifetime extension will also be important issues. The V2 units have already undergone a series of upgrades and fully meet international safety

standards. Periodic regulatory review of the requirements for continued operation will be necessary, with further upgrades and replacement of equipment as necessary. In this context, the increase in ÚJD's resources is to be welcome.

Similar VVER-440 units are in operation in the Czech Republic, Finland, Hungary, Russia and Ukraine. Co-operation between the operators, regulators and research institutes in countries operating these units has been vital for upgrading their safety and operating performance. Such co-operation, supported by relevant international organisations, will also be essential for the continued review of safety levels and implementation of further upgrades where necessary, taking into account lessons from the accident at the Fukushima Daiichi nuclear power plant in Japan. Maintaining public confidence in the safety of the plants will clearly be necessary if their operating lifetimes are to be extended.

The *Energy Security Strategy* envisages the construction before 2025 of a new unit of around 1 200 MW_e at Bohunice. The present government has said that it supports the new plant only if it is based on private sector investment with no further state participation. Investment by ČEZ and possibly other new entrants would be a welcome boost to competition in the Slovak generating sector. The setting-up of the National Nuclear Fund has put in place an effective institutional arrangement to collect and manage funds for decommissioning and long-term radioactive waste management and disposal. The planned periodic reviews of the contributions to the fund will need to ensure that these remain adequate to cover the expected costs. In addition, provision will need to be made for the remaining unfunded liabilities.

The government has established JAVYS as a national company for decommissioning and for radioactive waste management and disposal. Several waste treatment, storage and disposal facilities are already in operation, and a second spent fuel storage facility will follow. Decommissioning plans for the A1 and V1 units are being implemented. These steps are to be commended.

The principal omission from the radioactive waste management strategy is a firm plan and time scale to develop a solution for the disposal of high-level waste and spent fuel. While few other European countries expect to have repositories in operation by the 2020s, the Slovak Republic currently has no clear timeline to develop its own solution, despite its high degree of dependence on nuclear power. Given that it is likely to take 20 or more years to plan, site, license and construct a repository, it is important that activities are stepped up in the next few years.

RECOMMENDATIONS

The government of the Slovak Republic should:

- ☐ *Continue to review the operational and design safety of VVER-440 nuclear units, including the applicability of any changes in procedures and safety regulations as a result of lessons learned from the accident at the Fukushima Daiichi nuclear power plant in Japan, in co-operation with other countries operating similar plants and relevant international organisations, to support the extension of their operating lifetimes.*

- ☐ *In carrying out periodic reviews, ensure that contributions to the National Nuclear Fund are adequate to meet the latest estimates of total decommissioning and waste management costs, and make provisions to cover unfunded decommissioning liabilities.*
- ☐ *Develop and commence implementation of a programme leading to the final disposal of high-level radioactive waste and spent fuel.*

PART III
ENERGY TECHNOLOGY

12. ENERGY TECHNOLOGY AND R&D

Key data (2009)

Government energy R&D spending: EUR 17.9 million (nuclear 31%, renewables 25%, fossil fuels 7%).

Share in GDP: 0.28 per 1 000 units of GDP (IEA median)

The Slovak Republic's energy technology and R&D policy is driven to a large extent by European Union directives and requirements.

RESEARCH AND DEVELOPMENT POLICY

Energy-related research and development derives from the Slovak government's energy and overall science and technology policies. Energy policy directions are outlined in the *Energy* Policy *of the Slovak Republic*, adopted in 2006 and being updated in 2011. In addition, the *Energy Security Strategy*, adopted in 2008, outlines practical measures for enhancing energy security, which is a top priority. The Ministry of Economy has overall responsibility for energy policy as detailed in Part I.

The current *Energy Policy* specifically notes that research and development (R&D) in the power sector is a priority to foster technologies that will increase the competitiveness of the Slovak economy. While research has been primarily focused on nuclear, coal and natural gas, the 2006 policy document notes insufficient research for renewable energy sources other than hydropower and inadequate R&D funding across the board.

The *Energy Security Strategy* sets a priority to increase the share of renewables in power and heat generation to create the additional resources needed to cover domestic demand. The priority is biomass which, combined with geothermal, solar and energy efficiency, will reduce the quantity of natural gas needed for heating purposes. The aim is to increase the share of renewables in final consumption from 6.7% in 2005 to 14% by 2020, which has implications for the research and development agenda domestically and in partnership with other European Union members.[25]

Overall responsibility for science and technology policy rests with the Ministry of Education, Science, Research and Sport (Ministry of Education). The Slovak Republic has joined the efforts of other EU members to co-ordinate their national science and technology policies in line with the aims and priorities delineated in the Lisbon Strategy. The *Long-Term Plan of the State Science and Technology Policy by the Year 2015* (the Plan) was set out by the Ministry of Education in 2007.[26] The main objectives of the Plan for 2015 are to:

25. www.ec.europa.eu/energy/renewables/transparency_platform/doc/national_renewable_energy_action_plan_slovakia_en.pdf

26. http://www.minedu.sk/data/USERDATAEN/VaT/VaTDOC/Long%20Term%20Plan%20by%20the%20year%202015.pdf

- increase the involvement of science and technology in overall development to address the nation's economic and social challenges;
- harmonise and interlink the science and technology system in order to respond flexibly to national and international demands;
- ensure conditions for effective science and technology policy by setting objectives for, *inter alia*, enhanced co-ordination and infrastructure of science and technology, including human resources; systemic and substantive research and development priorities; financing framework; international collaboration; R&D evaluation; monitoring and reporting of national science and technology policy.

Energy is specifically referenced for setting substantive R&D priorities with an emphasis on enhancing energy security. It lists as vital R&D efforts related to:

- exploitation of indigenous energy resources, including fossil fuels, uranium, geothermal, and electricity and heat from renewables;
- generation IV nuclear reactors and nuclear fusion;
- nuclear safety and spent fuel storage;
- advanced power transmission systems.

Direct and indirect supports are employed in pursuit of the science and technology objectives. In the 2007 to 2015 period, support is mainly from: the government budget, EU structural funds, businesses and international sources. To ensure implementation of the goals, the Plan estimates that science and technology expenditures of 1.8% of GDP in 2015 will be needed. The government aims to increase private resources for science and technology to two-thirds of overall support by 2015, largely through tax incentives.

In 2009, the Parliament approved policy initiatives that aim to increase the share of private sector and European Union funds in financing R&D. Businesses can apply for direct grants, tax allowances, subsidises for feasibility studies, acquisition of intellectual property rights and R&D personnel. Maximum total support per applicant is EUR 1 million for basic research and EUR 3.5 million for applied and experimental projects (Law 185/2009 R&D Stimuli). Another measure allows qualified higher education institutions to enter into partnerships with private interests for R&D activities to establish incubators and support spin-offs.

INSTITUTIONS

Public R&D programmes are governed by the **Ministry of Education** in consultation with the **Board for Science and Technology**. The primary research performers are: the **Slovak Academy of Sciences** and other governmental research institutes; higher education facilities; industry research institutes and R&D departments of businesses. Funds from the government budget are directed to *institutional* financing as managed by KEGA, the **Cultural and Educational Grant Agency** of the Ministry of Education, for universities, and by VEGA, the ministry's **Scientific Grant Agency**. VEGA is an advisory and funding body for basic research and evaluation of research projects. In 2008, VEGA supported 1 722 projects with EUR 9.7 million in funding.

The **Slovak Research and Development Agency** (APVV) manages *project* financing to support basic and applied R&D in all fields of science and technology through

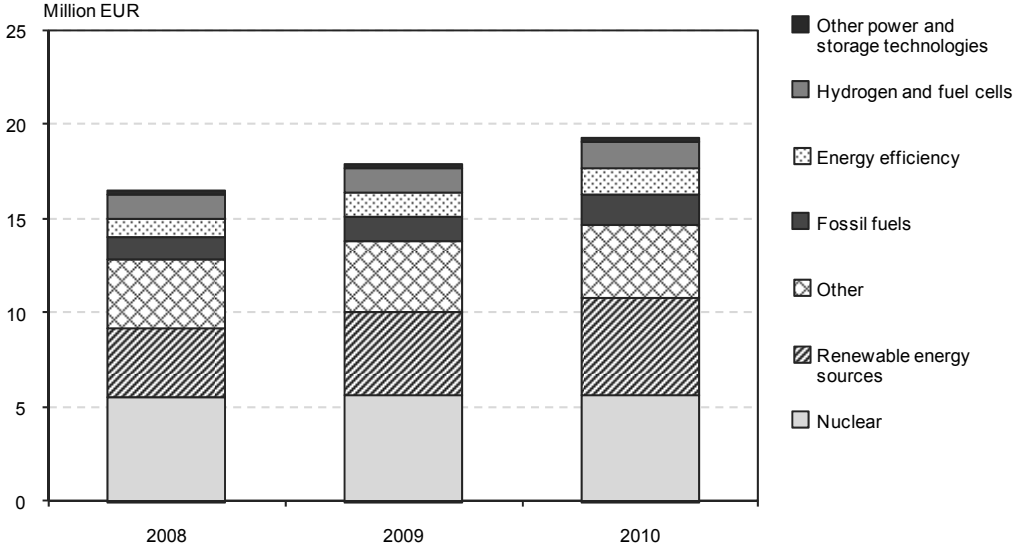
competitive tenders. APVV's budget increased from EUR 0.15 million in 2001 to EUR 40 million in 2009. Unlike VEGA, APVV can provide project funding for firms and individuals. Project financing is also provided through tenders in the national programme for infrastructure of R&D, and the programmes and projects of the Slovak Research and Development Agency.

The **Agency for Structural Funds of the EU** was established by the Ministry of Education in 2007. The Agency functions as an intermediary body to carry out activities within the scope of tasks delegated by the Ministry for the *Operational Programme: Education* and Operational *Programme: Research and Development*. Its objective is to facilitate the process of acceptance, assessment, financial management and monitoring of projects supported by the EU structural funds.

NATIONAL R&D BUDGET

Public spending on energy R&D in 2009 was EUR 17.9 million, up about 9% from the previous year. Estimated R&D expenditures were EUR 19.3 million for 2010. Nuclear R&D accounted for 31% and renewable energy sources for 25% of R&D spending in 2009. R&D spending by major area shows increases for renewable energy sources and energy efficiency in recent years (Figure 46). Further data by sub-category are summarised in Table 11.

Figure 46. **Government energy R&D expenditures, 2008 to 2010***



*Estimated data for 2010.

Sources*: OECD Economic Outlook: Slovak Republic 2010*, OECD Paris, 2010 and country submission.

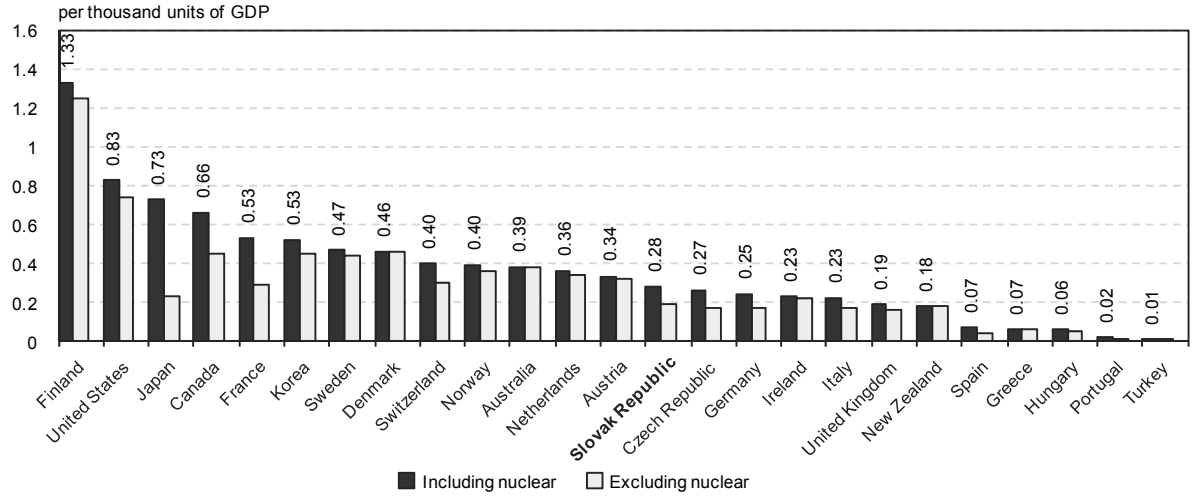
The Slovak Republic's public energy R&D budget is small when compared with other IEA countries, not only in absolute terms but also as a percentage of GDP (Figure 47). The energy R&D budget per thousand units of GDP was 0.28 in 2009, lower than the IEA average of around 0.37. There is a goal among EU member states to raise their annual overall R&D expenditure to 3% of GDP.

Table 11. **Government R&D expenditures by category, 2008 and 2009 (million euros)**

R&D category	2008	2009
Energy efficiency	**0.950**	**1.248**
Industrial	0.201	0.263
Residential/commercial	0.696	0.758
Transport	0	0.083
Other conservation	0.053	0.144
Fossil fuels	**1.178**	**1.330**
Coal	0.980	1.131
CO_2 capture and storage	0.198	0.199
Renewables	**3.623**	**4.415**
Solar	1.617	1.892
Wind	0.940	1.195
Bioenergy	0.627	0.830
Geothermal	0.429	0.465
Hydropower	0.010	0.033
Nuclear fission and fusion	**5.475**	**5.577**
Total nuclear fission	1.319	1.395
Light-water reactors	0.656	0.696
Fuel cycle	0.330	0.354
Total nuclear fusion	4.156	4.181
Hydrogen	**0.057**	**0.103**
Fuel cells	**1.164**	**1.195**
Energy storage technologies	**0.208**	**0.240**
Other technologies or research	**3.670**	**3.752**
TOTAL	**16.326**	**17.860**

Source: IEA databases.

Figure 47. **Government energy R&D budgets in IEA member countries, 2009**



Note: data missing for Belgium, Luxembourg and Poland.

Source: *OECD Economic Outlook,* OECD Paris, 2010 and country submission.

In its *2010 Economic Outlook of the Slovak Republic*, the OECD finds that overall research and development and innovation activities are relatively under-developed, with total gross R&D expenditures the second-lowest among OECD countries. A coherent national innovation plan is lacking and the effectiveness of public R&D spending in increasing private R&D performance is low. The OECD recommends that the current financial support of private R&D, which relies mainly on direct subsidies, should be redesigned, for example by widening the scope of tax expenditures. Further, the OECD suggests that the rules for granting R&D and innovation support should be clarified and protection of intellectual property rights strengthened.[27]

KEY RESEARCH AREAS AND SELECTED PROJECTS

R&D support spans a number of technology areas in the Slovak Republic. Some key areas are highlighted below.

NUCLEAR

The Slovak Republic's main activities in nuclear energy R&D relate to the VVER-440 type reactors, including safety systems, ageing management, decommissioning and spent fuel management. These activities are supported by a mixture of funding sources, including the electricity supply industry (principally Slovenské Elektrarné), the Nuclear Regulatory Authority (ÚJD), central government and the European Union. Some work is carried out in conjunction with other countries operating similar reactors, including the Czech Republic, Finland and Hungary.

In long-term research, the Slovak Republic is participating in the Generation IV programme to develop advanced reactor designs through Euratom. Together with the Czech Republic and Hungary, effort is being focused on the gas-cooled fast reactor (GFR), one of six Generation IV designs being developed worldwide. The Slovak Republic could host a demonstration (non-power generating) GFR, known as Allegro, which it is planned to build around 2016. However, the schedule and funding for this have yet to be confirmed.

The principal nuclear engineering and research organisation in the Slovak Republic is VÚJE, the former *Výskumný ústav jadrových elektrárni* (Nuclear Power Research Institute), based at Trnava, close to the Bohunice nuclear site. It became a joint stock company in 1994 and is now mainly owned by present and past employees. VÚJE has established itself as an engineering, design and research organisation covering high-voltage networks and renewable energies as well as nuclear power. Its principal clients are Slovenské Elektrarné, the transmission system operator, and distribution companies. It also participates in international projects. In 2009, VÚJE had a turnover of EUR 75 million and more than 700 employees.

RENEWABLES

Funding R&D on renewables aims to reduce the costs of renewable energy technologies, increase their efficiency and improve integration of variable generation resources into the electricity network. Levels of R&D support have been increasing in recent years.

27. *Slovak Republic: OECD Economic Outlook 2010*, OECD Paris, 2010.

A EUR 950 000 research fund is in place to channel support to Slovak research projects that can accelerate the development of clean energy. Additionally, in May 2009, a centre of excellence for the use of renewable energy sources was established at the Slovak University of Technology (STU) in Bratislava.[28] The National Centre for Research and Application of Renewable Energy Sources receives financial support of EUR 1 396 188 from the European Fund for Regional Development. The aim of the Centre is to increase the research and innovation potential of the University, and the integration of research teams concentrated on renewable energy sources. A fully equipped new laboratory will enable in-depth research and analysis on renewables sources of energy. It is the first centre of excellence in the Slovak Republic which focuses on green sources of energy at top academic level in co-operation with private companies.

Essential subjects of the research are energy and materials from biomass, solar heat and electricity and energy from water resources. Among its planned activities, the Centre will carry out pioneering research on the use of waste from biodiesel. The activities of the Centre have contributed to the competitiveness and success of the University of Technology in international research co-operation. The Centre has also integrated its research into the university's study programmes, thus enabling the education of the next generation of specialists. Additional support of EUR 2 782 233 has been provided to the project "Finalising of the National Centre for Research and Application of Renewable Energy Sources".

In November 2010, the Research Centre for Deep Drilling Technologies opened laboratories at the Slovak Academy of Sciences. The Ministry of Education secured around EUR 2.7 million from the EU's structural funds to support ULTRADRILL technology, the robotic platform of the Slovak-based private company Geothermal Anywhere.[29] The new robotic platform for ultra-deep drilling is primarily for geothermal reservoirs, but also for hydrocarbon prospects. The main obstacle to the exploitation of geothermal power is the exponential growth of drilling costs when the wells are more than 5 to 6 kilometres deep. The main difference between ULTRADRILL and traditional methods of ultra-deep drilling is the selected method of rock disintegration: conventional contact bits are replaced by contact-less plasma jets, which have a multiplied destructive effect.

INTERNATIONAL COLLABORATION

Given its own limited R&D budget, the Slovak Republic places emphasis on the importance of international collaboration. It is involved in international activities in research, development and innovation in the form of bilateral agreements on scientific-technical co-operation. EU programmes are an important source of financing and the Slovak Republic actively participates. Currently it does not participate in the IEA Implementing Agreements (IEA Framework of International Technology Co-operation).

Financial support for international scientific-technical co-operation is primarily provided by the government budget for those programmes that are partially supported by the European Union or other international sources. These activities are monitored by the Ministry of Education.

28. www.stuba.sk

29. www.GeothermalAnywhere.com

Priorities in the promotion of international co-operation are to:

- ensure the functioning of support structures and participation of Slovak R&D organisations in the EU 7th Framework Programmes;
- ensure participation of Slovak research organisations in the EU programme to support R&D related to small and medium-sized enterprises (EUROSTARS);
- ensure the participation of Slovak R&D organisations in the common European technology company for nanotechnology (ENIAC) and for embedded computing systems (ARTEMIS);
- ensure the participation of the Slovak Republic in the European Space Research Agency (ESA);
- ensure the participation of the Slovak Republic in the European strategic infrastructure for R&D (EXFEL, FAIR, LIFEWATCH, Central Sync, ESS);
- ensure participation in CERN, JINR in Dubna, EMBC, ICGBE.

CRITIQUE

Energy R&D expenditures in the Slovak Republic are low as a percentage of GDP compared to the IEA average. The main funding sources for its energy R&D are the national budget and European Union funds. The government should look for opportunities to increase spending on energy R&D in priority areas through additional funds, expand approaches to leverage available funds, strengthen intellectual property rights and provide incentives for wider participation in R&D and deployment efforts.

There is no strong link between the country's energy policy priorities and the R&D strategy. Research programmes seem to focus mainly on medium- to long-term priorities. Government support policies need to be appropriately tailored to the stage of development of a technology. The government is encouraged to review the balance between short-term and long-term R&D programmes with a view to adapting existing technologies and accelerating their deployment in areas where there is a need and a competitive advantage.

Further, the government should seek to enhance consistency between its energy policy and energy R&D programmes. Stronger co-ordination among relevant organisations, in particular the Ministry of Economy and the Ministry of Education, Science, Research and Sport, will be necessary to underpin the effectiveness of R&D funding and the deployment and commercialisation of the outcomes.

It is essential to focus the energy R&D on areas where the country has specific needs and a competitive advantage and to ensure policy coherence across institutions. For example, government forecasts preview a significant increase of combustible renewables in primary energy supply, particularly in district heating systems. It appears that this priority is being reflected in R&D budget increases for bioenergy in the government programme. Also, national biomass action plans, biofuels development programmes and fiscal measures, including tax exemptions, are in place. Yet, there are impediments to obtaining reliable supplies of biomass. In this regard, agriculture, forestry and energy policies need to be aligned to meet priorities given the multi-purpose nature of the biomass resources.

The Slovak government should ensure that the current R&D budgets are allocated in the most cost-effective way. Given the limited public resources for energy research, development and demonstration, the cost-effectiveness of the programme needs to be assessed. A major impediment to the effective allocation of funding is the lack of reliable data on R&D activities. It is important that the government develop and apply methods to review energy R&D policies and spending. It is necessary to ensure that expenditures and performance are in line with overall energy policies and delivered in a cost-effective manner.

Considering the need for low-carbon energy technologies, there are enabling actions that need to be taken to ensure wider industry and public support. These include: fostering industry leadership, developing a skilled energy workforce and expanding public support. The government, in co-operation with universities, should support the education of engineers and other skilled professions needed in the energy technology sector.

Efforts must also be made to improve the overall levels of public-private collaboration in order to promote deployment of new energy technologies. Progress has been made by inviting industries to participate in some research projects. Additional efforts should seek to further engage the private sector in energy R&D, with a view to sharing information, financing and commercialising R&D outcomes.

The Slovak Republic participates in international co-operation programmes through bilateral and multilateral arrangements, largely within the framework of the European Union. International co-operation is an effective way to optimise R&D spending. The Slovak Republic could further enhance its international activities, for instance through participation in some of IEA's Implementing Agreements that are in line with its R&D priorities. International collaboration can enhance opportunities through R&D efforts to acquire and adapt best available technologies and practices and tailor their application to suit national circumstances.

RECOMMENDATIONS

The government of the Slovak Republic should:

- *Develop a strategic energy R&D plan, building on the country's strengths and linking the focus of public funding with the demand- and supply-side priorities, in particular energy efficiency, Generation IV reactors and renewable energy sources such as biomass.*
- *Implement effective mechanisms for monitoring and evaluating progress in energy R&D in order to maximise the cost-effectiveness of public spending.*
- *Consider increasing public spending on energy R&D, in particular in strategic areas to meet national targets and European Union pledges.*
- *Enhance opportunities for energy R&D activities by industry, including through fiscal incentives and partnerships with government and academic programmes and projects to advance and deploy energy technologies and practices.*
- *Increase efforts in technical education to meet future demands for energy researchers, engineers and technicians.*

PART IV
ANNEXES

ANNEX A: ORGANISATION OF THE REVIEW

REVIEW CRITERIA

The *Shared Goals* of the IEA, which were adopted by the IEA Ministers at their 4 June 1993 meeting held in Paris, provide the evaluation criteria for the in-depth reviews conducted by the IEA. The *Shared Goals* are set out in Annex C.

REVIEW TEAM

The in-depth review team visited Bratislava between 21 and 26 November 2010. The team met with government officials, energy companies, interest groups and various other organisations. The report was drafted on the basis of these meetings, the government response to the IEA energy policy questionnaire and other information. The team is grateful for the co-operation and assistance of the many people it met during the visit. Thanks to their hospitality and willingness to share information, the visit was both highly productive and enjoyable.

The team wishes to give particularly warm and sincere thanks to Ms. Alena Žáková, Director of the Department of International Relations in Energy and Ms Adriana Váňová, Senior State Advisor, and all their colleagues at the Ministry of Economy, as well as Ms Martina Petrovičová at the Slovak Delegation to the OECD for their unfailing helpfulness, dedication and enthusiasm displayed in preparing and guiding the visit. The team also wishes to express its gratitude to Mr. Ján Petrovič, General Director of the Energy Section and Mr. Martin Chren, State Secretary, for their hospitality and personal engagement in briefing the team on energy policy issues.

The members of the team were:

IEA member countries

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Öztürk Selvitop, Turkey

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Martin Taylor

International Energy Agency

Robert Arnot

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Aurélien Saussay

Elena Merle-Beral (desk officer)

Elena Merle-Beral organised and managed the review team visit, and wrote the first draft of most of the chapters. Aurélien Saussay wrote Chapter 4 on Energy Efficiency, Robert Arnot Chapter 9 on Electricity, Teresa Malyshev Chapter 10 on Heat and Martin Taylor Chapter 11 on Nuclear Energy. Most of Chapters 6 and 7 on Gas and Oil are based on the findings of the IEA emergency response review of the Slovak Republic, conducted and drafted by Jason Elliott of the IEA Emergency Preparedness Division under the supervision of Aad van Bohemen. Georg Bussmann prepared most of the figures, drafted most sections on demand and supply trends and provided general statistical assistance. Support on statistics was also provided by Alex Blackburn, Davide D'Ambrosio and Karen Treanton; and maps were prepared by Bertrand Sadin. Shinichi Kihara and Teresa Malyshev finalised the report and prepared it for publication.

The report also benefited from comments of many IEA experts, including Milou Beerepoot, Ulrich Benterbusch, Aad van Bohemen, Anne-Sophie Corbeau, Ian Cronshaw, Rebecca Gaghen, Tom Kerr, Carrie Pottinger, Lisa Ryan, as well as from comments of other team members. Viviane Consoli provided editorial assistance.

ORGANISATIONS VISITED

The team held discussions with the following energy and environment stakeholders:

Ministry of Economy

Ministry of Environment

Ministry of Foreign Affairs

Ministry of Education, Science, Research and Sport

Ministry of Finance

Academy of Sciences

Anti-monopoly Office

Association of Industrial Energy Consumers

CECED, European Committee of Manufacturers of Domestic Equipment

Eustream

JAVYS, Nuclear Decommissioning Company

NJF, National Nuclear Fund

RONI, Regulatory Office for Network Industries

SEPS, Slovak Electricity Transmission System

SHMU, Slovak Hydro-meteorological Institute

SIEA, Slovak Innovation and Energy Agency

SPP, National Gas Company

Transpetrol

UJD, Nuclear Regulatory Authority

University of Technology

VUJE, Nuclear Power Research Institute

ANNEX B
ENERGY BALANCES
AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2008	2009
TOTAL PRODUCTION		**2.58**	**5.28**	**6.33**	**6.42**	**5.94**
Coal		1.70	1.40	1.02	0.62	0.65
Peat		-	-	-	-	-
Oil		0.13	0.08	0.06	0.23	0.20
Natural Gas		0.39	0.34	0.13	0.09	0.09
Biofuels & Waste[1]		0.18	0.17	0.42	0.72	0.88
Nuclear		0.06	3.14	4.30	4.40	3.72
Hydro		0.11	0.16	0.40	0.35	0.38
Wind		-	-	-	0.00	0.00
Geothermal		-	-	-	0.01	0.01
Solar/Other[2]		-	-	-	-	-
TOTAL NET IMPORTS[3]		**12.96**	**16.42**	**11.51**	**11.91**	**11.20**
Coal	Exports	-	0.09	0.04	0.17	0.16
	Imports	6.26	6.21	3.47	3.61	3.37
	Net Imports	6.26	6.12	3.43	3.44	3.22
Oil	Exports	1.70	1.81	2.93	3.78	3.89
	Imports	6.97	6.31	5.56	7.32	7.01
	Int'l Marine and Aviation Bunkers	-	-	-0.03	-0.06	-0.05
	Net Imports	5.27	4.50	2.61	3.47	3.07
Natural Gas	Exports	-	-	-	0.15	0.01
	Imports	1.17	5.35	5.71	5.13	4.82
	Net Imports	1.17	5.35	5.71	4.98	4.80
Electricity	Exports	0.02	0.18	0.74	0.77	0.66
	Imports	0.26	0.62	0.51	0.81	0.77
	Net Imports	0.24	0.45	-0.23	0.04	0.11
TOTAL STOCK CHANGES		**-0.01**	**-0.37**	**-0.09**	**-0.03**	**-0.42**
TOTAL SUPPLY (TPES)[4]		**15.52**	**21.33**	**17.74**	**18.30**	**16.72**
Coal		7.96	7.83	4.27	4.01	3.87
Peat		-	-	-	-	-
Oil		5.39	4.49	2.82	3.64	3.33
Natural Gas		1.56	5.09	5.78	5.17	4.42
Biofuels & Waste[1]		0.19	0.17	0.41	0.68	0.88
Nuclear		0.06	3.14	4.30	4.40	3.72
Hydro		0.11	0.16	0.40	0.35	0.38
Wind		-	-	-	0.00	0.00
Geothermal		-	-	-	0.01	0.01
Solar/Other[2]		-	-	-	-	-
Electricity Trade[5]		0.24	0.45	-0.23	0.05	0.11
Shares (%)						
Coal		*51.3*	*36.7*	*24.1*	*21.9*	*23.2*
Peat		-	-	-	-	-
Oil		*34.7*	*21.1*	*15.9*	*19.9*	*19.9*
Natural Gas		*10.1*	*23.9*	*32.5*	*28.2*	*26.4*
Biofuels & Waste		*1.2*	*0.8*	*2.3*	*3.7*	*5.2*
Nuclear		*0.4*	*14.7*	*24.2*	*24.0*	*22.3*
Hydro		*0.7*	*0.8*	*2.2*	*1.9*	*2.2*
Wind		-	-	-	-	-
Geothermal		-	-	-	-	*0.1*
Solar/Other		-	-	-	-	-
Electricity Trade		*1.6*	*2.1*	*-1.3*	*0.2*	*0.7*

0 is negligible, - is nil, .. is not available

Unit: Mtoe

DEMAND					
FINAL CONSUMPTION	**1973**	**1990**	**2000**	**2008**	**2009**
TFC	**10.86**	**15.75**	**11.42**	**11.81**	**10.83**
Coal	3.85	4.11	1.41	1.31	0.63
Peat	-	-	-	-	-
Oil	3.83	4.89	3.01	3.25	2.80
Natural Gas	1.40	3.91	4.17	3.90	3.24
Biofuels & Waste[1]	0.19	0.17	0.32	0.50	0.65
Geothermal	-	-	-	0.00	0.00
Solar/Other	-	-	-	-	-
Electricity	1.06	2.01	1.89	2.13	1.99
Heat	0.53	0.65	0.62	0.71	0.77
Shares (%)					
Coal	*35.4*	*26.1*	*12.4*	*11.1*	*12.8*
Peat	-	-	-	-	-
Oil	*35.3*	*31.0*	*26.4*	*27.5*	*25.8*
Natural Gas	*12.9*	*24.8*	*36.5*	*33.1*	*29.9*
Biofuels & Waste	*1.7*	*1.1*	*2.8*	*4.2*	*6.0*
Geothermal	-	-	-	-	-
Solar/Other	-	-	-	-	-
Electricity	*9.8*	*12.8*	*16.6*	*18.0*	*18.3*
Heat	*4.9*	*4.1*	*5.4*	*6.0*	*7.1*
TOTAL INDUSTRY[6]	**6.13**	**7.69**	**5.00**	**4.95**	**4.32**
Coal	2.66	1.93	1.16	1.02	0.85
Peat	-	-	-	-	-
Oil	1.73	2.95	1.55	1.23	1.03
Natural Gas	0.82	1.33	1.12	1.24	1.02
Biofuels & Waste[1]	0.19	0.17	0.32	0.32	0.42
Geothermal	-	-	-	-	-
Solar/Other	-	-	-	-	-
Electricity	0.72	1.29	0.84	1.08	0.93
Heat	0.02	0.02	0.02	0.07	0.08
Shares (%)					
Coal	*43.3*	*25.1*	*23.1*	*20.6*	*19.7*
Peat	-	-	-	-	-
Oil	*28.2*	*38.3*	*31.0*	*24.8*	*23.8*
Natural Gas	*13.4*	*17.3*	*22.4*	*25.0*	*23.6*
Biofuels & Waste	*3.1*	*2.3*	*6.4*	*6.4*	*9.6*
Geothermal	-	-	-	-	-
Solar/Other	-	-	-	-	-
Electricity	*11.7*	*16.8*	*16.8*	*21.8*	*21.4*
Heat	*0.3*	*0.2*	*0.4*	*1.4*	*1.9*
TRANSPORT[4]	**1.68**	**1.45**	**1.43**	**2.64**	**2.29**
OTHER[7]	**3.05**	**6.61**	**4.99**	**4.21**	**4.22**
Coal	1.19	2.18	0.26	0.29	0.54
Peat	-	-	-	-	-
Oil	0.48	0.60	0.11	0.10	0.11
Natural Gas	0.58	2.58	3.05	2.12	1.81
Biofuels & Waste[1]	-	-	0.00	0.05	0.07
Geothermal	-	-	-	0.00	0.00
Solar/Other	-	-	-	-	-
Electricity	0.29	0.62	0.97	1.00	1.02
Heat	0.51	0.63	0.60	0.65	0.69
Shares (%)					
Coal	*39.0*	*33.0*	*5.1*	*6.9*	*12.7*
Peat	-	-	-	-	-
Oil	*15.8*	*9.0*	*2.2*	*2.3*	*2.5*
Natural Gas	*19.0*	*39.0*	*61.1*	*50.3*	*42.8*
Biofuels & Waste	-	-	-	*1.3*	*1.6*
Geothermal	-	-	-	-	-
Solar/Other	-	-	-	-	-
Electricity	*9.5*	*9.4*	*19.5*	*23.8*	*24.1*
Heat	*16.7*	*9.5*	*12.0*	*15.3*	*16.3*

Unit: Mtoe

DEMAND					
ENERGY TRANSFORMATION AND LOSSES	**1973**	**1990**	**2000**	**2008**	**2009**
ELECTRICITY GENERATION[8]					
INPUT (Mtoe)	**2.64**	**6.91**	**7.92**	**7.39**	**10.24**
OUTPUT (Mtoe)	**1.06**	**2.19**	**2.65**	**2.47**	**2.23**
(TWh gross)	12.30	25.50	30.80	28.76	25.92
Output Shares (%)					
Coal	*64.4*	*31.9*	*19.8*	*17.9*	*16.5*
Peat	-	-	-	-	-
Oil	*17.7*	*6.4*	*0.7*	*2.4*	*2.4*
Natural Gas	*5.3*	*7.1*	*10.9*	*5.6*	*7.6*
Biofuels & Waste	-	-	*0.1*	*1.9*	*2.1*
Nuclear	*1.9*	*47.2*	*53.6*	*58.1*	*54.3*
Hydro	*10.7*	*7.4*	*15.0*	*14.0*	*16.9*
Wind	-	-	-	-	-
Geothermal	-	-	-	-	-
Solar/Other	-	-	-	*0.1*	*0.2*
TOTAL LOSSES	**3.36**	**5.86**	**5.94**	**6.47**	**5.84**
of which:					
Electricity and Heat Generation[9]	0.82	3.91	4.40	3.97	3.51
Other Transformation	1.67	0.49	0.34	0.75	0.70
Own Use and Losses[10]	0.87	1.46	1.20	1.74	1.64
Statistical Differences	**1.31**	**-0.28**	**0.39**	**0.03**	**0.04**
INDICATORS	**1973**	**1990**	**2000**	**2008**	**2009**
GDP (billion 2000 USD)	13.76	18.91	20.40	32.90	31.32
Population (millions)	4.64	5.30	5.40	5.41	5.42
TPES/GDP[11]	1.13	1.13	0.87	0.56	0.53
Energy Production/TPES	0.17	0.25	0.36	0.35	0.36
Per Capita TPES[12]	3.34	4.03	3.29	3.39	3.09
Oil Supply/GDP[11]	0.39	0.24	0.14	0.11	0.11
TFC/GDP[11]	0.79	0.83	0.56	0.36	0.35
Per Capita TFC[12]	2.34	2.97	2.12	2.18	2.00
Energy-related CO_2 Emissions (Mt CO_2)[13]	41.5	56.7	37.4	36.3	33.2
CO_2 Emissions from Bunkers (Mt CO_2)	-	-	0.1	0.2	0.1
GROWTH RATES (% per year)	**73-79**	**79-90**	**90-00**	**00-08**	**08-09**
TPES	4.0	0.8	-1.8	0.4	-8.6
Coal	0.8	-0.6	-5.9	-0.8	-3.4
Peat	-	-	-	-	-
Oil	4.2	-3.8	-4.5	3.3	-8.7
Natural Gas	12.5	4.4	1.3	-1.4	-14.4
Biofuels & Waste	-0.8	-0.3	9.0	6.5	28.2
Nuclear	45.1	17.0	3.2	0.3	-15.4
Hydro	6.0	-	9.4	-1.7	8.4
Wind	-	-	-	-	-
Geothermal	-	-	-	-	-
Solar/Other	-	-	-	-	-
TFC	3.7	1.4	-3.2	0.4	-8.2
Electricity Consumption	5.0	3.2	-0.6	1.5	-6.8
Energy Production	2.0	5.6	1.8	0.2	-7.5
Net Oil Imports	4.5	-3.8	-5.3	3.6	-11.6
GDP	2.5	1.6	0.8	6.2	-4.8
Growth in the TPES/GDP Ratio	1.5	-0.8	-2.6	-5.4	-4.0
Growth in the TFC/GDP Ratio	1.2	-0.2	-3.9	-5.4	-3.6

Please note: Rounding may cause totals to differ from the sum of the elements.

Footnotes to energy balances and key statistical data

1. Biofuels and waste comprises solid biofuels, liquid biofuels, biogases, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.
2. Other includes ambient heat used in heat pumps.
3. In addition to coal, oil, natural gas and electricity, total net imports also include biofuels and waste.
4. Excludes international marine bunkers and international aviation bunkers.
5. Total supply of electricity represents net trade. A negative number in the share of TPES indicates that exports are greater than imports.
6. Industry includes non-energy use.
7. Other includes residential, commercial, public services, agriculture, forestry, fishing and other non-specified.
8. Inputs to electricity generation include inputs to electricity, CHP and heat plants. Output refers only to electricity generation.
9. Losses arising in the production of electricity and heat at main activity producer utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of approximately 33% for nuclear and 100% for hydro and wind.
10. 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.
11. Toe per thousand US dollars at 2000 prices and exchange rates.
12. Toe per person.
13. "Energy-related CO_2 emissions" have been estimated using the IPCC Tier I Sectoral Approach from the *Revised 1996 IPCC Guidelines*. 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 2009 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 C: INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The member countries* of the International Energy Agency (IEA) seek to create conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and to 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, member countries 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 are 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 respect the Polluter Pays Principle where practicable.

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 member countries wish to retain and improve the nuclear option 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 encourages 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 the meeting of 4 June 1993 Paris, France.)

*Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States.

ANNEX D: GLOSSARY AND LIST OF ABBREVIATIONS

In this report, abbreviations are substituted for a number of terms used within the International Energy Agency. While these terms generally have been written out on first mention and subsequently abbreviated, this glossary provides a quick and central reference for many of the abbreviations used.

bcm	billion cubic metres
CCGT	combined cycle gas turbine
CHP	combined production of heat and power
CNG	compressed natural gas
CO_2	carbon dioxide
DH	district heating
DSO	distribution system operator
EC	European Commission
ETS	Emissions Trading System
EU	European Union
GHG	greenhouse gas
GW	gigawatt, or 1 watt x 10^9
IPCC	Intergovernmental Panel on Climate Change
kW	kilowatt, or 1 watt x 10^3
kWh	kilowatt-hour, or 1 kilowatt x 1 hour
LNG	liquefied natural gas
LPG	liquefied petroleum gas
LULUCF	land use, land use change and forestry
mcm	million cubic metres
Mt	million tonnes

Mtoe	million tonnes of oil-equivalent
MW	megawatt; or 1 watt x 10^6
MWh	megawatt-hour, or 1 megawatt x 1 hour
NEEAP	National Energy Efficiency Action Plan
No_x	nitrogen oxides
PJ	petajoule
PPP	purchasing power parity: the rate of currency conversion that equalises the purchasing power of different countries, *i.e.* estimates the differences in price levels between countries
PV	photovoltaic
R&D	research and development, especially in energy technology: may include the demonstration and dissemination phases as well
RES	renewable energy sources
SO_2	sulphur dioxide
TFC	total final consumption of energy
toe	tonne of oil equivalent
TPA	third-party access
TPES	total primary energy supply
TSO	transmission system operator
TWh	terawatt-hour, or 1 terawatt x 1 hour, or 1 million MWh
UNFCCC	United Nations Framework Convention on Climate Change
VAT	value-added tax
V4	the Visegrád group of countries (the Slovak Republic, Poland, the Czech Republic and Hungary)

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IEA PUBLICATIONS, 9, RUE DE LA FÉDÉRATION, 75739 PARIS CEDEX 15
PRINTED IN FRANCE BY SOREGRAPH, JANUARY 2012
(612011071P1) ISBN: 9789264098244