International Energy Agency

Energy Policies of IEA Countries

The Czech Republic

2010 Review

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The Czech Republic

The Czech Republic, rich in coal resources, is the third-largest electricity exporter in the European Union. The energy sector plays an important role for the country's economy and for the regional energy security. Since the last IEA in-depth review in 2005, the Czech Republic has strengthened its energy policy, further liberalised its electricity and gas markets and made laudable efforts to enhance oil and gas security.

The Czech government has a unique opportunity to develop coherent and balanced energy and climate strategies as it currently updates its policy documents. The draft State Energy Concept concentrates on energy security and on maintaining the Czech Republic as a net electricity exporter, through a diversified energy mix and a maximised use of indigenous resources, comprising coal, uranium and renewable energy.

While the focus on energy security is praiseworthy, energy policy could be further improved. Energy policy should be better integrated with climate change considerations. At the same time, economic efficiency should be another key pillar of energy policy. To improve its energy security while reducing greenhouse gas emissions and enhancing economic development, the Czech Republic could take measures to: improve energy efficiency and broaden demand-side measures; focus on low-carbon technologies; integrate electricity and natural gas markets regionally; and optimise needed new infrastructure.

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

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INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its mandate is two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply and to advise member countries on sound energy policy.

The IEA carries out a comprehensive programme of energy co-operation among 28 advanced economies, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency aims to:

- 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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International Energy Agency

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EXECUTIVE SUMMARY

The energy policy framework of the Czech Republic is set by the State Energy Policy adopted in 2004. The basic priorities are to strive for independence from foreign energy sources; maximise the safety of energy sources, including nuclear; and promote sustainable development. Since the last in-depth review in 2005, the Czech Republic has further liberalised its electricity and gas markets and has made commendable efforts to enhance oil and gas security.

The Czech Republic is the third-largest net electricity exporter in the European Union, after France and Germany. Electricity generation is largely composed of domestic coal (60%) and nuclear (32%), whereas natural gas (3.5%) is mainly used as complementary fuel in multi-fired units and for peaking purposes. Combined heat and power (CHP) constitutes one-third of electricity generation and over 40% of overall heat production, making the country the third-largest in CHP use after Denmark and Finland.

The Czech Republic imports nearly all of its oil and gas requirements, but imports are reasonably well diversified. Possibilities to exploit new coal resources are currently limited by past decisions taken on environmental grounds and the concerns of local populations. Taking into account the importance of the coal industry and its long-term contribution to the country's security of supply, there is increasing pressure to revoke the original decision of the government to limit exploitation of brown coal reserves.

According to the Kyoto Protocol, the Czech Republic is committed to reduce its greenhouse gas (GHG) emissions by 8% by 2008–2012 compared to 1990 levels. In 2007, GHG emissions were down by almost 22% below 1990 levels, and there should be no difficulties for the country to meet its Kyoto commitments. Despite a significant drop in total GHG emissions since 1990, per-capita emissions are still higher than the EU average and much higher than the global average.

The Czech government faces several challenges in fulfilling its energy policy objectives. The draft State Energy Concept (which is the preliminary document establishing a new energy policy, to be released in 2010) relies heavily on the maximum use of domestic resources thus focusing mainly on energy security but lacking a certain degree of coherence in climate-related policies. The Czech government could do more to implement energy efficiency policies and measures. Further, the government should clarify its role as an electricity exporter in the future.

THE DRAFT STATE ENERGY CONCEPT

In preparation for a new Energy Concept, to be adopted in 2010, the Czech government created an Independent Expert Energy Commission, charged with assessing the

country's long-term energy needs. The Commission delivered its final report to the government in January 2009. Since then, the Ministry of Industry and Trade published a draft update of the State Energy Concept (SEC) in September 2009. Separately, the Ministry of the Environment issued a draft Climate Protection Policy (CPP) in October 2009.

The draft State Energy Concept provides a scenario of the Czech energy market to 2050 with shorter-term objectives and policy recommendations. The Concept concentrates on the need for security of energy supply and the maintenance of the Czech Republic as a net electricity exporter, achieved through a diversified energy mix and maximising the use of indigenous resources, comprising coal, uranium and renewable energy, mainly biomass and waste. Future expansion of nuclear capacity has been presented as one of the major pillars of the updated draft SEC.

Encouragingly, according to the current version of the draft update, nuclear energy is projected to account for about 47% of the power generation mix in 2050 up from 32% currently, which will support the Czech government's efforts to achieve climate change objectives. Coal is projected to fall from 60% to about 12% of the generation mix in 2050, less than the projected share of renewable energy sources which will rise to about 30%. Gas will continue to play a complementary role (about 11%). The Concept outlines indicative targets for domestic resources, including nuclear fuel, with 90% and 80% shares in overall electricity and district heating, respectively. This would be a substantial transformation of the Czech electricity sector.

Although gains have been made in reducing energy intensity in the industry sector, the potential for energy efficiency improvements in the buildings and transport sectors is substantial. Energy use and carbon dioxide emissions in these sectors are growing. Energy efficiency is considered the low-hanging fruit in efforts to reduce energy consumption and address climate change, while also providing benefits for energy security. The transport sector is singled out in the draft SEC as a priority sector, which is a positive development. The main objectives are to expand public transport and incentives to reduce road traffic (for example by working from home) in the short term and to diversify the fuel and technology mix over the longer term.

In developing a national mid- and long-term integrated energy and climate policy, due account should be taken to particularly long-term needs for GHG emissions reductions. The Czech government needs to take actions today to meet these long-term objectives. Fortunately, current emissions reductions have provided the Czech Republic with a significant surplus of tradable emission allowances in the first commitment period of the Kyoto Protocol. The Czech government should be commended for reinvesting the profits resulting from the use of the Kyoto Protocol's flexible mechanisms in measures under the Green Investment Scheme but more efforts will be needed to achieve the necessary long-term emissions reductions.

In developing an integrated energy and climate change policy which takes account of both national objectives and European policy constraints and targets, the government should encourage greater consultation between ministries (notably the Ministry of Industry and Trade and the Ministry of the Environment, but also the Ministries of Transport and of Agriculture). It could also consider the scope for greater co-ordination with neighbouring countries aiming at common energy security and climate change objectives. The government should examine different scenarios of future energy use and production and consider re-evaluating its proposed policies. Reducing emissions over the

long term will be challenging for the Czech Republic because of its heavy reliance on coal and its small potential for expanding the use of renewable energy sources. Specifically, the Czech Republic should concentrate resources on implementing energy efficiency policies and measures. The 2009 edition of the IEA *World Energy Outlook* highlighted that over half of the reductions in global emissions needed in its 450 ppm Scenario to 2050 can be achieved through energy efficiency improvements.[1]

Given the need for major investments in infrastructure over the next few years to achieve the necessary long-term policy goals, it is particularly important that the Czech government agrees quite soon a coherent and credible policy framework to provide a stable and competitive business climate for such investment to be made.

GREAT STRIDES IN ENERGY SECURITY BUT NEED MORE FOCUS ON CLIMATE CHANGE

Energy security is at the core of the Czech energy policy and is prioritised mainly by preferential use of all available domestic resources. This is largely attributed to the perception of external risks to supply and to the comparative advantage of some of the national energy industries, in particular coal mining and power generation. The Czech Republic established an Expert Group on Energy Security in 2006 and a Raw Materials and Energy Security Department within the Ministry of Industry and Trade in October 2009. The updated draft State Energy Concept highlights a variety of strategic priorities centred on enhancing energy security, and the ministry is planning to prepare a comprehensive energy security strategy in 2010.

The Czech Republic is in compliance with the IEA obligation regarding oil stocks. Since the last in-depth review, the progress achieved in terms of improving security of gas supply is commendable but must be continued further. The provisional reserve flow capacity from Germany, high storage withdrawal and Norwegian supplies enabled the Czech Republic to face a disruption of Russian supplies in January 2009 while maintaining deliveries to all essential customers.

Major targets outlined in the draft State Energy Concept include priority use of domestic resources, including uranium, and further diversification of oil and natural gas supplies, for which a specific target has been set to limit the share of one source to the maximum level of 65% of total annual consumption. The target implies a reduction of imports from Russia, a policy reinforced by the Russia-Ukraine dispute in January 2009 and a fear of similar supply disruptions in the future. This has triggered the application of energy security-related strategies in a wider context.

The Czech Republic plans substantial increases in gas storage capacities, the development of interconnections with neighbouring countries and a further extension of its natural gas transmission grid to provide for larger volumes of reverse flow. Emergency measures have also been identified in order to be better prepared for any significant reduction in natural gas imports. The Czech Republic's long-term strategy for the electricity sector has also been affected by the perception of risks related to natural gas security of supply. The Czech government should consider potential future developments in the regional natural gas market and the positive role that gas plays in addressing climate change and, if feasible and economical, consider expanding the role

1. The 450 scenario shows abatement options needed to limit the long-term concentration of greenhouse gases in the atmosphere to 450 parts per million (ppm) of CO_2-equivalent and to keep the global temperature increase to around 2 degrees Celsius above pre-industrial levels.

of gas in a long-term strategy to reduce emissions. Gas-fired plants are the second-fastest plants to build, after wind farms, and are less subject to NIMBY[2] than coal or wind. They also provide reserve capacity for wind, since the intermittency in Baltic wind represents an increasing issue for the Czech transmission system operator.

The draft State Energy Concept is built on the general philosophy that domestic resources are the most secure for improving the energy situation in the Czech Republic. But energy security benefits targeted by the maximum use of domestic resources need to be complemented by detailed assessments on economic efficiency and environmental sustainability of the formulated actions. Improvements in energy efficiency and wider demand-side measures, regional integration in electricity and natural gas markets and optimising the need for new infrastructure are among the areas through which the Czech Republic could also strengthen its energy security. In this respect, the comprehensive energy security strategy should seek an efficient set of policies taking into account all the relevant economic, social and environmental factors.

Further focus and detailed road-maps are essential for ensuring robust long-term strategies, particularly in the areas pertaining to efficiency improvements, development and deployment of advanced combustion technologies, sustainable coal and other low-carbon technologies, and flexible and wider use of fuel-switching options. Given the energy-intensive structure of the Czech economy and the strong seasonality in electricity and heat demands, facilitation of demand-side measures, in particular with participation from industry, should contribute to the efforts of the Czech Republic to enhance energy security and environmental sustainability in a cost-effective manner.

CLARITY REQUIRED REGARDING FUTURE ROLE AS ELECTRICITY EXPORTER

The updated draft State Energy Concept envisions a self-sufficient and export-oriented electricity sector, largely motivated by the government's perception of risks related to energy security. On the generation side, refurbishment of the existing capacity, mainly through efficiency improvements, and timely and effective replacement of coal-fired plants that are retired will be essential for maintaining a surplus as desired by the government. Continuous monitoring and evaluation of the supply-demand balance with further co-ordination among the Ministry of Industry and Trade, the Energy Regulatory Office (ERO) and the transmission system operator (ČEPS) are necessary for providing clear signals to the market to achieve the desired growth targets for the Czech electricity system. Creating a market-oriented environment should remain the core aspect of any action to direct generation investments in parallel with the long-term policy goals of the government.

The Czech Republic's transmission system could allow electricity exchange options with all its neighbouring countries. The net transfer capacity of the existing interconnections of 17 cross-border lines is over 30% of Czech installed capacity. Further extension of the infrastructure through the construction of new lines and modernisation of existing lines is planned for the period to 2026. These developments are consistent with the export-oriented strategies of the Czech Republic.

Further development of cross-border infrastructure will be necessary for the establishment of regional and European Union-wide physical electricity markets. The Czech government should co-ordinate and co-operate with neighbouring governments

2. "not in my backyard" which refers to public resistance to energy infrastructure being constructed.

and transmission system operators in order to ensure that growth in electricity supply is compatible with the regional supply and demand balance.

The role of the energy regulator and the Office for the Protection of Competition will continue to be central in monitoring market developments as the partially state-owned utility, ČEZ, has a dominant position in the Czech electricity market.

The development of additional nuclear facilities will, in the first place, be aimed at replacing fossil fuel-fired power plants at the end of their lifetime. While some of the Czech Republic's neighbouring countries have nuclear facilities or are considering their development, others either do not have nuclear plants or are potentially shutting them down. In this environment, the Czech Republic should consider supporting co-operation among governments and system operators at the regional level in order to avoid the development of excess capacity over the longer term. Regional co-operation should also be encouraged with regard to radioactive waste storage/repository facilities.

A common day-ahead market has been launched between the Czech Republic and the Slovak Republic, formulated on the principle of implicit auctions. In the case of the Polish, Slovak and both German interconnections, co-ordinated explicit auctions are also organised in co-operation with neighbouring transmission system operators. These developments are positive for the establishment of a regional electricity market. In this context, the Czech Republic should continue to co-operate with its neighbours to ensure functioning electricity markets, without any restrictions on imports.

IMPORTANCE OF TECHNOLOGY DEVELOPMENT

Given the ambitious CO_2 emissions reduction goals agreed by the European Union and the Czech government's plans for coal use in power generation, the country will need to actively pursue the development of sustainable coal technologies. Without reducing the carbon footprint of coal combustion, it will be difficult to meet the desired long-term GHG emissions reduction targets. On the other hand, a radical switch in the fuel mix which reduces the share of coal could have adverse effects on the country's security of supply. The government should pursue the greater deployment of available clean coal technologies and research and development of other sustainable coal technologies, in particular carbon capture and storage (CCS). Other priorities should include the development of electricity storage and smart grids.

A CCS policy should be established. Potential investment in CCS at the industrial scale will depend on future coal availability within the context of a decision on mining limits and on addressing the problem of insufficient storage potential. So far, there has been only a handful of publicly funded research projects focused on CCS.

It is commendable that the Czech Republic sustains numerous high-level research and development projects in nuclear technology, including Generation III and IV reactors, notably in the Nuclear Research Institute. It should continue to build on its national strengths and capacities and engage in international programmes.

KEY RECOMMENDATIONS

The government of the Czech Republic should:

- *Build on the draft State Energy Concept, on the Climate Protection Policy and on the report by the Independent Expert Energy Commission to develop coherent energy and climate strategies, including a vision to 2050 consistent with the latest EU policies in these areas, and consider different scenarios to assess in particular the economic and environmental sustainability of the proposals.*
- *Use the revenues accrued from the use of flexible mechanisms under the Kyoto Protocol to encourage, in a cost-effective manner, measures to further reduce greenhouse gas emissions in the near term.*
- *Assess the economic and social costs and benefits of enhancing energy security through the predominant use of domestic energy resources and, if necessary, consider low-carbon energy sources, such as gas, in devising a long-term strategy to reduce emissions.*
- *Support co-operation among governments and transmission system operators at the regional level, in order to ensure that growth in electricity supply is compatible with the regional supply and demand balance, and strengthen co-operation with neighbouring countries to develop a functioning regional electricity market.*
- *Develop an integrated strategy to improve energy efficiency, addressing both primary and final energy use, particularly in the buildings and transport sectors, and improving the co-ordination and cost-effectiveness of different energy efficiency schemes.*

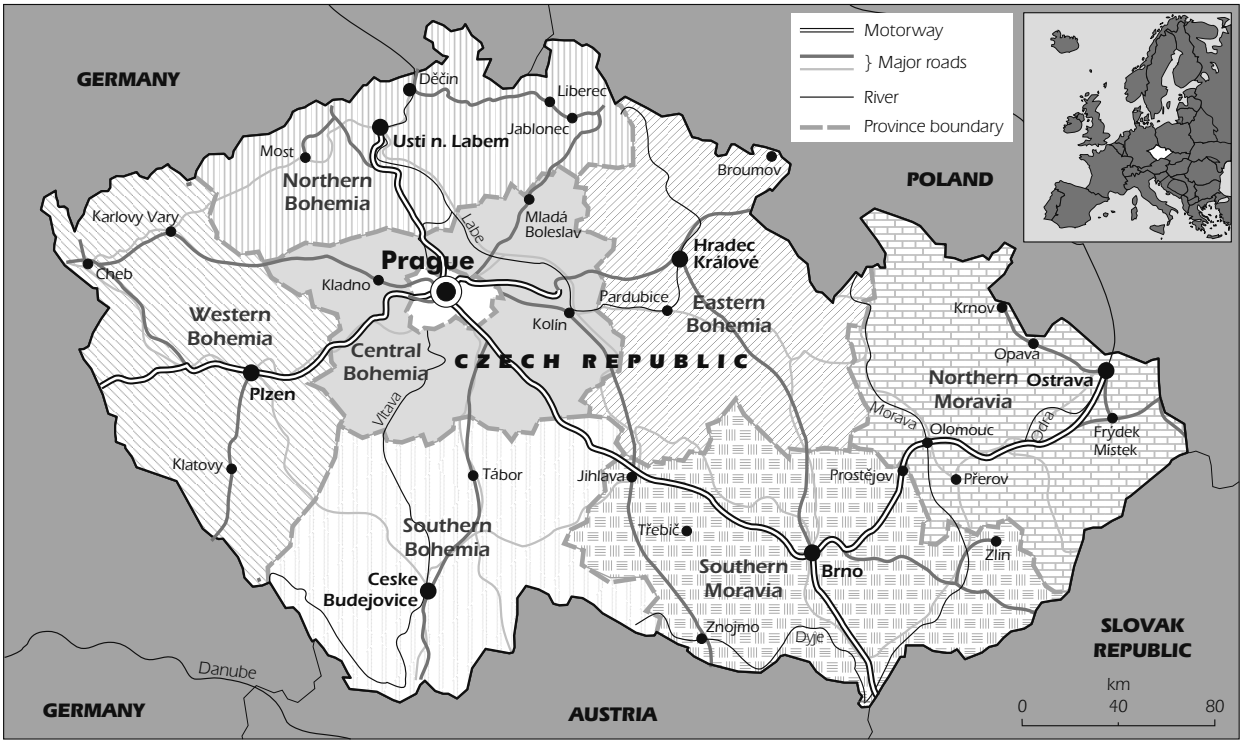
PART I
POLICY ANALYSIS

2. GENERAL ENERGY POLICY

OVERVIEW

The Czech Republic is situated in Central Europe, neighbouring the Federal Republic of Germany, Austria, the Slovak Republic and Poland (Figure 1). The population is some 10.47 million and the surface area is 78 864 km^2.

Figure 1. Map of the Czech Republic



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

The Czech Republic joined the International Energy Agency in 2001 and the European Union in 2004. The Czech Republic, Poland, Hungary and the Slovak Republic are part of the Visegrád Group, which facilitates co-operation and stability among their countries and with other states, including Austria and Slovenia. The Czech Republic is also a member of the Energy Charter and is planning to join the International Renewable Energy Agency (IRENA).

After several years of growth averaging close to 6% per year, the Czech economy slowed markedly in 2008, entering a sharp recession in the fourth quarter.[3] Real GDP is estimated to have fallen by 4.9% in 2009. This reflected the collapse of world trade that followed the onset

3. For more information on the Czech economy, see *OECD Economic Surveys: Czech Republic*, OECD Paris, April 2010.

of the global financial crisis. The Czech economy's integration in global markets and supply chains made it particularly vulnerable. Real GDP began to recover slightly in the second quarter of 2009, but the strength of the recovery will depend chiefly on the growth of world trade.

The energy industry – including mining, production of coke, natural gas, power, and heat production and distribution – plays a major role in the Czech Republic. Brown coal, extracted mostly in Northern Bohemia, is used mainly for power generation. Black coal is primarily extracted in Northern Moravia and nearly half is used to produce coke. The Czech Republic has a few small oilfields and the oil is used exclusively in the chemical industry to produce lubricants.

Following the reduction in its industrial output in the 1990s, the Czech Republic has become a major exporter of electricity. Nearly 60% of generation is coal-fired and another 32% nuclear. The Czech Republic has two nuclear power stations, located in Temelín in Southern Bohemia and in Dukovany in Southern Moravia. An intermediate storage facility for spent radioactive fuel is located in Dukovany.

Hydropower plants represent about 3% of total generation. Thanks to recent strong government support, the share of other renewable energy sources has increased rapidly over the past several years, particularly solar photovoltaics (PV) and wind, albeit from a low base.

Since the last in-depth review in 2005, the Czech Republic has made considerable efforts to strengthen and enhance its energy security. From January to June 2009 the Czech Republic chaired the Council of the European Union and energy issues were one of its three priority areas. The disruption of gas supply in January 2009 highlighted a need to strengthen EU action in external energy issues.

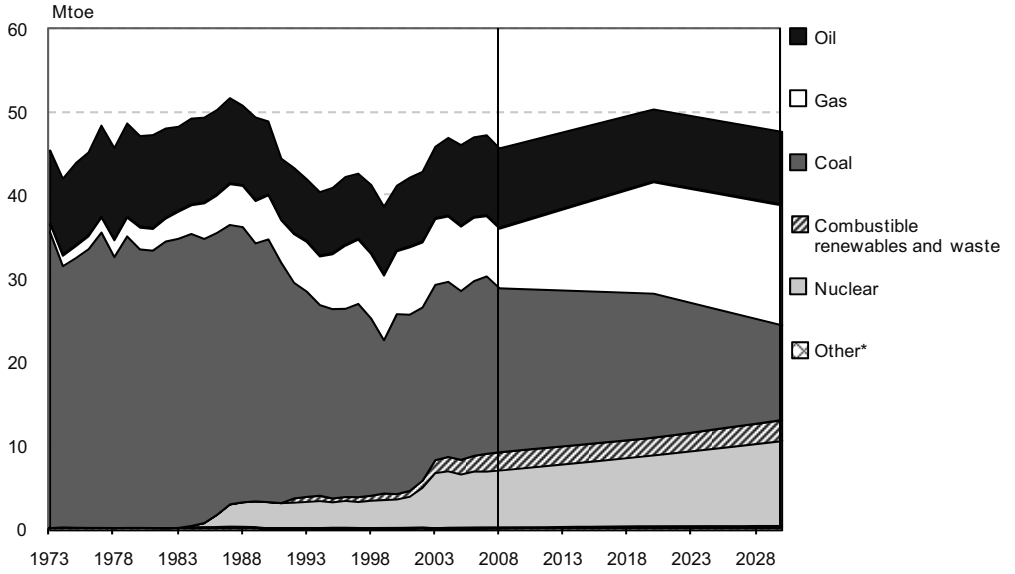
SUPPLY AND DEMAND

Total primary energy supply (TPES) in the Czech Republic was 44.63 Mtoe in 2008, down from some 49 Mtoe in 1990 (Figure 2). Coal represented the greatest share (44% in 2008), although it has fallen from 54% in 2000. Oil demand accounted for 21% of TPES in 2008, its share rising two percentage points since 2000. The share of gas has declined, from 19% in 2000 to 16% in 2008, while nuclear's share has nearly doubled, from 9% to 16% over the same period. Combustible renewables and waste saw their share rise to nearly 5% of TPES in 2008, from less than 2% in 2000. The Czech primary energy mix is well diversified compared with some other IEA countries (Figure 3).

The Czech Republic is the third-largest net electricity exporter in the European Union in absolute terms, after France and Germany. Electricity generation is largely composed of domestic coal (60%) and nuclear (32%), whereas natural gas (3.5%) is mainly used as complementary fuel in multi-fired units and for peaking purposes. Combined heat and power (CHP) constitutes one-third of electricity generation and over 40% of overall heat production, making the country the third-largest in CHP use after Denmark and Finland.

The decline in coal's share since the 1990s is due to switching from coal to gas and electricity in the industry and buildings sectors. The overall share of coal in total final consumption of energy (TFC) dropped from 40% in 1990 to 19% in 2000 and to only 11% in 2008 (Figures 4 and 5). Final gas demand increased rapidly in the 1990s, with its share in TFC rising from 14% in 1990 to 24% in 2000, but declined marginally to 23% in 2008. The share of oil in final energy consumption, predominantly for transport, rose to 34% in 2008 from 24% in 1990. The share of electricity in overall TFC was 19% in 2008. Heat accounted for 8% and combustible renewables and waste for some 7%.

Figure 2. Total primary energy supply, 1973 to 2030

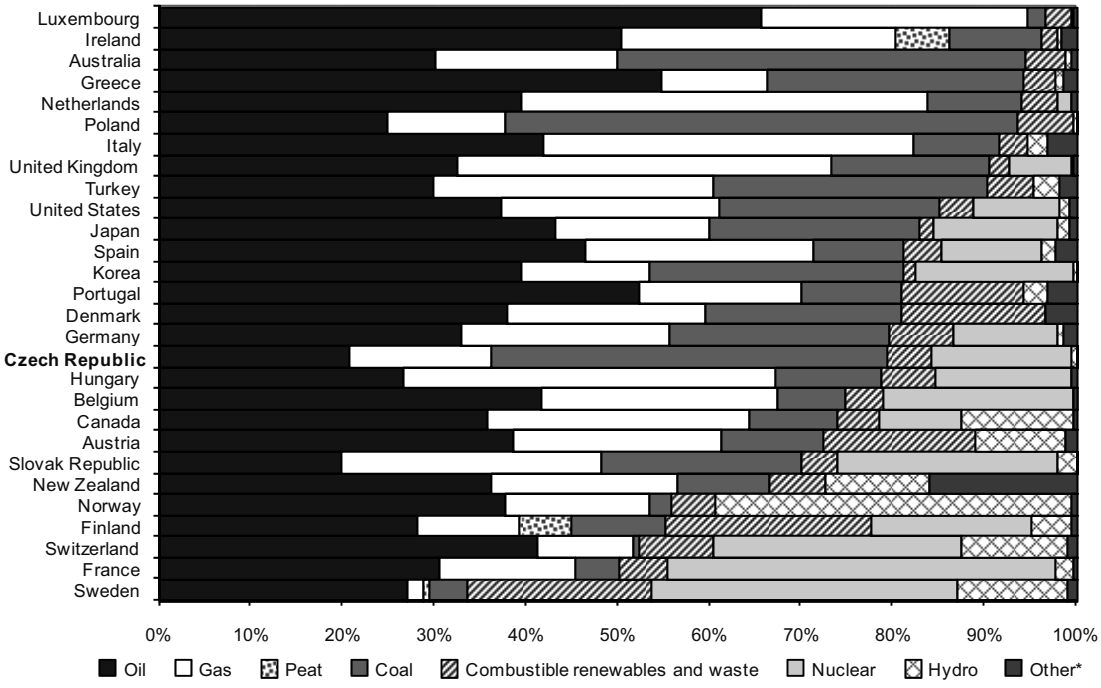


* *Other* includes peat, hydro, wind, solar, geothermal and ambient heat used in heat pumps (negligible).

Note: The graph shows historical data until 2008 and the Czech government's forecasts from 2009 to 2030.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2009 and country submission.

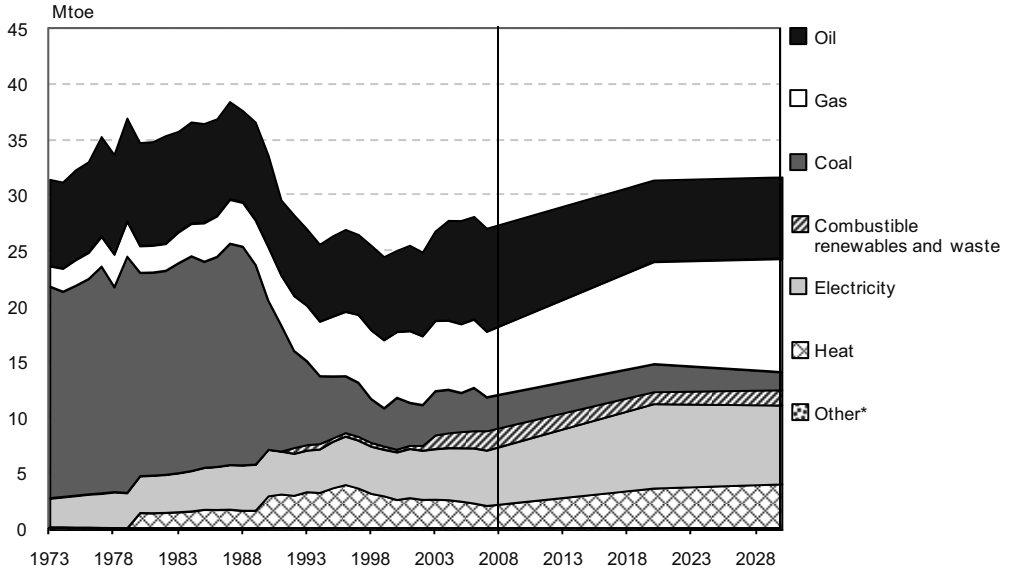
Figure 3. Total primary energy supply in IEA member countries, 2008



* *Other* includes geothermal, solar, wind, tide/wave/ocean and ambient heat production.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2009.

Figure 4. Total final consumption by source, 1973 to 2030

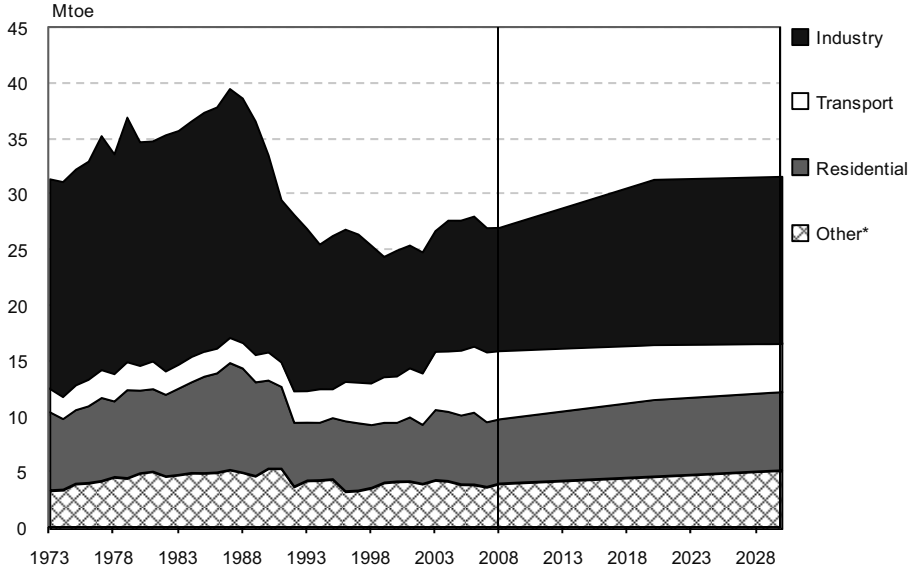


* *Other* includes peat, solar and ambient heat used in heat pumps (negligible).

Note: The graph shows historical data until 2008 and the Czech government's forecasts from 2009 to 2030.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2009 and country submission.

Figure 5. Total final consumption by sector, 1973 to 2030



* *Other* includes commercial, public service, agricultural, fishing and other non-specified sectors.

Note: The graph shows historical data until 2008 and the Czech government's forecasts from 2009 to 2030.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2009 and country submission.

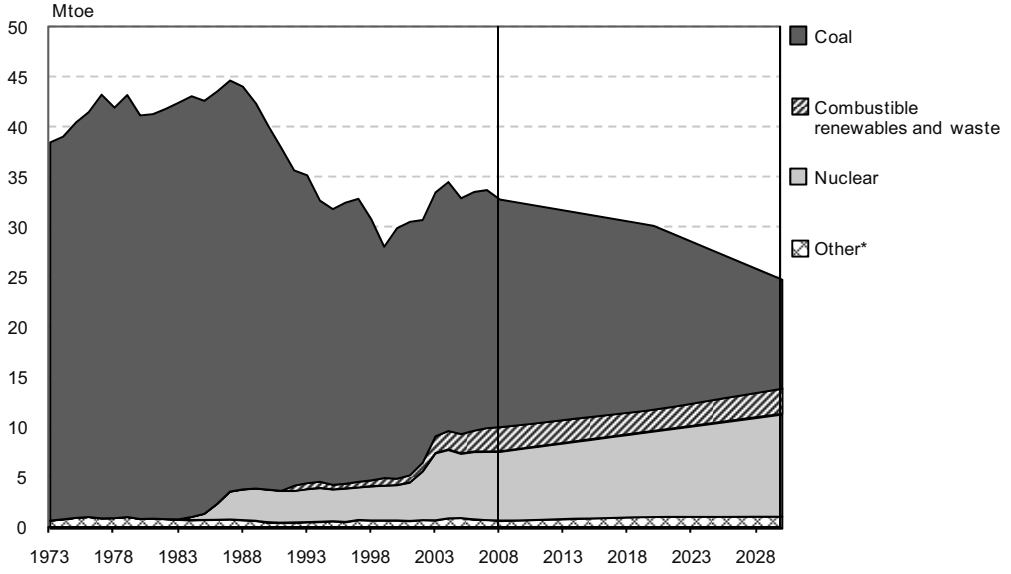
According to the Czech Statistical Office and the Energy Regulatory Office (ERO), electricity intensity in the industry sector declined by about 28% from 2002 to 2007, that is, about 5% per year on average. This was mainly thanks to structural changes in the sector. Although gains have been made in reducing energy intensity in the industry sector, however, the potential for energy efficiency improvements in the buildings and transport sectors is substantial (see Chapter 4 on Energy Efficiency).

PRODUCTION AND TRADE

In 2008, coal accounted for nearly 70% of energy production in the Czech Republic (with total production of 32.82 Mtoe). Nuclear accounted for 21% and combustible biomass and waste some 7% (Figure 6). Coal production declined precipitously in the late 1980s and 1990s. After government decrees were put in place in 1991, mining activities ceased in several coal districts in the Czech Republic. According to the government, these limits were put in place because of local opposition to the environmental impacts of mining.

Production of oil and gas is minimal. The Czech Republic imports nearly all of its oil and gas demand. However, the country is a net exporter of electricity to the Slovak Republic, Austria and Germany. It also exports a significant quantity of coking coal to the Slovak Republic and Poland.

Figure 6. Energy production by source, 1973 to 2030



* *Other* includes oil, gas, peat, hydro, wind, solar, geothermal and ambient heat used in heat pumps.

Note: The graph shows historical data until 2008 and the Czech government's forecasts from 2009 to 2030.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2009 and country submission.

KEY ENERGY POLICY DIRECTIONS

The Czech energy policy is increasingly guided by the EU requirements and targets. For example, EU directives set requirements for electricity and natural gas markets (Chapters 6 and 9). The EU Energy and Climate package (Chapter 3) sets targets for greenhouse gas reductions, energy efficiency and renewable energy.

The key national energy policy document is the State Energy Concept (SEC), approved in 2004. This has been reviewed twice since, by the Ministry of Industry and Trade (MIT) which has overall responsibility for energy policy. In January 2007, the Independent Expert Energy Commission, created by the Czech government, commenced an assessment of long-term energy needs. An Opponent Commission was tasked by the Prime Minister to assess the report. The government took note of this assessment and of the Independent Expert Energy Commission's final report in January 2009. The results provided the government with independent information on the energy sector and recommendations for future strategies in the development of this sector.

The Ministry of Industry and Trade has prepared an updated draft State Energy Concept with the aim to submit it to the government in fall 2010. The previous State Energy Concept outlook to 2030 was extended to 2050.

In March 2004 the Czech government approved a State Environmental Policy of the Czech Republic for the years 2004-2010, in which it defined a framework for long-term and medium-term sustainable development. Since 2007 the Czech Republic has started the National Programme of Emissions Reduction and the National Programme to Abate Climate Change Impacts. An update of the Climate Protection Policy (CPP) was introduced by the Ministry of the Environment in October 2009 and subsequently was submitted for a public and interdepartmental consultation.

STATE ENERGY CONCEPT 2004

The vision of the SEC 2004 is comprised of the following:

- *independence*: from foreign energy sources, from energy sources from risky regions;
- *safety*: of all energy sources, including nuclear, reliability of supplies, reasonable decentralisation of all energy systems;
- *sustainable development*: environmental protection, economic and social development.

The main priorities are to:

- decrease the energy intensity of GDP by 3.0% to 3.5% annually (indicative target);
- decrease the electricity intensity of GDP by 1.4% to 2.4% annually;
- maintain current level of TPES;
- achieve the following TPES mix by 2030: coal 30% to 32%; gas 20% to 22 %; oil and other liquid fuels 11% to 12%; nuclear 20% to 22%; renewable sources 15% to 16%;
- maintain maximum limits for dependence on energy imports (indicative targets): 45% in 2010, 50% in 2020, 60% in 2030;
- comply with binding EU emission limits in 2010;

- fulfil international obligations of the Kyoto Protocol and of other agreements connected with it;
- create conditions for wider use of renewable energy sources and meet the national indicative target for the share of renewable sources in gross electricity production (8% in 2010);
- create conditions for a gradual increase in the share of renewable energy sources in TPES;
- prepare for trade in greenhouse gas emissions;
- adapt energy management system measures to the model used within the EU.

DRAFT STATE ENERGY CONCEPT 2009

The updated draft State Energy Concept shares a common vision with the previous energy concept and sets out the following six strategic priorities:

- achieve a balanced energy mix, with preferential use of all domestic energy resources and maintain excess production of electricity;
- improve energy efficiency, particularly in the buildings sector, and reduce energy intensity;
- promote regional development of electricity networks, strengthen international co-operation and enhance integration of electricity and gas networks with neighbouring countries;
- enhance the competitiveness of the Czech economy by supporting more research and development and higher education;
- increase energy security and the ability of the Czech Republic to respond to energy supply disruptions;
- minimise the impacts of energy use on the environment.

There are indicators and targets associated with each of the strategic priorities.[4] The draft State Energy Concept also provides a scenario of the Czech energy market to 2050 with shorter-term objectives and policy recommendations. Future development of the energy sector is predicated on the desire to enhance security of energy supply and maintain the Czech Republic as a net electricity exporter. Objectives for the future energy mix would be achieved through further diversification of energy supply and preferential use of indigenous resources, comprising coal, uranium and renewable energy, mainly biomass and waste.

Future expansion of nuclear capacity has been presented as one of the major pillars of the updated draft SEC. According to the most recent version of the updated draft Concept, nuclear power is projected to account for over 47% of the power generation mix in 2050. Coal is projected to account for less than 12%, less than the projected share of renewable energy sources (some 30%). Gas will continue to play a complementary role (about 11%). The draft Concept outlines indicative targets for domestic resources, including nuclear fuel, with 90% and 80% shares in overall electricity and district heating, respectively. The draft Concept also envisages reductions in energy intensity and in CO_2

4. These indicators and targets are discussed in the relevant chapters.

emissions. It promotes more research and development and the training of future energy technicians to counter the shortage of such expertise in the Czech Republic.

NATIONAL ACTION PLAN ON ENERGY EFFICIENCY[5]

In its National Energy Efficiency Action Plan (EEAP) 2008-2016, the Czech Republic committed to a 1% national energy savings target in 2010 and a 9% target in 2016. Overall attainable energy savings amount to 19 842 GWh, divided between five sectors (household, tertiary, industrial, transport, agriculture). Approximately 30% of savings are to be achieved in the buildings sector, followed by the industrial and transport sectors (24% and 23% respectively).

NATIONAL PROGRAMME ON ENERGY MANAGEMENT AND USE OF RENEWABLE ENERGY SOURCES 2006-2009[6]

Priorities

- Maximise energy and electricity efficiency and utilisation of energy savings.
- Higher utilisation of renewable and secondary energy sources.
- Higher utilisation of alternative fuels in transport.

Targets

- Increase of energy efficiency of 2.6 % annually and energy savings about 11 petajoules (PJ) annually.
- Contribution to target fulfilment in the use of renewable energy sources (RES) and in the use of biofuels in transport.

STATE ENVIRONMENTAL POLICY 2004[7]

Main targets

- Higher usage of renewable and secondary energy sources, higher usage of energy saving potential.[8]
- Fulfil national goal in electricity production from renewable sources in gross electricity consumption (8% in 2010).
- Minimise CO_2 emissions and local pollutants, mainly at large combustion sources.
- Support science, research and the deployment of modern technologies, for example fuel cells, heat pumps, photothermal systems, photovoltaic, hydrogen management, heat exchangers, central biomass engines, biomass co-generation and

5. For more details, see Chapter 4.
6. For more details, see Chapter 8.
7. For more details, see Chapter 3.
8. Act. No. 180/2005 Coll. on promotion of energy production from renewable energy sources and amending certain acts.

biofuels, wind plants, small water plants, waste heat-using technologies, fluid combustion, gas and steam gas cycles, combined heat and electricity production.

- Support usage of low-carbon fuels to replace solid fuels.
- Promote a high-quality solution for back-end of the fuel cycle in nuclear energy mechanisms.
- Support energy savings in building heating and cooling systems, energy audits, certification systems for heating mechanisms, low-energy houses.
- Commit financial resources to research and application of modern energy technologies and environmental protection programmes.

NATIONAL PROGRAMME FOR THE REDUCTION OF EMISSIONS (to be updated in 2010)

The *National Programme for the Reduction of Emissions of the Czech Republic* was approved in June 2007, replacing the 2004 *Integrated National Emissions Reductions Programme*. The programme's main target is to reduce the emissions' damaging effects on ecosystems and human health. It sets emission ceilings and specific compliance deadlines for sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia. It also focuses on compliance with the defined limits of air pollutants, in particular PM_{10} and benzo(a)pyrene.

NATIONAL PROGRAMME TO ABATE CLIMATE CHANGE IMPACTS[9]

The National Programme to Abate Climate Change Impacts was approved by Czech Government Resolution no. 187 of 3 March 2004. Its main targets for the period commencing after the end of the first commitment period of the Kyoto Protocol (2012) include:

- reduce CO_2 emissions per capita to 2020 by 30 % compared to 2000;
- reduce total aggregate CO_2 emissions to 2020 by 25 % compared to 2000;
- increase the share of renewables in primary energy consumption to 6% by 2010 and to 20% by 2030.

These emissions reduction targets are to be achieved through the following instruments:

- reduce energy intensity in the area of production, distribution and final consumption of energy to a level of 60% to 70% of current primary energy consumption in 2030;
- introduce an environmental tax reform;
- increase the share of biofuels and other alternative fuels in transport to 5.75% in 2010 and 20% in 2020.

9.This will be replaced by the Climate Protection Policy; see Chapter 3.

INSTITUTIONS AND GOVERNMENT ORGANISATIONS

MINISTRY OF INDUSTRY AND TRADE (MIT)

The Ministry of Industry and Trade is the central body of the government administration involved in the integrated raw materials policy, the use of mineral resources, energy, gas and heat production, mining, crude oil, natural gas, solid fuels, nuclear materials, ores and non-ores treatment and conversion. The ministry takes primary responsibility for policies and measures related to renewable sources of energy and energy efficiency. It is responsible for the elaboration, presentation and evaluation of fulfilment of energy policy (www.mpo.cz).

ENERGY REGULATORY OFFICE (ERO)

The Energy Regulatory Office is an administrative authority for regulation in the energy sector. Its remit is to promote competition, support the use of renewable and secondary energy resources and protect consumer interests in the areas of energy industries, where competition is not feasible (www.eru.cz).

STATE OFFICE FOR NUCLEAR SAFETY (SÚJB)

The State Office for Nuclear Safety is a regulatory body responsible for governmental administration and supervision in the fields of nuclear energy and radiation, and of radiation protection. By the decision of the government, this body reports directly to the Prime Minister (www.sujb.cz).

ADMINISTRATION OF STATE MATERIAL RESERVES (ASMR)

The Administration of State Material Reserves is a government agency responsible for the state material reserves. It provides funding for necessary measures to be taken in case of emergency and the funding, refreshment, substitution, lease, release, sale, storage, protection and control of the state material reserves as well as for their acquisition pursuant to the requirements of emergency plans (www.sshr.cz).

CZECH ENERGY AGENCY

The Czech Energy Agency was abolished in 2007. Its activities were handed over to the Ministry of Industry and Trade, the agency CzechInvest and the State Energy Inspection agency.

STATE ENERGY INSPECTION (SEI)

The State Energy Inspection is a public administrative body under the Ministry of Industry and Trade which supervises and monitors compliance with business requirements and the exercise of state administration in the energy sector. It imposes penalties for all violations. It monitors behaviour of licence holders in the electricity, gas and heating sectors, energy audits and controls the prices of heat, electricity and gas (www.cr-sei.cz).

MARKET OPERATOR OTE

OTE is a joint stock company founded by the state in 2001 that provides comprehensive services to the electricity market, in particular: the daily and intra-day electricity market; settlement of differences between agreed and actual values of electricity supply; processing reports on the Czech electricity market (monthly and yearly); and, since 2005, the administration of publicly accessible register of trading in greenhouse gas emissions. Since January 2010, OTE also serves as the operator of the gas market. It will perform similar activities as in the electricity market, *i.e.* clearing and settling deviations, financial security of individual entities, the organisation of the gas market, and will provide technical support for switching (www.ote-cr.cz).

MINISTRY OF THE ENVIRONMENT

The Ministry of the Environment sets the framework for environmental policy. Regarding the energy sector, the ministry strives to minimise the impact of energy use on the environment, to promote rational energy consumption and supply of energy, and to introduce wherever possible the principles of sustainable development (www.env.cz). The ministry is responsible for the implementation of the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. Climate change policies and legislation, including the European Union Emissions Trading Scheme (EU-ETS), are the competency of the Department of Climate Change, which consists of two units – the Climate Change Unit and the Emissions Trading Unit. Because of the cross-cutting character of the climate change issue, a Working Group for Climate Change was set up with representatives from the Industry, Transport, Agriculture and Finance Ministries.

CZECH HYDROMETEOROLOGICAL INSTITUTE

The Hydrometeorological Institute is based on three independent disciplines covered by the meteorological, hydrological and atmospheric quality protection departments (www.chmu.cz). The Climate Change Department of the Czech Hydrometeorological Institute (supervised by the Ministry of the Environment) is responsible for the national inventory of greenhouse gases.

CZECH GEOLOGICAL SURVEY

The Geological Survey collects and assesses information about the geology of the Czech territory and provides it to state authorities for their political, economic and environmental decision making. The main fields of expertise include geological mapping and research, study of mineral resources and their economic potential, mining impact assessment, geochemistry, environmental studies, applied geology, hydrogeology and natural hazards, management of geo-data and the geographic information system (www.geofond.cz).

NATIONAL FUND FOR THE ENVIRONMENT

The National Fund for the Environment is a major institution funding environment protection and development. It serves as a basic economic tool for national environmental policy and for meeting international and European Union commitments (www.sfzp.cz).

MARKET REFORM

Electricity market liberalisation in the Czech Republic as in other countries in the European Union (EU) is driven by the directives of the European Parliament and of the Council (Directive 96/92/EC and Directive 2003/54/EC). The three major implementation aspects of the directives relate to market opening, third-party access and the independent system operator:

- all non-household customers are eligible to choose their supplier from 1 January 2005 and all consumers are eligible from 1 January 2006;
- regulated third-party access is imposed and a regulator must be appointed to approve the tariffs, monitor congestion management and act as a dispute-settlement authority;
- transmission and distribution companies have implemented legal unbundling.

Other positive developments since the last in-depth review include:

- intra-day trading was launched in May 2006 by the Market Operator;
- Prague Energy Exchange was launched in 2007; start of trading from 17 July 2007.

The Czech Republic's generation sector is highly concentrated, with the partly state-owned utility ČEZ accounting for 73% of total generation in 2008. This share has actually risen slightly since the last in-depth review in 2005.

In terms of gas, the Czech Republic transposed and implemented the second EU Directive 2003/55 EC in 2005. This triggered the process of phased liberalisation of the domestic gas market, with the individual categories of customers gradually gaining the right to choose their own supplier. Consumers with an annual gas use of over 15 million cubic metres (mcm), power and heat generators, became eligible in January 2005, while all non-residential consumers became eligible in January 2006. All final customers of natural gas became eligible in January 2007, in line with the second EU directive requiring the complete opening by July 2007. As part of the market opening, RWE Transgas was legally unbundled. An independent transmission system operator was established on 1 January 2006, and the storage activity was unbundled in January 2007. Independent distribution system operators were established with effect from 1 January 2007.

ENERGY PRICES AND TAXES

All types of primary and final energy use are subject to a value-added tax (VAT) of 19% with the exception of district heating and cooling, which is taxed at a reduced rate of 9%.[10]

In January 2008, the environmental excise tax was modified by the Czech government to meet requirements for energy taxation set out in a 2003 European Union directive. The tax was introduced on electricity, solid fuels and natural gas. Previous tax rates for petrol, diesel and heavy fuel oil were not changed.

The tax rates are as follows:

- up to 8% for the use of brown coal for heating;
- at least 1 euro per megawatt-hour of electricity;
- a minimum of 0.15 to 0.3 euros per gigajoule for natural gas used for business.

Consumers relying on district heating are granted a tax exemption.

10. For gas, electricity and renewable energy prices, see the relevant chapters.

Table 1. Excise and energy tax rates of selected commodities

	Tax rate (CZK)	Equivalent in EUR	Unit
Petrol	11 840	447.73	Thousand litres
Gas oil	9 950	376.26	Thousand litres
Heavy fuel oil	472	17.85	Tonne
Electricity	28.30	1.07	MWh
Natural gas	30.60	1.16	MWh
Solid fuels	8.50	0.32	GJ

Note: In 2009 on average, one Czech crown (CZK) = EUR 0.038.

Source: Ministry of Industry and Trade.

The electricity tax rate applies to all electricity, with the exception of electricity produced from renewable energy sources or electricity consumed in energy-intensive processes, CHP and public transport.

There are no social tariffs for electricity and gas consumption.

COMBINED HEAT AND POWER

Electricity produced through combined heat and power (CHP) production and combustion of secondary energy resources, is supported through a contribution to the electricity market price. The amount of contribution varies according to the size of installed capacity or, in the case of secondary sources, by category of burnt fuel.

BIOFUELS

There are no price subsidies for oil products or biofuels, but tax benefits have been legislated (see Chapter 8 on Renewable Energy).

ENERGY SECURITY

Energy security is at the core of Czech energy policy and is prioritised mainly by preferential use of all available domestic resources. This is largely attributed to the perception of external risks to supply as well as the comparative advantage of some of the national energy industries, in particular coal mining and power generation. The Czech Republic established an Expert Group on Energy Security in 2006 and a Raw Materials and Energy Security Department within the Ministry of Industry and Trade in October 2009. The updated draft State Energy Concept highlights a variety of strategic priorities centred on enhancing energy security and the ministry is planning to prepare a comprehensive energy security strategy in 2010.

Major targets outlined in the draft State Energy Concept include priority use of domestic resources, including uranium, and further diversification of oil and natural gas suppliers, for which a specific target has been set to limit the share of one source to the maximum level of 65% of total annual consumption. The target implies a reduction of imports from Russia, a policy reinforced by the Russia-Ukraine dispute in January 2009 and a fear of

similar supply disruptions in the future. This has triggered the application of energy security-related strategies in a wider context.

The Czech Republic plans substantial increases in gas storage capacities and further extension of its natural gas transmission grid to provide for larger volumes of reverse flow. Emergency measures have also been identified in order to be better prepared for any significant reduction in natural gas imports.

Without affecting essential customers, the Czech Republic managed a reduction of imported oil supplies in the second half of 2008 and a complete supply cut of natural gas imported from Russia via Ukraine from 7 January to 19 January 2009.

CRITIQUE

The energy policy framework of the Czech Republic is set by the State Energy Policy adopted in 2004. In preparation for a new State Energy Concept, to be adopted in 2010, the Czech government created an Independent Expert Energy Commission, charged with assessing the country's long-term energy needs. The commission delivered its final report to the government in January 2009. Since then, the Ministry of Industry and Trade (MIT) published a draft update of the State Energy Concept (SEC) in September 2009. Separately, the Ministry of the Environment issued a draft Climate Protection Policy (CPP) in October 2009.

Since the last in-depth review in 2005, the Czech Republic has further liberalised both electricity and gas markets, although the major players in each remain dominant. Following the recommendations in the last review, the Independent Expert Energy Commission undertook an assessment of the costs and feasibility of achieving national energy objectives; some steps have been taken to reflect environmental externalities in energy prices; and measures have been introduced to increase renewable energy production.

The draft State Energy Concept concentrates on the need for security of energy supply and the maintenance of surplus in electricity production and capacity, achieved through a diversified energy mix and maximising the use of indigenous resources. In practice this means a significant reduction in fossil fuels for electricity generation and an increase in the shares of nuclear and renewables. Nuclear power is projected to account for nearly 50% of the power generation mix in 2050, which will support the Czech government's efforts to achieve climate change objectives. Although gains have been made in reducing energy intensity in the industry sector, the potential for energy efficiency improvements in the buildings and transport sectors is substantial. Energy use and emissions in these sectors are growing. Energy efficiency is considered the low-hanging fruit in efforts to reduce energy consumption and address climate change, while also providing benefits for energy security. The transport sector is singled out in the draft SEC as a priority sector, which is a positive development. The main objectives are to expand public transport and incentives to reduce road traffic (for example by working from home) in the short term and to diversify the fuel and technology mix over the longer term.

The Climate Protection Policy envisages a target of a 40% reduction in greenhouse gas emissions by 2020 compared to 1990 levels across the whole Czech economy. In developing a mid- and long-term integrated energy and climate policy, the Czech government should take due account of particularly long-term needs for GHG emissions reductions. In this regard, findings of the Intergovernmental Panel on Climate Change

(IPCC) that developed countries as a group should reduce their GHG emissions by 80% to 95% below 1990 levels by 2050 should be taken into account, realising such emissions reductions require the development of near zero-carbon energy systems.

The analysis of the SEC, CPP and the Independent Expert Energy Commission provides the Czech government with an excellent opportunity to develop an integrated energy and climate change policy taking account of both national objectives and EU policy targets. The government intends to consult various stakeholders on the State Energy Concept, which is commendable. It should encourage greater consultation between ministries (notably the MIT and the Ministry of the Environment, but also the Ministries of Transport and Agriculture) in developing an integrated policy. The government should also take this opportunity to examine different scenarios of future energy use and production, and consider the need for evaluating the cost-effectiveness of the policies proposed. It could also consider the scope for greater co-ordination with neighbouring countries in meeting common energy security and climate change objectives.

Given the need for major investments in infrastructure over the next few years to achieve the necessary long-term policy goals, it is particularly important that the Czech government agrees quite soon on a coherent and credible policy framework to provide a stable and competitive business framework for such investment to be made.

The Czech Republic's long-term strategy for the electricity sector has also been affected by the perception of risks related to natural gas security of supply. As a result, natural gas plants are given a marginal role, mostly for peaking purposes, in expansion of the electricity system until 2050 as outlined in the draft SEC. The Czech government should consider potential future developments in the regional natural gas market and the positive role that gas plays in addressing climate change and, if feasible and economical, consider expanding the role of gas in a long-term strategy to reduce emissions. In addition, gas-fired plants are the second-fastest plants to build, after wind farms, and are less subject to NIMBY than coal or wind. They also provide reserve capacity for wind, since the intermittency in Baltic wind represents an increasing issue for the Czech transmission system operator.

The draft SEC, built on the general philosophy that domestic resources are the most secure for improving the energy situation, lacks a certain degree of coherence in energy security and climate-related policies. Improvements in energy efficiency and wider demand-side measures, regional integration in electricity and natural gas markets and optimising the need for new infrastructure are among the areas where the Czech Republic can improve its energy security objectives. In this respect, the comprehensive energy security strategy should seek an optimal set of policies taking into account all the relevant economic, social and environmental factors.

RECOMMENDATIONS

The government of the Czech Republic should:

- ☐ *Build on the draft State Energy Concept, on the Climate Protection Policy and on the report of the Independent Expert Energy Commission to develop coherent energy and climate strategies, including a vision to 2050 consistent with the latest EU policies in these areas, and consider different scenarios to assess in particular the economic and environmental sustainability of the proposals.*

- *Consider the recommendation by the IPCC that developed countries reduce GHG emissions by at least 80% by 2050, implying a need to have in place near zero-carbon energy systems, as a point of departure for a medium- and long-term integrated energy and climate policy.*
- *Assess the economic and social costs and benefits of enhancing energy security through the predominant use of domestic energy resources and, if necessary, consider low-carbon energy sources, such as gas, in devising a long-term strategy to reduce emissions.*
- *Increase human capacity in energy-related skills and expertise.*

3. ENERGY AND THE ENVIRONMENT

KEY DEVELOPMENTS IN ENERGY AND ENVIRONMENT POLICY

EU ENERGY AND CLIMATE PACKAGE

The EU Energy and Climate Package was agreed by all EU member states in December 2008. The package aims at reducing the EU's greenhouse gas emissions to 20% below 1990 levels by 2020. The package also implements the EU's target of more than doubling the share of energy generated from renewable sources to 20% by 2020. In addition, the measures agreed will contribute towards meeting the EU's goal of increasing energy efficiency by 20% by 2020.

This new legislation requires the Czech Republic to:

- adhere to the provisions of the EU Emissions Trading Scheme (EU-ETS), *i.e.* to implement the EU27 target for power generation and other industries;
- limit increases in its GHG emissions to 9% in 2020 in the sectors not covered by the EU-ETS[11] (*i.e.* transport, buildings, waste management, agriculture and small industrial installations) compared to 2005;
- increase the share of renewable energy in final energy consumption to 13% by 2020, including a specific 10% target in the transport sector;
- be in line with a 20% improvement of energy efficiency by 2020 agreed by the EU.

NATIONAL CLIMATE CHANGE POLICY

The energy sector contributes 40% to total greenhouse gas emissions in the Czech Republic, a share somewhat higher than the EU average because of the dominance of coal in the energy mix. The Czech Republic has an emissions reduction target of 8% below the1990 level for the first commitment period of the Kyoto Protocol (2008-2012). The National Programme to Abate Climate Change Impacts, set up under the State Environmental Policy 2004-2010 and approved by the Czech government in 2004, sets these additional targets:

- following the end of the first commitment period of the Protocol, reduce CO_2 emissions per capita by 30% by 2020 compared to the 2000 level;
- following the end of the first commitment period of the Protocol, reduce total aggregate CO_2 emissions by 25% by 2020 compared to the 2000 level.

On the basis of Government Resolution No. 395 of 6 April 2005, an evaluation was made in 2007 of the GHG emissions reductions achieved since the adoption of the National

11. Non-ETS sources account for about 60% of all EU greenhouse gas emissions.

Programme. The Ministry of the Environment submitted the document "Evaluation of the National Programme to Abate Climate Change Impacts in the Czech Republic" to the government in April 2008. This document highlights in particular the recent increase in the share of renewables in the energy mix (from 2% of total primary energy supply in 2000 to 5.4% in 2008), adaptation measures in water management and greater investments in research on the impacts of climate change.

Following the evaluation, the government started to develop a new State Environmental Policy. The National Programme to Abate Climate Change Impacts will be replaced by the Climate Protection Policy (CPP) of the Czech Republic. The targets set out in the National Programme will be updated in the CPP, in line with the EU Energy and Climate Package. The draft Climate Protection Policy indicates that previous national targets were unrealistic and that the target for CO_2 reductions to 2020 will be 20% (instead of 25%) compared to the 2000 level. This target is compatible with an allowed increase in GHG emissions of 9% in non-ETS sectors. The draft CPP target represents a 40% reduction in the sectors included in the EU-ETS and a 10% reduction in the non-EU-ETS sectors.

In the draft Climate Protection Policy, which has not yet been approved by the government, the proposed measures are evaluated from the point of view of their cost-effectiveness. All the measures in the draft Climate Protection Policy are being quantified by their expected reduction in GHG emissions and relative costs, resulting in a greenhouse gas abatement cost curve for the Czech Republic.

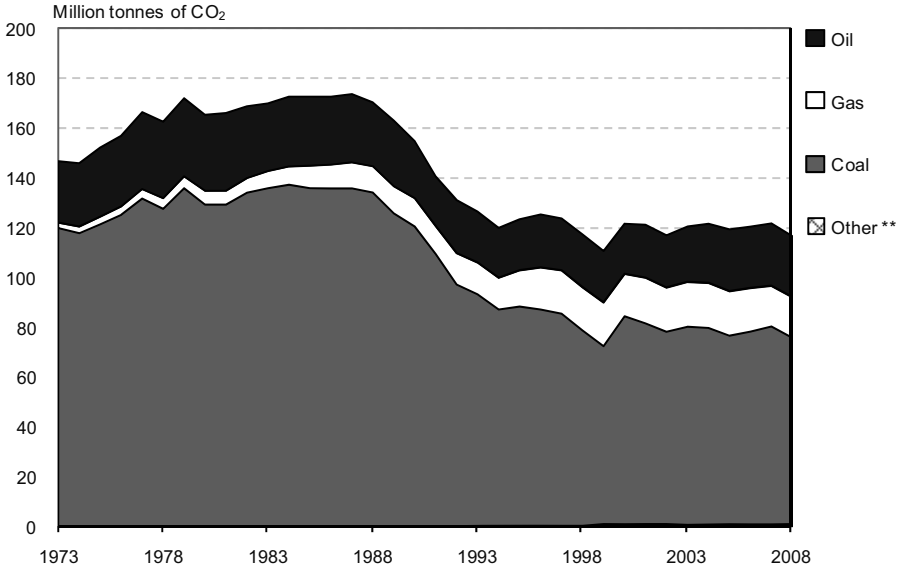
The Czech Republic is on track to meet its Kyoto target. In 2007, GHG emissions were nearly 22% below the 1990 level. The country is expected to have a surplus of 150 million assigned amount units (AAUs) during the Kyoto commitment period 2008-2012. Approximately 100 million AAUs are scheduled to be sold and 50 million will be kept in reserve. Buyers have been found for some 63% of the AAUs which are scheduled to be sold. The resulting revenues will be placed in the State Environmental Fund. The funds can only be used for mitigation action and projects. In 2009, the Green Investment Scheme was launched with the goal of increasing energy efficiency in the housing sector, largely through investment grants (see Chapter 4 on Energy Efficiency).

GHG emissions have declined slightly since the mid-1990s, and are currently around 140 million tonnes of CO_2-eq. The significant drop and stabilisation of emissions allows the Czech Republic to easily meet its commitments under the Kyoto Protocol. After the Czech Republic became a member of the European Union in 2004, however, it became necessary to transpose into Czech legislation a number of EC instruments affecting GHG emissions. In relation to the commitment for the post-Kyoto period, the current system of policies and measures is inadequate for attaining further emissions reductions.

TRENDS IN GREENHOUSE GAS EMISSIONS

GHG emissions decreased substantially in the Czech Republic in the 1990s, thanks to industry restructuring following the disintegration of the centrally planned economy. CO_2 emissions declined by over 20% from 1990 to 2007 (Figure 7).

Figure 7. CO_2 emissions by fuel*, 1973 to 2008

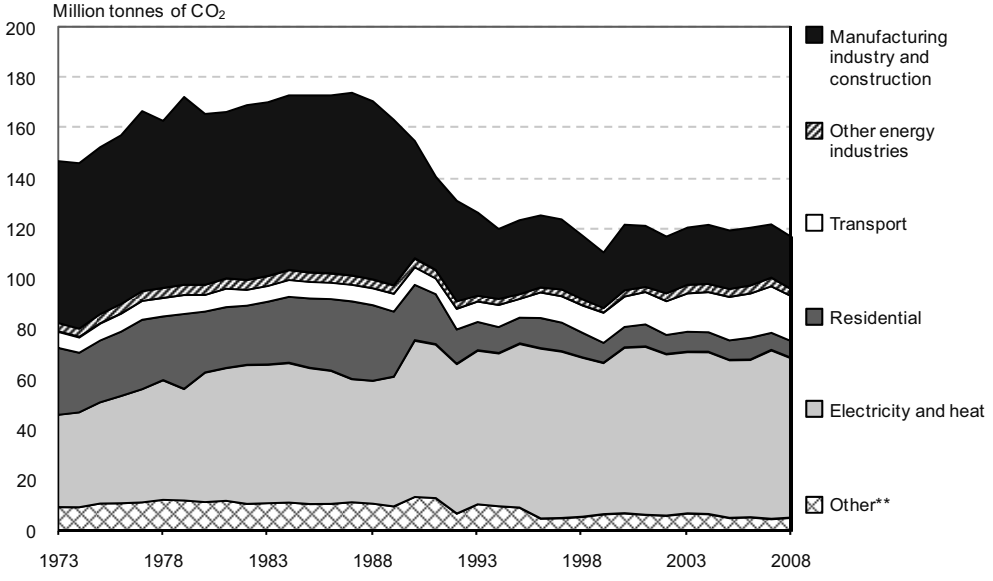


* Estimated using the IPCC Sectoral Approach.

** *Other* includes industrial waste and non-renewable municipal waste (negligible).

Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2009.

Figure 8. CO_2 emissions by sector*, 1973 to 2008



* Estimated using the IPCC Sectoral Approach.

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

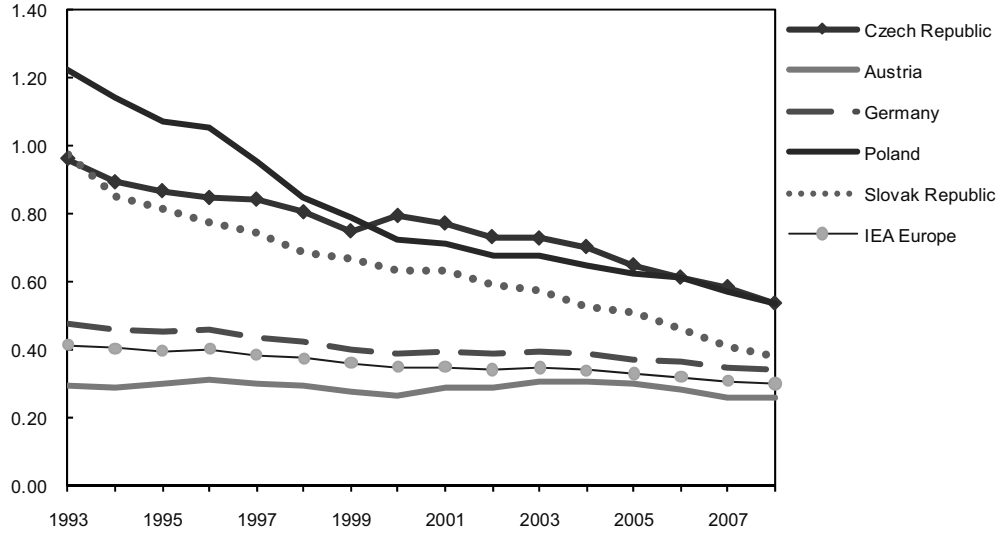
Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2009.

After dropping substantially in the early 1990s, CO_2 emissions in the industry sector have levelled off. Emissions in the power generation sector have been rather stable since the early 1990s but their share in overall emissions has risen. This is due to the high share of coal use, nearly 60% in 2008. In 1990, CO_2 emissions from transport corresponded to some 6% of total emissions of carbon dioxide. They have risen by 157% from 1990 to 2007, when their share in total emissions climbed above 14%. Cutting emissions in this sector is a priority for the Czech government.

CO_2 emissions per GDP are very high in the Czech Republic compared with other IEA member countries (Figure 9). Although reduced by over 40% from 1990 to 2007, CO_2 emissions per unit of GDP are still the second-highest in the IEA after Australia. Per-capita emissions were 11.83 tonnes in 2007.

Figure 9. Energy-related CO_2 emissions per GDP in the Czech Republic and in other selected IEA member countries, 1993 to 2008

(tonnes of CO_2 emissions per thousand USD/GDP using 2000 prices and purchasing power parities)



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2009 and *National Accounts of OECD Countries*, OECD Paris, 2009.

GREENHOUSE GAS EMISSION PROJECTIONS

The latest emission projections submitted by the Czech Republic to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat present three different scenarios based on a number of GHG reduction measures:

- projections without measures (WOM);
- projections with measures (WM);
- projections with additional measures (WAM).

The additional measures in the WAM scenario are mainly:

- the Green Investment Scheme (funded by revenue from the sale of AAUs);

- measures to meet the requirements in the EU Energy and Climate Package (both EU-ETS and non-ETS sectors);
- EU regulations on emission standards for new passenger cars.

The Czech government considers these measures to be adequate to meet the required reductions in the WAM scenario. In the WOM scenario, total emissions decline to 143 Mt CO_2-eq in 2020, or by some 2% compared with the level in 2005. In the WAM scenario, which includes the policies in the draft Climate Protection Policy, GHG emissions in 2020 are reduced by 38 million tonnes of CO_2-eq below the 2005 level (Table 2). Reductions in emissions in the electricity and heat generation sector, achieved through greater use of renewable energy sources, nuclear and natural gas, account for over half, 21 Mt, of the total reduction. The replacement of coal-fired generation by the planned new unit at the Temelín nuclear power station accounts for more than 8 Mt of the total reduction, while construction of three 440 MW steam-gas plants reduces emissions by 4.2 Mt.

Emissions are reduced by a further 6 Mt through lowering energy intensity in buildings and greater penetration of energy-saving appliances and lighting. Efficiency improvements in the industry sector reduce emissions by an additional 4 Mt, while those in the transport sector contribute another 2 Mt. Afforestation of unused agricultural land and other measures in the agricultural sector, such as binding carbon in arable land, lead to a further reduction of 5 Mt.

Table 2. Summary of greenhouse gas projections
(Mt CO_2-eq)

	2005	2010	2015	2020	% change 2020/2005
Without measures	146	147	148	143	-2
With measures	146	138	127	123	-16
With additional measures	146	132	112	108	-26

Source: Ministry of the Environment.

EU EMISSIONS TRADING SCHEME AND NATIONAL ALLOCATION PLANS

In January 2005, the EU launched its Emissions Trading Scheme (EU-ETS), a mandatory cap-and-trade programme to cap CO_2 emissions from the power sector and several industries in Europe. While not directly linked to the UNFCCC and the Kyoto Protocol, the EU-ETS constitutes a cornerstone of the EU's strategy to meet the Kyoto commitment. The first phase of the scheme, intended as a pilot phase, ran from 2005 to 2007. The second phase corresponds to the first commitment period of the Kyoto Protocol, and covers 2008-2012. The EU-ETS limits the amount of CO_2 emissions from installations mostly in six energy-intensive industries: power and heat; iron and steel; cement and lime; glass and ceramic construction materials; pulp and paper; and oil refining. Each installation is allocated emission allowances and must hold allowances to cover its total CO_2 emissions. If its emissions are higher than expected, it can purchase more allowances on the allowance market to avoid a penalty. If it needs fewer allowances than it holds, it can sell them or bank them for future use (from 2008 onward). Allocation in the first two phases of the EU-ETS is based on a National Allocation Plan (NAP) that is prepared by the Czech government and approved by the EU Commission.

A review of the ETS Directive initiated as part of the Energy and Climate Package led to significant changes to the system, starting with phase 3, from 2013 to 2020. An EU-wide cap was adopted, which gradually falls to a GHG emissions level of 21% below 2005 levels by 2020. Allocation rules were harmonised, with a focus on auctioning, and access to flexibility was ensured by enabling banking and clarifying the use of international offsets. All these rules have created considerable certainty up to 2020 in the EU carbon market. The changes for the post-Kyoto period imply that no more individual national allocation plans will be prepared after 2012.

In the first phase, 355 installations were covered by the EU-ETS in the Czech Republic. Emissions were very unevenly divided among these installations: 43.4% of the total number of installations emitted only 0.69% of total emissions. The number of allowances, some 97.1 million per year, allocated among the monitored sources in the 2005–2007 period (NAP 1) was substantially higher than the reported emissions (Table 3). The Czech government estimates that emissions from installations included in the EU-ETS were reduced by 3 to 5 Mt CO_2 in 2005, when the price of allowances was about EUR 20 per tonne of CO_2. In the next two years, the reduction was only some 0.5 to 1 Mt CO_2 per year, as the price plunged below EUR 1/tCO_2 during 2007. According to the Czech government, the main benefit of the first trading period was the learning aspect, namely how to implement the administratively complicated allocation of allowances, the monitoring, verification and reporting of emissions, the establishment of individual accounts for transactions, and the connection of the national system to the global carbon market.

Table 3. Actual and allocated emissions in the National Allocation Plan 1, 2005-2007
(tonnes of CO_2)

Plants	2005	%	2006	%	2007	%	NAP I allocation 2005-2007
Combustion	59 084 881	71.13	59 333 423	70.34	61 949 438	70.72	67 225 264
Refineries	996 971	1.20	1 105 483	1.31	1 094 932	1.25	1 370 498
Chemical industry	4 692 213	5.65	4 704 251	5.58	4 402 823	5.03	5 574 288
Coke ovens	238 046	0.29	246 875	0.29	234 773	0.27	249 827
Iron and steel	12 225 291	14.72	12 971 180	15.38	13 367 876	15.26	15 455 479
Cement	2 553 038	3.07	2 796 427	3.31	3 218 704	3.67	3 047 260
Lime	1 008 137	1.21	1 029 858	1.22	1 116 799	1.27	1 341 085
Glass	782 407	0.94	766 949	0.91	747 936	0.85	827 848
Ceramics	720 843	0.87	688 069	0.82	728 003	0.83	808 166
Pulp	451 292	0.54	419 333	0.50	450 040	0.51	734 908
Paper	307 316	0.37	295 013	0.35	286 740	0.33	465 375
Total	**83 060 435**	**100.00**	**84 356 861**	**100.00**	**87 598 064**	**100.00**	**97 100 000**

Source: Ministry of the Environment.

Studies on the behaviour of operators during the 2005–2007 period indicated that the operators of small sources did not take advantage of the trading system because of lack of know-how and high per-unit transaction costs. Consequently, the Czech government is considering removing small sources (<25 kilotonnes per year) from the EU-ETS system after the end of the second trading period (2008–2012) and including them in a national programme to reduce emissions.

Four hundred installations were covered by EU-ETS in NAP 2 in the Czech Republic, emitting just over 60% of CO_2 emissions. Only 137 of these installations reported annual verified emissions over 25 kt CO_2. The remaining installations covered are small emitters with aggregate emissions amounting to only 2.6% of the total EU-ETS emissions. In 2008, enterprises included in the EU-ETS discharged 80.4 Mt of CO_2. The Czech Republic has been allocated 86.8 million allowances per year in the NAP 2 period. However, on 8 December 2006 the Czech government submitted to the Commission a NAP 2 for a total amount of 101.9 million allowances a year. The European Commission declared over 15 million allowances to be incompatible with Directive 2003/87/EC of the European Parliament and of the Council establishing a scheme for greenhouse gas emission allowance trading. On 5 June 2007 the Czech Republic brought action against the Commission on the grounds that the Commission's decision of 26 March 2007 concerning the National Allocation Plan was invalid. A ruling on this case was still pending at the time of writing this review.

JOINT IMPLEMENTATION PROJECTS

Joint implementation allows an Annex B Party with an emissions reduction commitment under the Kyoto Protocol to earn emissions reduction units (ERUs) from an emissions reduction or emissions removal project in another Annex B Party, each equivalent to one tonne of CO_2, which can be counted towards meeting its Kyoto target. In May 2009 a total of 42 joint implementation projects were approved for the Kyoto commitment period 2008-2012 in the Czech Republic. These projects will generate approximately 0.7 million ERUs/year during this period (Table 4).

Table 4. Approved joint implementation projects in the Czech Republic

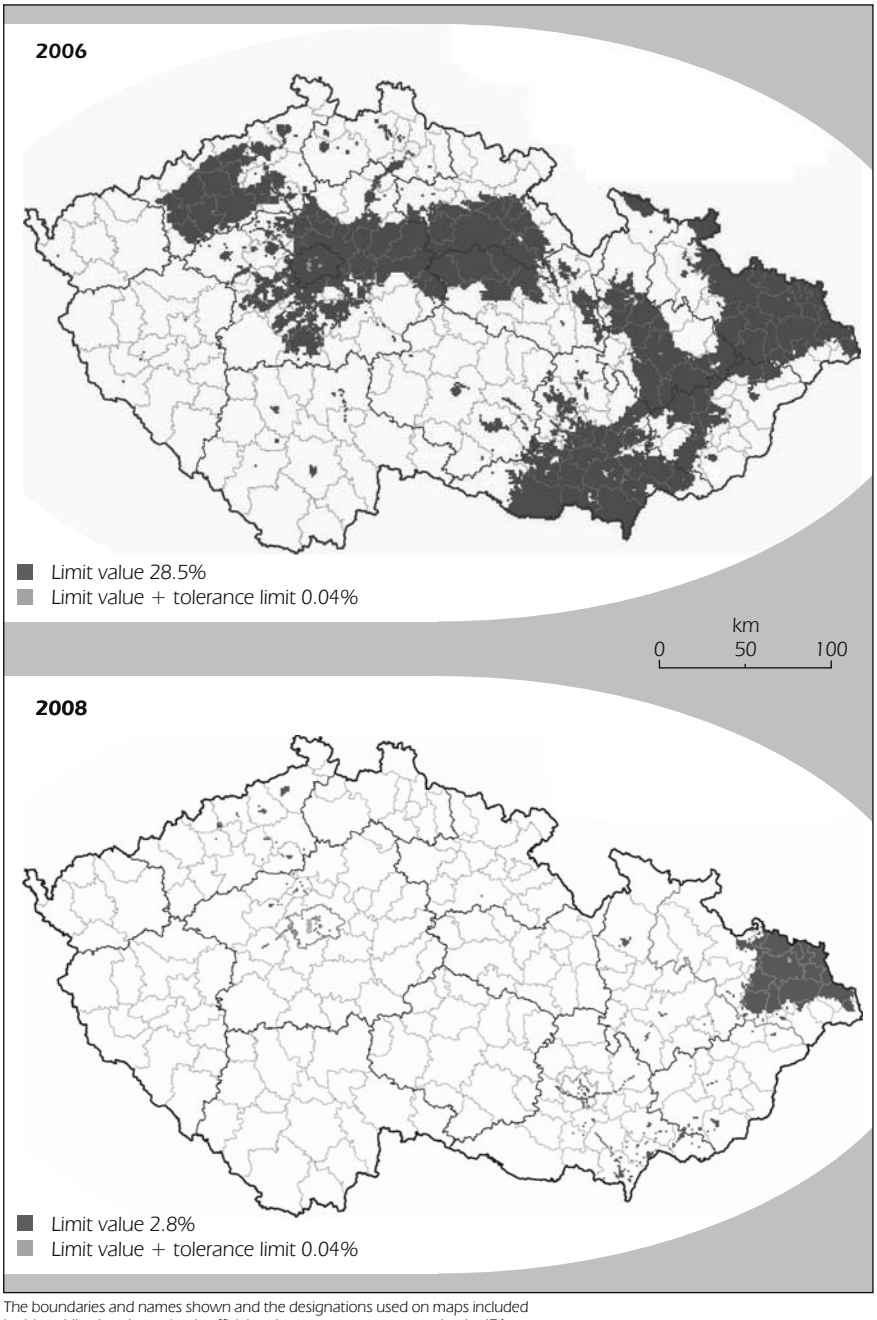
	Number of projects	ERUs/year
Small hydropower	17	67 076
Biomass	14	254 096
Industrial processes nitrous oxide destruction	1	175 500
Fuel-switching (coal to gas)	2	28 200
Landfill gas utilisation	8	148 807
Total	**42**	**715 678**

Source: Ministry of the Environment.

LOCAL AIR POLLUTION

The most polluted areas in the Czech Republic are the Moravian-Silesian region (mainly the Ostrava and Karviná areas), the Central Bohemian region and Prague, the city of Brno and the Olomoucký and Ústecký regions. The government has taken measures since the late 1990s to reduce emissions of sulphur dioxides, nitrogen oxides and volatile organic compounds from large combustion plants. Air pollution is however still a serious concern.

Figure 10. Areas with air quality below health protection limit values in 2006 and 2008



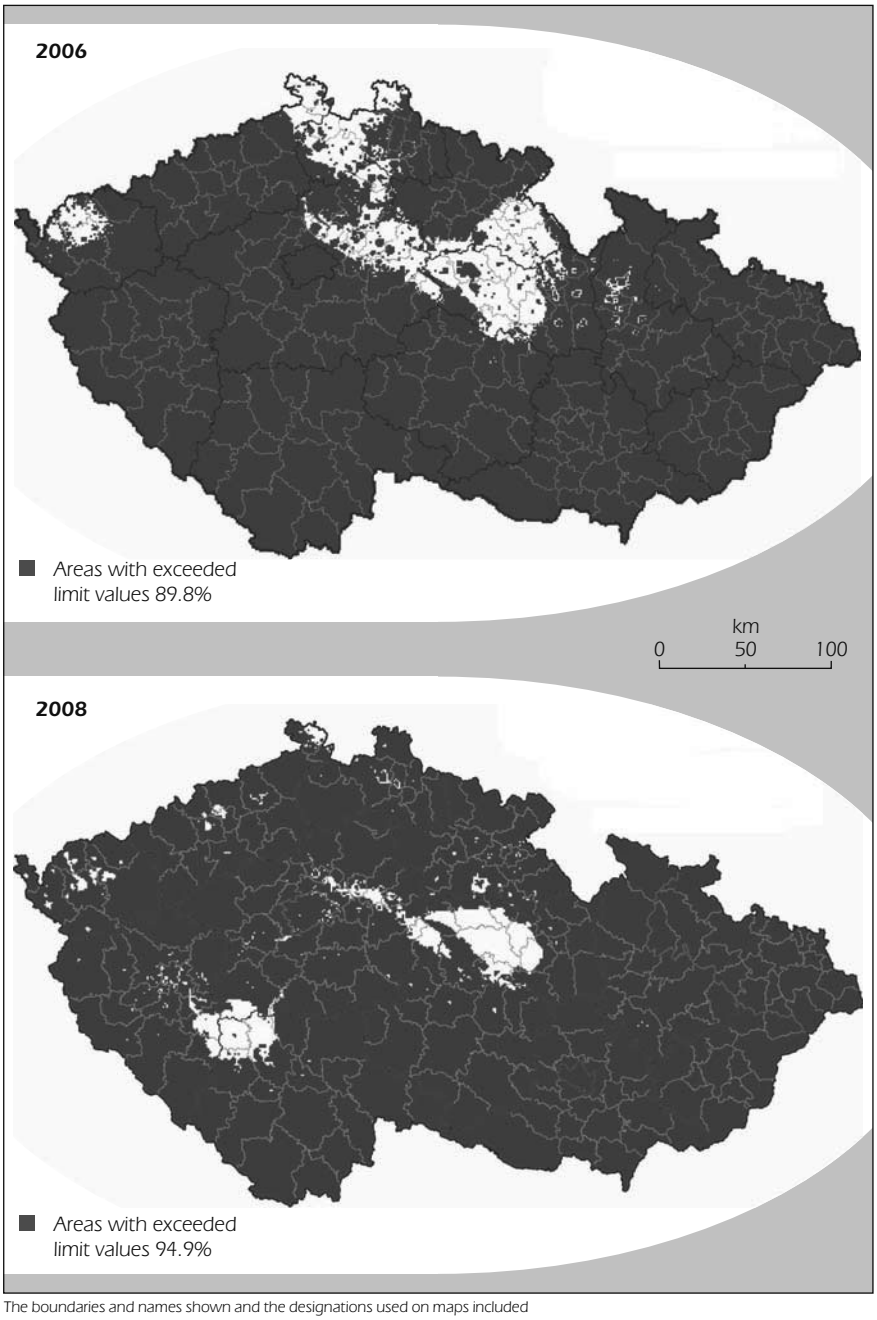
The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: CHMI.

The principal air quality issue in the Czech Republic is pollution from suspended particles PM_{10}. In 2006 the 24-hour average concentration of PM_{10} exceeded EU limits in 29% of the Czech territory. More than 66% of the population lived in areas where PM_{10} concentrations exceeded these limits. In 2007 and 2008, the area with higher concentrations shrank thanks to favourable meteorological conditions (Figure 10).

In connection with excess values for PM_{10} in large areas of the Czech Republic, the European Commission has started proceedings for non-compliance with Article No. 10 of the Treaty establishing the European Community.

Figure 11. Areas with air quality excessively below health protection limit values in 2006 and 2008, including ground-level ozone



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: CHMI.

The limits for ground-level ozone set for the protection of human health and of ecosystems and vegetation were exceeded almost everywhere in the Czech Republic in 2006 and 2008 (Figure 11).

According to EU Directive 2008/50/EC, member states have to meet the new limit values for suspended particles $PM_{2.5}$ by 2015. The Czech Republic will have difficulty reaching the limits without taking appropriate measures. As a step to remedy the air quality situation, the government set up the Green Investment Scheme which aims, in part, to improve air quality through replacing coal, oil and lignite boilers.

Air Quality Plans have been set up since 2004. They outline concrete measures at the regional level to improve air quality in affected areas, timetables for implementation of these measures, possible financial sources and indicators for the assessment of the plans. These plans were updated in 2006 and a second update commenced in 2009. Plans have to be updated at least once every three years according to the Air Quality Act No. 86/2002 Coll. Plans are set up in accordance with Directive 2008/50/ES (Art. 23).

The Czech Republic has also short-term action plans in place to respond to high pollution levels caused by meteorological conditions.

In 2007, the Czech government adopted Government Order No. 630, which includes the National Emissions Reduction Programme. This document contains measures at national level for the improvement of air quality and timely meeting of the national emission ceilings. The Ministry of the Environment is drafting a new air quality act which should come into force in 2011.

CRITIQUE

According to the Kyoto Protocol, the Czech Republic is committed to reduce its emissions of greenhouse gases by 8% below 1990 levels by 2008–2012. In 2007, GHG emissions were down by almost 22% from 1990 levels, so the Czech Republic is likely to meet its commitments. These emissions reductions will provide the Czech Republic with a significant surplus of tradable emission allowances in the first commitment period of the Kyoto Protocol. The Czech government should be commended for reinvesting the profits resulting from the use of the Kyoto Protocol's flexible mechanisms in measures under the Green Investment Scheme, aiming at further reducing GHG emissions.

However, it is noted with concern that the Green Investment Scheme, and other programmes as well, is exclusively used to provide state financial support in the form of investment grants, even for investments that are cost-effective despite high upfront costs. Another concern is that measures to reduce GHG emissions, such as the installation of solar panels, could obtain investment support from more than one government programme. Cost-effectiveness could be improved if the most appropriate financing instrument, for example loans, tax relief and guarantees, was chosen for each kind of measure to be promoted, after an assessment of specific financing conditions. Cost-effectiveness could be further improved by avoiding overlapping of policies and measures.

Monitoring and data gathering have improved significantly since the last in-depth review but there is still need for enhanced co-operation between various government departments.

Despite the significant drop in GHG emissions since 1990, per-capita emissions in the Czech Republic are still higher than the EU average, and much higher than the global average. Hence more could be done to reduce emissions. The allocation of emission allowances to Czech heat and power generation installations in the EU Emissions Trading Scheme (EU-ETS) may be too high to encourage taking measures to reduce CO_2 emissions in the energy sector up to 2020. In fact, it also reduces incentives for energy efficiency and fuel-switching in the heat and power generation sector. Additional policy measures could be taken to encourage energy efficiency and emissions reductions in the heat and power generation sector. In this case it will be important to ensure that such measures do not reduce the cost-effectiveness of the overall energy and climate policy.

With regard to mid-term climate strategies, the current portfolio of policies and measures seems to overlap in some sectors and to be missing in others. The EU Energy and Climate Package establishes a differentiation between the sectors included in the EU-ETS and those that are not. A similar approach has been taken in the Czech Energy and Climate Policy up to 2020. This enhances transparency and facilitates coherence. In a long-term perspective to 2050, an economy-wide climate target should be set, alongside an economic development strategy coherent with the target, in order to guide a coherent mid- and long-term energy and climate policy.

The EU target to reduce GHG emissions by 20% by 2020 compared to 1990 implies that emissions in the non-ETS sector of the Czech Republic can increase by no more than 9% by 2020 compared to 2005. A mid-term target for the non-ETS sector should however reflect that the EU has an ambition to increase its emissions reduction target to 30%. More importantly, the estimated technical and economic potential for emissions reductions in the non-ETS sector is substantial.

Unrestricted emissions of small particles from combustion installations for domestic heating and road transport vehicles contribute to poor air quality in several regions of the Czech Republic. The Czech government should be commended for drafting a new air quality act to improve the effectiveness of air quality protection.

RECOMMENDATIONS

The government of the Czech Republic should:

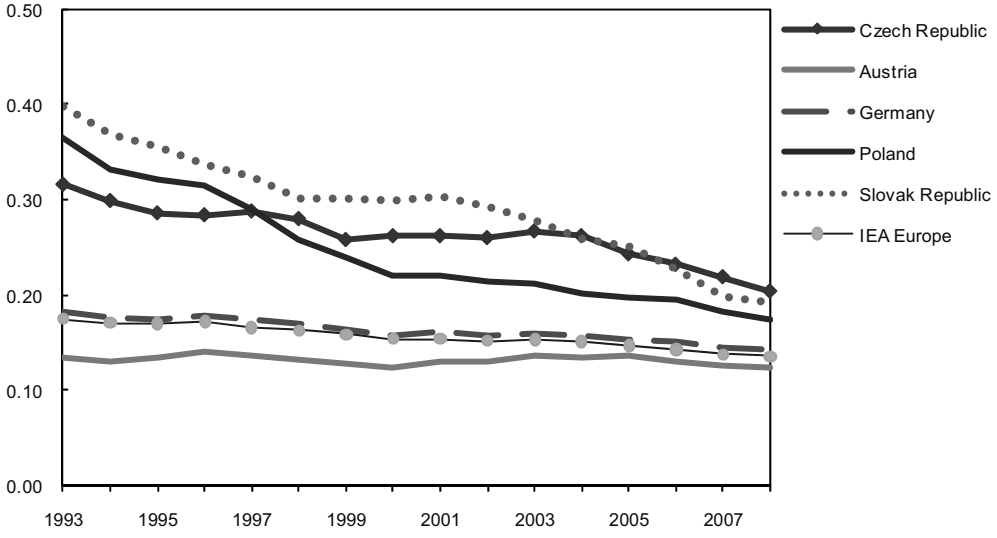
- ☐ *Utilise revenues from the use of flexible mechanisms under the Kyoto Protocol to encourage, in a cost-effective manner, measures to further reduce greenhouse gas emissions.*
- ☐ *Establish separate but co-ordinated GHG emissions reduction strategies and targets for both the EU-ETS and the non-ETS sectors.*
- ☐ *Consider cost-effectiveness in the design and implementation of strategic and co-ordinated policies and measures to reduce greenhouse gas emissions in different sectors.*
- ☐ *Take targeted measures to increase awareness and knowledge among different actors – particularly households, small and medium-sized industrial enterprises and the tertiary sector – about measures to reduce their energy use and greenhouse gas emissions.*

4. ENERGY EFFICIENCY

ENERGY INTENSITY

In 2008, aggregate energy intensity, as measured by a ratio of TPES in tonnes of oil equivalent (toe) over GDP, was 0.2 toe per 1 000 USD[12] in the Czech Republic, higher than the average 0.14 toe per 1 000 USD among all IEA countries. In 2008, TPES per capita was 4.28 toe, less than the IEA average but more than the average among IEA European countries. Figure 12 compares energy intensity in the Czech Republic to the IEA European average and other European countries.

Figure 12. Energy intensity in the Czech Republic and in other selected IEA member countries, 1993 to 2008
(toe per thousand USD at 2000 prices and purchasing power parities)



Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2009 and *National Accounts of OECD Countries*, OECD Paris, 2009.

Energy intensity, adjusted for power purchase parity (PPP), declined on average by 2.5% per year from 1990 to 2008. This is a faster decline than the average among all IEA member countries, 1.5%, over the same period.

12. In thousands US dollars at year 2000 prices and purchasing power parities.

ENERGY EFFICIENCY POLICIES

Energy efficiency policy in the Czech Republic is guided by EU directives and non-binding goals. The Directive on Energy End-Use Efficiency and Energy Services (2006/32/EC) contains an indicative national energy savings target of 9% up to 2016, to be reached by way of energy efficiency improvement measures in the sectors that are not part of the EU-ETS. The reduction is calculated against the annual average TFC in the non-ETS sectors over the most recent five-year period previous to 2008 for which official data are available. The Directive on the Energy Performance of Buildings (EPBD, 2002/91/EC) sets requirements for energy efficiency in building codes.

As of January 2009, the EPBD had been fully implemented in the Czech Republic, including provisions on mandatory energy performance certificates for both new and existing buildings and penalties for non-compliance.

Over the longer term, the Directive Establishing a Framework for the Setting of Ecodesign Requirements for Energy-Related Products (2009/125/EC) will improve the energy efficiency of all new products outside the transport sector. The EU-ETS has an indirect effect on energy efficiency in heavy industry and in the heat and power sector. Under the EU Energy and Climate Package, EU27 countries are required to reduce energy consumption by 20% by 2020 through energy efficiency policies and measures.

Since the last in-depth review, the Czech government has enacted new legislation aiming to enhance energy efficiency, specifically in the buildings sector. The main legislation is:

- Decree No. 148/2007 Coll., on the Energy Performance of Buildings that provides the method for evaluating energy performance and the content of energy performance certificates;
- Decree No. 276/2007 Coll., on the Control of Heating Systems that specifies the frequency, range and method of controls on boilers with capacity between 20 and 200 W;
- Decree No 277/2007 Coll., on the Control of Air Conditioning Systems that specifies the frequency, range and method of controls on these systems.

Several programmes offer investment assistance, training and energy management support to enterprises. This support is combined with mandatory energy audits and reporting, leading to a well-integrated approach. The Czech Republic also has programmes which specifically aim to facilitate energy efficiency and renewable energy investments in small and medium-sized enterprises (SMEs). Energy audits for SMEs are also supported. The Czech government financed the creation of the energy services company, EkoWATT, in 1990. EkoWATT is a non-governmental organisation that provides consulting, analysis, audits and surveys for a wide variety of both private and public actors.

NATIONAL ENERGY EFFICIENCY ACTION PLAN

In its National Energy Efficiency Action Plan (EEAP) 2008-2016, the Czech Republic committed to a 1% national energy savings target in 2010 and a 9% target in 2016. Overall attainable energy savings amount to 19 842 GWh, divided between five sectors (households, services, industry, transport, agriculture). Approximately 30% of savings are

to be achieved in the buildings sector, followed by the industrial and transport sectors (24% and 23% respectively).

Legislation is being prepared to set statutory energy audits for buildings, energy performance certificates, periodic inspections of heating systems, periodic inspections of air-conditioning systems, energy labelling of household appliances, taxation of energy commodities and energy services and information to end-users.

The Energy Efficiency Action Plan categorises energy-saving measures according to fuel (solid, liquid, gas) and energy (electricity and heat) across the various sectors. Measures by sector include:

Household sector

- Minimum requirements regulating energy demands of new and reconstructed buildings.
- Energy audits of buildings.
- Building energy passports (being prepared for 2009).
- Energy labelling of household appliances and Eco-design Directive.
- Provision of energy services and information, through training, workshops, energy agencies and consultation centres.
- Support for energy efficiency and renewable energy activities through Intelligent Energy Europe.
- Investment support for refurbishment of prefabricated buildings.
- Support for local utilisation of renewable sources for heat generation.

Services sector

- Minimum requirements regulating energy demands of new and reconstructed buildings.
- Investment support for energy conservation measures in buildings and technological processes.
- Support for local utilisation of renewable sources for heat generation.
- Energy audits of buildings.
- Building energy passports (being prepared for 2009).
- Periodic verifications of boilers and air-conditioning equipment (for 2008 and 2009).
- Energy labelling of household appliances and Eco-design Directive.
- Provision of energy services and information, through training, workshops, energy agencies and consultation centres.

Industry

- Minimum requirements regulating energy demands for new and reconstructed buildings.

- Requirements for minimum efficiency during generation of electricity and heat.
- Investment support for energy conservation measures in buildings and technological processes.
- Research and development in energy conservation.
- Support for energy efficiency and renewable energy activities through Intelligent Energy Europe.

Transport

- Investment support for construction of facilities for combined transport.
- Investment support for the modernisation of equipment and infrastructure in rail transport.
- Research and development in energy conservation.
- Agriculture.
- Minimum requirements regulating energy demand of new and reconstructed buildings.
- Support for decentralisation of energy generation in agriculture.

GREEN INVESTMENT SCHEME

The Green Investment Scheme (*i.e.* the Greenlight to Savings in the Czech Republic) came into force in April 2009 and was reformed in August 2009. It provides subsidies and grants for energy-saving measures in the buildings sector; CZK 25 billion (EUR 0.95 billion)[13] was allocated to fund this scheme over 2009-2012. Some CZK 10 billion (EUR 0.38 billion) was disbursed in 2009.

This scheme provides households with grants of up to half the cost of insulating their homes. It also provides grants to enable new construction to meet passive house standards, as well as for the installation of heating equipment using renewable energy sources. Improvement measures must result in specific annual heat savings to qualify. A bonus is provided when insulation (full or partial) or new construction is combined with the installation of heating equipment using renewable energy sources, or if more than one equipment using renewable energy sources is installed in the new construction. The bonus is CZK 20 000 (EUR 756) for single homes and CZK 50 000 (EUR 1 890) for apartments.

For full insulation, the subsidy is paid per square metre of floor area, and will vary depending on the type of building and the specific annual heat level achieved. For family houses, achieving heating consumption of 70 kWh/m^2/year after renovation results in a subsidy of CZK 1 550/m^2 (EUR 58.6/m^2), increasing to CZK 2 200 (EUR 83.2) for houses consuming 40 kWh/m^2/year. For apartments, the minimum standard to reach is 55 kWh/m^2/year, benefiting from a subsidy of CZK 1 050/m^2 (EUR 39.7/m^2). A subsidy of CZK 1 550/m^2 (EUR 58.6/m^2) is offered for apartments consuming 30 kWh/m^2/year.

13. Throughout the book, on average in 2009, CZK 1 = EUR 0.038.

For partial insulation, specific U-values[14] are required for the various components being insulated, such as outer walls, roofs and ceilings, as well as for the replacement of windows. Forced ventilation with waste-heat recuperation systems must meet minimum efficiency levels. At a minimum, partial insulation measures must result in a reduction of specific annual heating needs of 20%. At this level of saving, the subsidy provided is of CZK 650/m^2 (EUR 24.6/m^2). This increases to CZK 850/m^2 (EUR 32.1/m^2) when the reduction is 30%.

Specific efficiency standards are also required for the replacement of boilers with low-emission biomass boilers or heat pumps. For the installation of biomass sources and heat pumps in new constructions, as of 1 January 2011, the specific annual heat needs for space heating cannot exceed 55 kWh/m^2/year of floor area. In addition, the subsidy recipient must pledge to operate and maintain the equipment for a period of 15 years. Subsidies for biomass boilers and heat pumps range from CZK 50 000 to 90 000 (EUR 1 890 to 3 400) depending on the equipment's specific characteristics.

The government has set aside funds to evaluate the impact on energy consumption for heating after the current programme ends in 2012. This evaluation will lead to proposing a new programme and/or other measures.

COMBINED HEAT AND POWER

The Czech Republic has a long-standing tradition of using combined heat and power generation. All directives of the European Parliament and Council concerning this technology have been transposed into Czech legislation.

An amendment to the Energy Act published under number 158/2009 Coll., which defines highly efficient heat and power generation (CHP) is in force. The Act has been followed by several decrees, of which the Commission Decision of 21 December 2006, laying down harmonised efficiency reference values for the separate production of electricity and heat while using Directive 2004/8/EC on the promotion of co-generation. The Commission Decision of 19 November 2008 sets out detailed guidelines for the implementation and application of Annex II of this directive.

Among the priorities of the Czech Republic included in the updated draft State Energy Concept 2009 is the continued preferential use of CHP, because energy conversion efficiency is about twice as high as separate production of electricity and heat. Heat and electricity co-generated at coal-fired plants are used in about 80% of the buildings in large cities. Thus, in addition to the heat production, there is the "extra" production of about 10 terawatt-hour (TWh) of electricity, which, according to the Czech government, is equivalent to saving about 10 million tonnes (Mt) of lower-quality brown coal.

Additional savings have also been obtained by using co-generation technologies with large and small units using natural gas, secondary gases and renewable sources, *e.g.* biomass, biogas and waste.

14. The U-value represents the rate of heat loss, *i.e.* how much energy passes through one square metre of a material by a difference of one degree in temperature. It is measured in watts (W) per degree Kelvin (K) per square metre.

DRAFT STATE ENERGY CONCEPT

In the updated draft State Energy Concept 2009, improving energy efficiency, particularly in the buildings sector, is one of the strategic priorities for the Czech energy sector. This will be achieved through higher penetration of energy-saving appliances; setting stringent minimum efficiency targets for boilers and other equipment; increasing the efficiency of energy distribution; mandating higher standards for energy performance in buildings; supporting the development of more efficient combined heat and power generation; stringent energy auditing; more efficient power generation; and the introduction of smart grids. Specific targets include:

- reduce overall energy intensity by 40% by 2020 and by 55% by 2030, relative to the 2005 level;
- increase the thermal insulation in apartment blocks so that energy consumption for heating is reduced by 30% by 2030, relative to the 2005 level;
- ensure that all new buildings constructed after 2020 be low-energy;
- by 2030, increase the share of rail in total freight transport to 40% (from 25% in 2007) and in total passenger transport to 30% (from 26% in 2007), through specific targets for energy consumption per freight- and passenger-kilometre;
- ensure the share of heat from CHP in overall heat consumption is at least 40%.

IMPLEMENTATION

Implementation of energy efficiency policies and measures is a concern in the Czech Republic, particularly in the transport sector. An IEA study, *Implementing Energy Efficiency Policies: Are IEA Member Countries on Track?*, measures countries' progress with implementing the IEA Energy Efficiency Recommendations which were issued in 2008 (see Box 1 below). In the Czech Republic, none of the recommendations for improving energy efficiency in the transport sector had been even partially implemented in 2008, although there were plans to implement 80% of them. Even in the buildings sector where the EU EPBD has been implemented, only 28% of IEA recommended policies were fully or substantially in place as of March 2009. There remains significant potential to achieve a least-cost, optimum level of energy use in the transport and buildings sectors.

Implementation of policies in the industry sector, however, was more positive, with nearly 65% of policies either fully or substantially implemented.

INSTITUTIONAL FRAMEWORK

The responsibility for initiation, support and realisation of activities related to energy efficiency improvements and energy savings is divided between the Ministry of Industry and Trade and the independent agency CzechInvest replacing the energy efficiency agency, Czech Energy Agency, since December 2007. The budget of CzechInvest is CZK 226.6 million (EUR 8.6 million). CzechInvest is responsible for preparation, realisation and consistent evaluation of the Operational Programmes for Industry and Enterprise and for Enterprise and Innovation. Czechinvest contributes to attracting foreign investment and to developing domestic companies through its services and

development programmes. It also promotes the Czech Republic abroad and acts as an intermediary between the EU and small and medium-sized enterprises in implementing structural funds in the Czech Republic.

CzechInvest is exclusively authorised to file applications for investment support and prepares draft offers for granting investment support. It also provides potential investors with current data and information on the business climate, investment environment and investment opportunities in the Czech Republic. The Ministry of the Environment is responsible for the State Environment Fund which manages the Operational Programmes for Infrastructure and Environment the aim of which is the implementation of the policies and measures in the National Energy Efficiency Action Plan.

CRITIQUE

The government of the Czech Republic has made some progress in implementing the IEA's 2005 in-depth review recommendations for energy efficiency, such as expanding efforts to capture the energy-saving potential of small and medium-sized energy users and enhancing policies to encourage renovation of existing buildings. However, little progress has been made in implementing energy efficiency measures in the transport sector. The IEA estimated in its Energy Efficiency Progress Report that the Czech Republic had fully or partially implemented only 22% of the IEA recommendations on energy efficiency as of 2009 and thus there remains much work to be done.

In its National Energy Efficiency Action Plan (EEAP) 2008-2016, the Czech Republic committed to a 1% national energy savings target in 2010 and a 9% target in 2016. The EEAP provides shares of potential savings by end-use sector as targets. The largest amount of savings is expected to come from the industrial and transport sectors. The Czech government should be commended for setting up a number of national measures (such as the Green Investment Scheme and the promotion of energy service companies, ESCOs) and measures implementing EU legislation (mainly the Energy Performance of Buildings Directive, energy labelling and Eco-design).

Nevertheless, the Czech government could do more to place energy efficiency policy firmly within the broader policy context. It should prioritise resource allocation across the entire energy efficiency portfolio, the absence of which has resulted in a lack of synergy between policies and duplication across sectors. There are no clear responsibilities for implementation and, as a consequence, there are weaknesses in implementation of both national and EU policies. The inter-linkages between the measures and the expected savings should be more clearly described. Public awareness of the benefits of energy efficiency also needs to be strengthened, as better informed consumers can be drivers of change. Thus, the realism of attaining the 9% savings target in 2016 is questionable.

The Czech government is commended for having made energy audits mandatory for public buildings since 2001, as well as energy labelling for new buildings. However, certification lags behind for the existing building stock. Certification of new buildings and businesses has been more successful. More follow-up and co-ordination with industry associations are needed. Some 30% of the Czech population lives in apartment blocks. Renovating these buildings is often problematic because there is no consensus among dwellers to carry out the needed efficiency improvements. Residents consider the return

on energy-efficient investments to be too small and the government does not provide enough incentives to reduce the upfront costs.

The transport sector represents the biggest challenge to improving energy efficiency. Energy use and emissions in this sector are growing and show no signs of decline. The average age of passenger vehicles is estimated to be 14 years. The EU regulation on CO_2 emissions from passenger cars will improve the fuel efficiency of new cars; however, complementary measures such as fiscal measures aligned with vehicle labelling are needed to promote the most efficient vehicles. A modal shift is needed to reduce road transport for passengers and freight. Investments and incentives are required to change behaviour in this regard. The transport sector is singled out in the draft State Energy Concept as a priority sector, which is a positive development. The main objectives are to expand mass transit and provide incentives to reduce road traffic (for example by working from home) in the short term and to diversify the fuel and technology mix over the longer term. Improving efficiency and reducing emissions in this sector is difficult for all IEA member countries, but greater attention should be paid to prioritising policies and their implementation.

As in most countries, measures to increase energy efficiency in electricity and heat supply and demand have been identified as low or even "negative" cost measures to reduce GHG emissions in the Czech Republic. Moreover, as is also the case in other countries, several of these low-cost measures are not implemented, although they would be profitable.

Among the more important barriers to the implementation of energy efficiency measures that have been identified are the lack of knowledge, data and information in the area of efficient energy use, especially in households, the service sector and small and medium-sized industrial enterprises.

Lack of co-ordination between the Ministry of Industry and Trade and the Ministry of the Environment has seriously hampered the implementation of energy efficiency policies. As the energy efficiency agency, Czech Energy Agency, was closed at the end of 2007, its duties were transferred to the Ministry of Industry and Trade and to the new agency CzechInvest. It is commendable that the Ministry of the Environment is undertaking an analysis of the cost-effectiveness of the policies and measures included in the Climate Protection Policy (see Chapter 3). Policies should not be evaluated solely on their achievement of climate goals but on other measures of sustainability as well.

Policies targeting appliances, equipment and lighting could benefit from wider implementation. Efficiency standards for stand-by power regulation need to be strengthened. Energy efficiency measures focus on end-use with little attention paid to potential gains in primary energy use. There is great potential for decreasing energy intensity, particularly in heat and power generation, and policies in this area could be strengthened.

RECOMMENDATIONS

The government of the Czech Republic should:

- ☐ *Develop an integrated energy efficiency strategy, addressing both primary and final energy use and improving the co-ordination of different energy efficiency schemes, so as to optimise their effectiveness; identify specific policy measures to achieve*

particular energy-saving targets, empower the responsible institutions, enable sufficient resource allocations and set time-lines for implementation.

- ☐ *Enhance public awareness of the benefits of energy efficiency as a means of improving energy security, saving money and reducing GHG emissions and local air pollution.*
- ☐ *Increase institutional capacity to improve implementation and monitoring of energy efficiency policies, and clearly define and better co-ordinate the respective roles and competencies of government institutions in implementing them.*
- ☐ *Improve data collection in energy efficiency policy so that the inter-linkages between policies and measures and expected savings in each sector can be examined; and assess the costs and benefits of proposed measures, including through consultation and co-ordination with industry.*
- ☐ *Develop a co-ordinated strategy to increase energy efficiency in the transport sector with a robust timetable for implementation.*

Box 1. IEA energy efficiency recommendations

The IEA has prepared a set of energy efficiency policy recommendations covering 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.

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.

Box 1. IEA energy efficiency recommendations (*continued*)

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/yr by 2030. This is equivalent to one-fifth of global energy-related CO_2 emissions in 2030 under the IEA Reference Scenario, in which no new policies are adopted or implemented. Taken together, these measures set out an ambitious road-map for improving energy efficiency on a global scale.

The IEA published its evaluation of the performance of all member countries, including the Czech Republic, in 2009 (available at www.iea.org/w/bookshop/add.aspx?id=368).

PART II
SECTOR ANALYSIS

5. COAL

OVERVIEW

Coal plays an important role in the Czech Republic's energy mix, although less so over the last couple of decades. Coal represented 65% of total primary energy demand in 1990, but less than 50% in 2007. The hard coal and brown coal sectors have been completely privatised, today comprising six companies. There is no financial support for coal production; coal prices are market-determined.

In the updated draft State Energy Concept (SEC) 2009, the Czech government envisages expanding the role of domestic energy sources in the fuel mix. With regard to coal, this strategy would involve removing administrative obstacles to mining in certain areas which are restricted by mining limits (Box 2), prolonging the life of existing mines with modern mining techniques and completing exploration activities in certain localities, including Frenštát. The SEC 2009 also recommends that the government promote preferential use of brown coal for the heating industry.

Box 2: Coal mining limits and mine closures

In 1991, under Government Decrees Nos. 331 and 444 on Territorial Environmental Limits on Mining, mining activities ceased in several coal districts in the Czech Republic. According to the government, these closures occurred because of local opposition to the environmental impacts of mining in these districts. Significant hard coal reserves are blocked from mining in the southern part of the Upper Silesian basin located in the Beskydy Mountains of Northern Moravia. Construction of the Frenštát colliery in this basin started in 1980 but has not been completed. In the Northern Bohemian basin, there are some 900 million tonnes of brown coal reserves which are not accessible owing to the mining limits, mainly at the Důl Československá armády (ČSA) and Bílina collieries. In total, approximately 1.3 billion tonnes of brown coal reserves are off-limits, equal to over 20 years of production at the current level of national output.

The Czech government is financially obliged to remediate the closed mining facilities and to meet the social and health requirements of the unemployed miners. These obligations were transferred to the state-owned enterprises, DIAMO, s. p. and Palivový kombinát Ústí, s. p., which acquired the assets of the closed mining companies. The government provides subsidies to these enterprises. Since the government was responsible for the mine closures, it was not possible to transfer these commitments to mining companies. Payment to the two enterprises, however, cannot be considered as support to the coal mining sector as they are not coal producers. Nevertheless, the government needs to ensure that all coal mining sites are properly restored following cessation of mining activities; in the past the slow pace fomented local opposition.

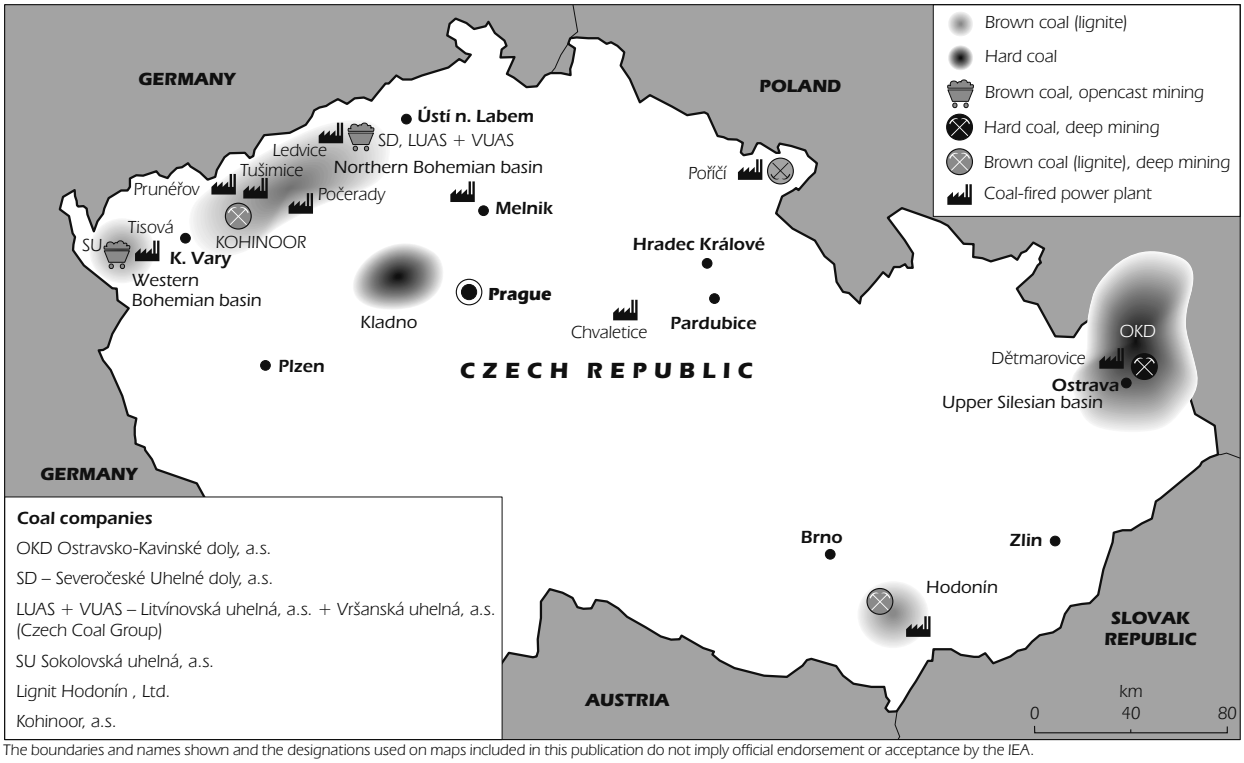
At present, there is increasing pressure to revoke the decrees which limited coal mining. The government acknowledges that if new mines are opened in areas which are currently limited, compensation should be paid by project owners, not the government, in a transparent manner. The updated draft State Energy Concept 2009 calls for the government to rescind the limits to help meet its objective of increasing the use of domestic energy resources.

RESERVES AND PRODUCTION

According to the Czech government, at the end of 2008, there were some 192 million tonnes (Mt) of recoverable hard coal reserves in active mines, approximately 900 Mt of recoverable brown coal and 2 Mt of lignite reserves.[15] Hard coal reserves are located in the Czech part of the Upper Silesian basin in Northern Moravia near the Polish border (Figure 13). Brown coal reserves are extracted in the coal basins located in the valley along the Krušné Hory Mountains in north-western Bohemia.[16]

The Upper Silesian basin, with an area of 6 500 km^2, ranks as one of the largest hard coal basins in Europe. A major part of this basin is located in Poland, while about one-sixth lies in the Czech Republic, in the Ostrava-Karviná area. This is where the company Ostravsko-Karvinské doly a.s. (OKD) extracts hard coal at four mining complexes: Darkov, Karviná, ČSM and Paskov. Longwall working combined with controlled caving is the mining method used. The extracted coal is processed in the preparation plants at each of the complexes.

Figure 13. Coal mines, coal fields and coal-fired power plants



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Sources: Ministry of Industry and Trade, IEA Clean Coal Centre CoalPower5 database and IEA analysis.

Labour productivity at OKD mines is very low. In 2008, over 11 000 people were employed by OKD to produce less than 13 Mt of coal (Table 5). This implies a

15. The German Federal Institute for Geosciences and Natural Resources (Bundesanstalt für Geowissenschaften und Rohstoffe, BGR) reported that in 2009 the Czech Republic had 3 112 Mt of hard coal reserves and 185 Mt of brown coal reserves. It reported additional resources in the country of 21 106 Mt of hard coal and 772 Mt of brown coal, www.bgr.bund.de.
16. In Czech terminology, lignite is a variety of brown coal that exhibits the lowest degree of coalification.

productivity of just 1 110 tonnes (t) per man-year – below what might be expected in an OECD country. The most productive countries outside Europe attain productivity of over 10 000 t/man-year. The coal company claims that the low productivity is a result of long-term contracts with its employees and that the labour force can only be reduced very gradually.

Overall labour productivity in the brown coal sector is higher, as would be expected at the mainly opencast mining sites, but again falls below what is achieved at efficient sites elsewhere, including in Europe.

Table 5. Coal mining companies and other statistics, 2008

	Extractable reserves (Mt)	Production (Mt)	Type and (number of mines)	Calorific value (MJ/kg)	Employees
Brown coal					
Czech Coal Group (LUAS and VUAS)	240	15	O (2)	10-18	6 205
SD	478	22.3	O (2)	11-13	3 517
SU	192	9.7	O (2)	12-13	4 667
Lignit Hodonín, Ltd.	2	0.4	U (1)	8	358
Důl Kohinoor, a. s.	0.9	0.3	U (1)	15	304
Hard coal					
OKD	192	12.7	U (4)	19-36	11 439

Note: LUAS: Litvínovská uhelná, a.s.; VUAS: Vršanská uhelná, a.s.; SD: Severočeské uhelné doly, a.s.; SU: Sokolovská uhelná, a.s.; OKD: Ostravsko-Karvinské doly a.s. U: Underground; O: Opencast.

Source: Ministry of Industry and Trade.

In 2008, the Czech Republic produced 47.5 Mt of brown coal, of which 37.1 Mt were mined in Northern Bohemia.[17] Other coal fields are near the city of Sokolov in Western Bohemia and near the city of Hodonín in Southern Moravia. There are other coal fields in the south of the country but they are not economically viable.

The main brown coal deposit and the largest mining area, covering 1 400 km^2, is the Northern Bohemian coal basin. Brown coal is extracted in this basin at the Československá armády (ČSA) and Vršany surface mines. In 2005, the brown coal mining company Mostecká uhelná (MUS) was acquired by the Czech Coal Group; assets included the two surface mines and Czech Coal a. s., a trader in energy commodities. The Czech Coal Group was restructured in 2008 to improve the efficiency of mining activities and to facilitate development projects. Three new companies were established: Vršanská uhelná, a. s. (VUAS), Litvínovská uhelná, a. s. (LUAS) and Czech Coal Services, a. s. which provides shared services to VUAS and LUAS, and manages all subsidiaries.

The Chomutov-based brown coal company Severočeské uhelné doly, a.s. (SD) has been fully owned by the CEZ Group since 2006. It operates in the north-western part of the Northern Bohemian coal basin. SD extracts brown coal at the Nástup Tušimice and Bílina mines. SD's market share increased in 2007 to almost 50% of the Czech Republic's brown coal production. After preparation at the Tušimice crushing plant, most of the coal is supplied to power stations operated by the ČEZ Group.

17. Carbonnion Bohemia estimates that 45 million tones of brown coal were produced in 2009. The outlook for brown coal production in 2013 is 42 Mt.

In Western Bohemia, the brown coal basin around the town of Sokolov is the third most important brown coal mining area in the Czech Republic. Here the brown coal company Sokolovská uhelná, a.s. (SU) mines and processes lignite from deposits in the western part of the coal field below the Krušné Hory Mountains and operates the Družba and Jiří opencast mines. Brown coal from the Sokolov area is used mainly for power and heat generation. SU generates electricity in two of its own power installations: the Vřesová integrated gasification combined-cycle (IGCC) plant (2 x 200 MW_e) and a combined heat and power (CHP) plant (4 x 270 MW_{th}).

A smaller deposit of some 2 Mt of workable lignite reserves is located in Southern Moravia near the town of Hodonín. Lignite extraction by the company Lignit Hodonín, Ltd. is by mechanised longwall with controlled caving: 97% of the production is delivered to the Hodonín power station and the remainder is used by households.

The underground mining company Důl Kohinoor, a. s. is situated in Northern Bohemia and extracts a limited amount of brown coal.

TRADE

According to recent projections by the Ministry of Industry and Trade, hard coal production in the Czech Republic will decline rapidly after 2020, and the country will become a net importer by 2030. Brown coal production will also decline but not as fast. The country is expected to remain a net exporter of brown coal in the period to 2030.

The Czech Republic imported some 1.1 Mt of hard coal in 2008, predominantly from Poland, although 11% came from the United States. Brown coal imports were negligible. In 2008, an estimated 3.1 Mt of coking coal was exported to the Slovak Republic, Austria, Poland and Hungary, mainly for steel production. Brown coal exports amounted to some 1.5 Mt.

DEMAND

The share of coal in total primary energy supply in 2007 was 46%, down from 65% in 1990. Coal is primarily used for power and heat generation, which accounted for over 70% of total coal demand in 2007. The share of coal in power generation was 60.1% in 2007 and in heat production, 55%. Final consumption of coal is mainly for iron and steel production, although a small proportion is used directly for heating in the residential sector.

The CEZ Group is the largest coal consumer in the Czech Republic and in 2007 accounted for nearly 50% of all coal demand, entirely for power generation. ČEZ supplies more than 70% of electricity demand (see Chapter 9).

COAL-FIRED POWER PLANT EMISSIONS

The EU Large Combustion Plants Directive (LCPD) (2001/80/EC) sets limits for the emissions of sulphur dioxide (SO_2), nitrous oxides (NO_x) and particulates for all new and existing plants with a rated thermal input 50 MW or larger. Limits for existing plants have been in force since January 2008. In addition, all combustion plants with an

installed capacity over 20 MW have to comply with the EU-ETS and surrender emission allowances on an annual basis equal to their CO_2 emissions.

All coal-fired power plants in the Czech Republic that are larger than 50 MW_{th} are compliant with the EU LCPD (Table 7). No plant has opted out of the LCPD and an accession treaty derogation for two boilers expired in 2007. The Czech government has implemented the EU LCPD with a National Emissions Reduction Plan (NERP). Instead of applying emission limit values to individual plants, the NERP limits emissions to an equivalent level, but with flexibility on where emissions reductions are to be made.

Compliance with the EU LCPD is regulated by Art. 2 of Government Decree No. 372/2007 Coll. on the National Programme for Reducing Emissions from Existing Extra-Large Combustion Sources. In case of an exchange of part of the emission caps or even in case of an exchange of part of emission caps among operators, maintaining the values of emission caps is guaranteed. The values are also maintained when an operator meets a common emission cap for each pollutant in two or more operated installations. According to Art. 4 of Government Decree No. 372/2007 Coll., those installations included in a National Emissions Reduction Programme may exchange part of their assigned caps. This may happen only under the condition that the National Emissions Reduction Programme eliminates an installation that took up part of the emission caps of another installation. The part of the emission cap which was taken over has to be returned back for performance to the unit from which it was received. Furthermore, according to the Law on Air Pollution, an operator of two or more installations under a National Emissions Reduction Programme may meet the emission cap, which is the sum of the emission caps set for these units by 1 January 2008 (instead of meeting individual caps for each of these installations). By elimination of an installation from the National Emissions Reduction Programme from existing extra-large combustion units, including its contributions to the group emission targets, these totals will automatically be reduced by the shares of the eliminated unit.

Table 6. Emission caps and actual emissions in 2008
(tonnes per year)

	New group emission caps*	Actual emissions
Sulphur dioxide (SO2)	147 008	112 120
Nitrous oxides (NOx)	127 562	93 380
Dust or solid pollutants	14 487	3 480

*New group emission caps after deduction of emission contributions of eliminated installations.

Source: Ministry of Industry and Trade.

Reducing emissions in small CHP plants (between 20 and 50 MW) has been more challenging, because of the high cost of adding desulphurisation equipment. The government has asked for additional time to comply with the relevant Integrated Pollution Prevention and Control Directive (2008/1/EC).

Table 7. Coal-fired power plants in the Czech Republic, operational in 2010, with status under EC Large Combustion Plants Directive (LCPD), including planned plants

Plant name	Location	Owner	CHP	Capacity, MW	Units, MW (commissioned)	Fuel	LCPD	Notes
Chvaletice	Přelouč, Východní Čechy	ČEZ, a.s.	Yes	800	4 x 200 (1977-78)	sub-bituminous	NERP	FGD (1997)
Dětmarovice	Ostrava, Severni Morava	ČEZ, a.s.	Y	800	4 x 200 (1975-76)	bituminous	NERP	FGD (1998)
Hodonin	Jižni Morava	ČEZ, a.s.	Y	105	1 x 50 (1997) 1 x 55 (1997)	lignite	NERP	CFBC CFBC
Kladno	Central Bohemia	Matra Powerplant Holding B.V. (89%) Středočeská energetika, a.s. (11%)	Y	305	2 x 135 (2000) 1 x 34 (1978)	bituminous, sub-bituminous	NERP	CFBC
Komořany	Most, Ústecký kraj	United Energy, a.s.	Y	239	4 x 32 (1959/58/58/78) 1 x 35 (2006) 1 x 22 (1995) 1 x 34 (1997)	lignite	NERP	
Komořany II	Most, Ústecký kraj		Y			lignite		CFBC
Ledvice II	Teplice, Severni Čechy	ČEZ, a.s.	Y	220	2 x 110 (1966/68)	sub-bituminous	NERP	FGD (1996)
Ledvice III	Teplice, Severni Čechy	ČEZ, a.s.	Y	110	1 x 110 (1998)	sub-bituminous	NERP	CFBC
Ledvice IV	Teplice, Severni Čechy	ČEZ, a.s.			1 x 660	sub-bituminous		planned
Mělnik I	Stredni Čechy	Energotrans, a.s.	Y	352	4 x 60 (1960-61) 2 x 56 (1961)	sub-bituminous	NERP	FGD (1998) FGD (1998)
Mělnik II	Stredni Čechy	ČEZ, a.s.	Y	220	2 x 110 (1971)	sub-bituminous	NERP	FGD (1997)
Mělnik III	Stredni Čechy	ČEZ, a.s.	Y	500	1 x 500 (1980)	sub-bituminous	NERP	FGD (1998)
Mladá Boleslav	Northern Bohemia	RWE Power (21%) OBAG Aktiengesellschaft (21%) Středočeská energetika, a.s. (12%) VW Kraftwerk GmbH (12%) Skoda Auto, a.s. (34%)	Y	88	2 x 44 (1998)	bituminous	NERP	CFBC
Most	Most, Northern Bohemia	Appian Group			1 x 600-800	lignite		planned
Opatovice	Hradec Králové, Eastern Bohemia	Energetický a Průmyslový Holding (J&T Finance Group a.s.)	Y	360	6 x 60 (1959) 1 x 100	sub-bituminous	NERP	FGD (1996-97) planned
Počerady	Louny, Severni Čechy	ČEZ, a.s.	Y	1 000	5 x 200 (1970-77) 1 x 660	sub-bituminous	NERP	FGD (1994-96) planned
Poříčí	Trutnov, Východní Čechy	ČEZ, a.s.	Y	165	1 x 55 (1958) 2 x 55 (1997/98)	bituminous, sub-bituminous (some imported)	NERP	CFBC
Přerov	Olomouc	Dalkia Česká republika a.s.	Y			n.a.	n.a.	n.a.
Prunéřov I	Chomutov, Severni Čechy	ČEZ, a.s.	Y	440	4 x 110 (1967-68)	sub-bituminous	NERP	FGD (1995)
Prunéřov II	Chomutov, Severni Čechy	ČEZ, a.s.	Y	1 050	5 x 210 (1981-82)	sub-bituminous	NERP	FGD (1996)
T700 Chemopetrol	Litvínov, Ústí nad Labem	Chemopetrol, a.s.	Y	109	3 x 25 1 x 28 1 x 6	sub-bituminous	NERP	
Tisová I	Sokolov, Západni Čechy	ČEZ, a.s.	Y	184	3 x 57 1 x 13	sub-bituminous	NERP	CFBC (1996/97)
Tisová II	Sokolov, Západni Čechy	ČEZ, a.s.		112	1 x 112 (1959)	lignite	NERP	FGD (1997)
Třebovice	Ostrava, Northern Moravia	Dalkia Morava, a.s.	Y	152	1 x 50 (1951) 1 x 30 (1961) 1 x 72 (1968)	bituminous	NERP	
Tušimice II	Kadaň, Severni Čechy	ČEZ, a.s.	Y	800	4 x 200 (1974-75)	sub-bituminous	NERP	FGD (1997)
Vřesová I	Sokolov, Western Bohemia	Sokolovská uhelná, a.s.	Y	220	4 x 55 (1966)	lignite	NERP	FGD (2002)
Vřesová II	Sokolov, Western Bohemia	Sokolovská uhelná, a.s.	Y	400	2 x 200 (1995/96)	sub-bituminous	NERP	IGCC (1995/96)

Notes: CFBC – circulating fluidised bed combustion, FGD – flue gas desulphurisation, IGCC – integrated gasification combined cycle, NERP – National Emissions Reduction Programme (under the EU Large Combustion Plants Directive).

Sources: IEA Clean Coal Centre CoalPower5 database and IEA analysis.

CARBON CAPTURE AND STORAGE

The Czech Republic does not have an established carbon capture and storage (CCS) policy. There has been only a handful of publicly funded research projects focused on CCS and participation of Czech companies and research centres in the EC framework programmes continues to be limited. Transposition of relevant EU directives, above all the Directive on the Geological Storage of CO_2 (2009/31/EC), commits the Ministry of the Environment to implement CCS laws and regulations by June 2011.

Potential investment in CCS at the industrial scale is constrained by two factors: limited availability of coal because of the government-imposed limits on coal mining and relatively small storage potential; reflecting the scarcity of suitable sedimentary formations in the Czech Republic.

The utility, ČEZ, studied the possibility of constructing larger-scale demonstration facilities (post-combustion capture) at two of its lignite-burning power plants, using slip-stream of flue gas.

CRITIQUE

Despite ample reserves, possibilities to exploit new coal resources in the Czech Republic are currently limited by the past decision of the government to limit coal mining in several areas. These limits were put in place because of local opposition to the environmental impacts of mining. Approximately 1.3 billion tonnes of brown coal reserves are not accessible because of the binding territorial limits imposed by the government. In the Northern Bohemian basin, some 900 Mt of brown coal reserves are off-limits for ČSA and Bílina collieries. Significant hard coal reserves are blocked from mining in the southern part of the Upper Silesian basin.

Taking into account the importance of the coal industry in the Czech Republic and its long-term contribution to the country's security of supply, there is increasing pressure to revoke the government's decision to limit exploitation of brown coal reserves. Local populations in prospective areas, however, expect the past obligations on mining limits to be respected. Investment in additional brown coal power plants would unlikely be forthcoming unless the mining limits are lifted.

Severočeské uhelné doly, a. s., a mining company owned by the power incumbent ČEZ, mined 22.3 Mt of brown coal in 2008 (47% of brown coal production in the country). This brown coal is used for power generation in ČEZ power stations under long-term contracts. Ensuring a competitive market for brown coal is difficult because mines and adjacent power stations are mutually dependent as brown coal cannot be easily transported over long distances. In practice, competition should be in the electricity market between a number of vertically integrated mining-power companies. Concerning the lifting of territorial limits, the government should be careful to avoid manipulating the sectoral market allocation of coal.

Given the ambitious CO_2 emissions reduction goals agreed by the European Union and the Czech government's plans for coal use in power and heat generation, the country will need to actively pursue the development of sustainable coal technologies. Without reducing the carbon footprint of coal combustion, it will be difficult to meet the desired long-term GHG emissions reduction targets. On the other hand, a switch in the fuel mix

which reduces the share of coal could affect the country's security of supply. The government should seek to expand the deployment of available clean coal technologies.

The government should increase funding for research and development of other sustainable coal technologies, in particular carbon capture and storage (CCS). Given the country's reliance on coal, a CCS policy is necessary. Furthermore, laws and regulations will be required under the EU Directive on CCS. Potential investment in CCS at the industrial scale will depend on future coal availability within the context of a decision on mining limits and on addressing the problem of insufficient CO_2 storage potential. Co-operation with CCS projects in Poland, for example, could address the problem of storage capacity.

RECOMMENDATIONS

The government of the Czech Republic should:

- ☐ *Address the future of the geographical mining limits as soon as possible in order to reassure the local public, provide mining and energy companies with a long-term stable investment environment, and make efforts to avoid involvement in the market allocation of coal supply.*
- ☐ *Monitor the ownership structure of the mining sector so that it remains competitive and efficient, and ensure that a competitive electricity and heat market is maintained.*
- ☐ *Ensure that the use of coal in new installations complies with environmental and climate objectives, and promote the deployment of sustainable coal technologies.*
- ☐ *Develop a policy for carbon capture and storage.*

6. NATURAL GAS

OVERVIEW

The Czech Republic has a relatively small gas market and is almost entirely dependent on imports. Natural gas consumption constituted 16% of total primary energy supply in 2008. The dominance of coal and nuclear has limited the role of gas in the power sector. Gas consumption is expected to increase only moderately in the long term.

Security of gas supply is high on the agenda, in particular after the January 2009 disruption of Russian supplies through Ukraine. Since then, the Czech government has put in place a response plan for dealing with a reduction in gas supplies which relies on co-ordination with industry in order to optimise the use of gas storage and to regulate demand-side measures in a crisis. The Czech Republic has also been working on new interconnections and intends to increase storage capacity.

In line with the liberalisation of the natural gas market under the European Directive 2003/55/EC, each of the vertically integrated companies has been unbundled. RWE Transgas, the dominant importer of natural gas into the Czech Republic, has been split into a transmission system operator, RWE Transgas Net, and a gas storage operator, RWE Gas Storage, with the remaining part carrying on the business of natural gas wholesale. In 2008, the share of gas imports held by RWE Transgas dropped to 86% of the Czech imports and to 69% of sales to final customers. Regional gas suppliers have also been split into trading parts and eight individual distribution system operators.

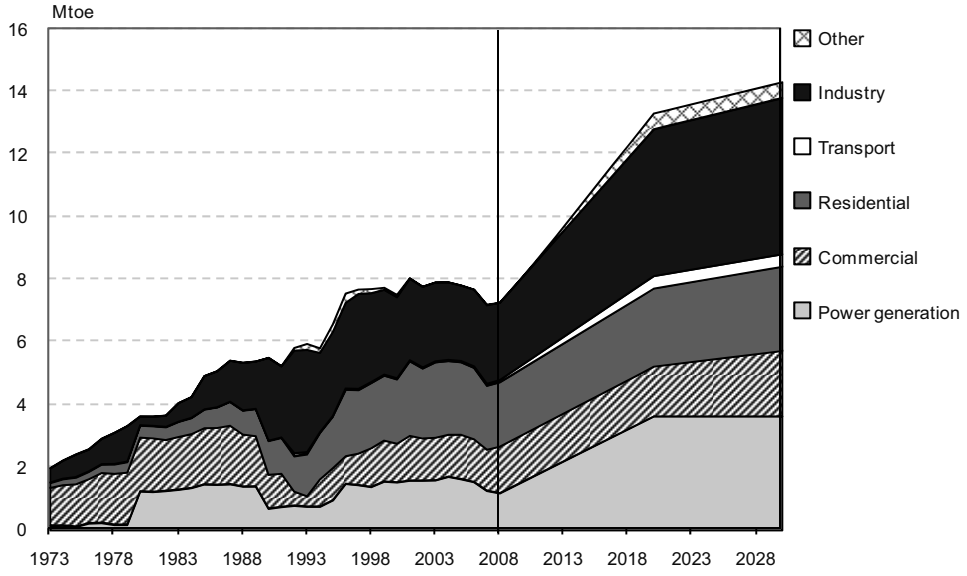
SUPPLY AND DEMAND

In 2008, demand for natural gas was nearly 8.7 billion cubic metres (bcm), only slightly more than in 2007. The 2007 level (8.2 bcm) was the lowest since 1997 and is largely attributed to both a slow-down in economic activities and milder average winter temperatures reducing industrial and residential gas demand, respectively. Industry is the primary user of gas in the country, representing 36% of total consumption in 2008. Residential users make up the second-largest group, representing 29% of gas use, primarily for heating. The transformation sector accounted for 13%, where gas-fired generation is mainly used for meeting peak electricity demand. While gas use in the transformation sector is relatively limited at present, there are plans by industry to build gas-fired electricity generation capacity in the coming decade.

Daily gas consumption in 2008 ranged from a minimum level of 7.7 million cubic metres per day (mcm/d) in the summer to a 50.8 mcm/d peak in the winter. Winter consumption typically varies within a range of 30 to 65 mcm/d, inferring a relatively high seasonality of gas demand (1:8). The highest daily peak was reached in January 2006, when temperatures dropped to -16.9 °C and gas consumption reached 67.6 mcm/d.

In the updated draft State Energy Concept, gas demand is expected to marginally increase over the period to 2050. Its share in TPES would increase from 18% in 2005 to 20% in 2030 and 22% in 2050. Gas demand in the short term depends on the development of gas-fired generating capacity in the form of combined cycle gas turbines (CCGTs). The government is also looking at measures to introduce compressed natural gas (CNG) in the transport sector.

Figure 14. Natural gas supply by sector*, 1973 to 2030



* Total primary supply 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.

Note: The graph shows historical data until 2008 and the Czech government's forecasts from 2009 to 2030.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2009 and country submission.

The Czech Republic has limited gas reserves. In 2008, some 116 mcm of gas were produced, meeting roughly 1.3% of demand. Gas is produced in Southern Moravia by Moravské naftové doly, a.s. (MND), with the gas supplied largely to Jihomoravská plynárenská, a.s. (JMP) and companies affiliated with MND. There is also some coal-bed methane gas produced from hard coal mines in Northern Moravia by UNIGEO, UNIMASTER and OKD for local needs.

IMPORTS AND TRANSIT

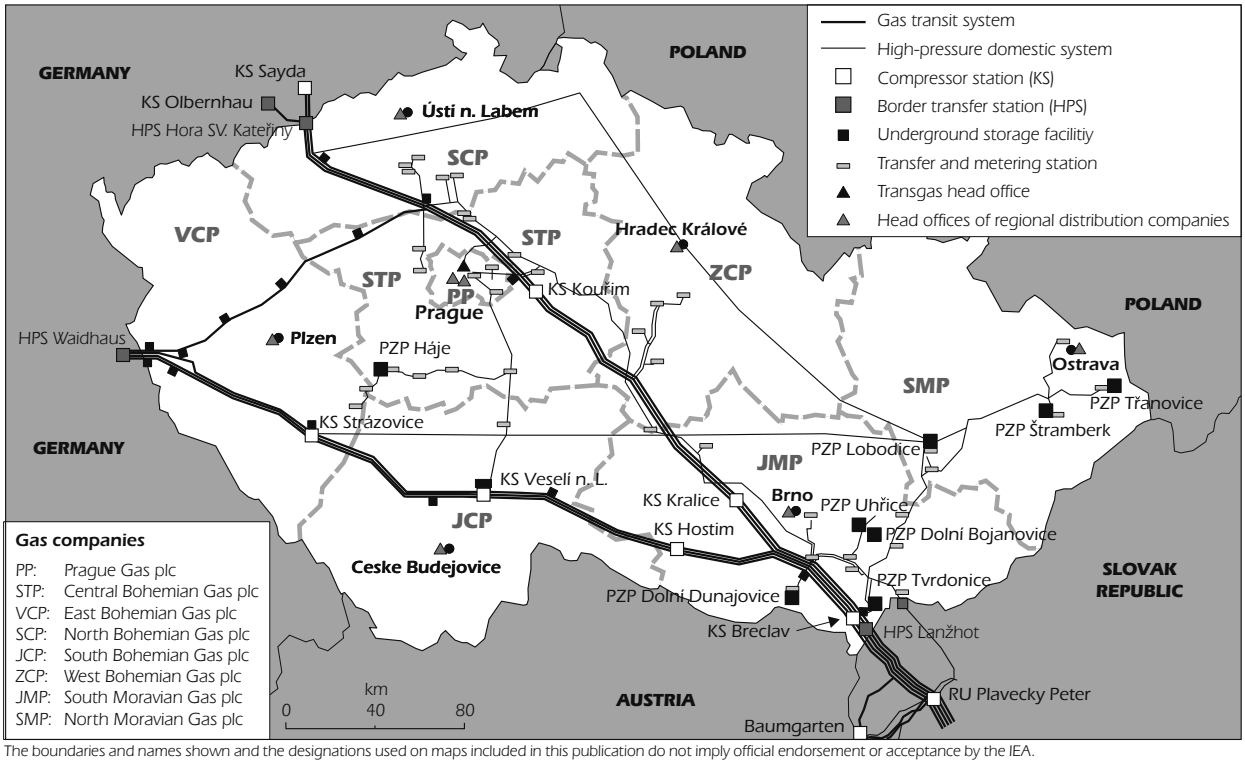
Historically, all gas imports came from Russia. In the late 1990s, following efforts to diversify supply, the Czech Republic began importing from Norway. Total imports from Norway reached a quarter of gas consumption in the early 2000s, but have since declined, to 22% in both 2007 and 2008.

Gas is imported under long-term contracts with Russia's Gazprom Export and the Norwegian suppliers Statoil, Norsk Hydro and Saga Petroleum. Russian gas contracts represent approximately 70% of RWE Transgas's long-term purchase portfolio and run

until 2035, while Norwegian contracts remain in effect until 2017. VEMEX, a trader subsidiary of Gazprom, is the second main importer of natural gas after RWE and has a supply contract with Gazprom Export until 2012 (with an option to extend it to 2017). In 2008, imports by RWE and VEMEX represented 86% and 9.3% respectively.

Most of the gas from Russia is transported into the Czech territory via Ukraine and the Slovak Republic and arrives at the Czech cross-border point Lanžhot. Norwegian gas is transported to the Czech Republic via the German Netra and Ontras transmission networks from Dornum in northern Germany to Hora Svaté Kateřiny, the north-western entry point to the Czech gas transmission network (Figure 15).

Figure 15. Gas pipelines and facilities



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: RWE Transgas.

RWE Transgas Net, the Czech Republic's transmission system operator (TSO), controls 2 460 km of transit pipelines and 1 190 km of domestic pipelines, including six compressor stations with a total installed capacity of 351 MW. The access to transmission capacity is regulated and existing capacity (including minor upgrades) is booked via an "open subscription window" (OSW) procedure. Available border-to-border transit capacity is offered as point-to-point (P2P) products, while domestic transport capacity is offered as entry and exit (E/X) products. The network is used both to transport natural gas for consumption in the Czech Republic and for transit (some 30 billion cubic metres/year) of Russian gas to other end-user markets further west.

Linked to the pipeline construction of Nord Stream (through the Baltic Sea from Russia to Greifswald, Germany) and OPAL (connecting Nord Stream, through Germany, to Hora Svaté Kateřiny), the Gazelle pipeline project will connect Hora Svaté Kateřiny to Waidhaus, with a

capacity of 30 bcm/year. The project is expected to be operational in 2011/12. This could potentially lead to a shift of transit flows through the Czech Republic, moving amounts of Russian gas that currently enter the country at Lanžhot (after transiting through Ukraine) to the Olbernhau entry point. Other areas of upgrade being considered by the TSO and the government to improve the transmission system include a possible interconnection with Poland and enhancing reversibility of gas flows from west to east.

Most of the gas currently transiting through Ukraine and the Czech Republic to Waidhaus can be expected to flow through the Nord Stream and Gazelle pipelines, but there might be a loss of transit volumes in the short term. In the medium to long term, further interconnections with neighbouring countries are planned depending on whether the corresponding supply projects move forward. In addition to the existing volumes of gas imported from Russia and Norway, the Czech Republic could also import gas from planned liquefied natural gas (LNG) terminals in the region, particularly in Poland (Świnoujście) and Croatia (Krk). A link to the planned Nabucco pipeline is also under consideration.

STORAGE AND SECURITY OF SUPPLY

There are eight storage facilities in the Czech Republic, owned and operated by three storage system operators (SSO): RWE Gas Storage, MND and SPP Bohemia. RWE Gas Storage operates six storage facilities while the other two SSOs operate one storage facility each. The current total gas storage capacity is 3.1 bcm, of which RWE Gas Storage operates 2.3 bcm. The maximum withdrawal capacity of the virtual storage operated by RWE Gas Storage is 35.7 mcm/d, while maximum injection capacity is 26.3 mcm/d. MND's Uhřice facility has a total capacity of 180 mcm and SPP Bohemia's Dolní Bojanovice has a capacity of 576 mcm, but is used exclusively for supplying Slovakia. Meanwhile the facility Láb located in Slovakia is used by the Czech Republic and has a capacity of 500 mcm, thus resulting in a net total of nearly 2.92 bcm of gas storage, and 56.2 mcm/d of withdrawal capacity, for consumption in the Czech Republic.

Table 8. Underground gas storage facilities in the Czech Republic

Storage site	Working capacity (mcm)*	Peak output (mcm/day)**
Lobodice (RWE Gas Storage)	155	3.6
Tvrdonice (RWE Gas Storage)	523	7.0
Stramberk (RWE Gas Storage)	480	7.0
Dunajovice (RWE Gas Storage)	780	16.5
Háje (RWE Gas Storage)	59	6.0
Tranovice (RWE Gas Storage)	240	4.1
Uhřice (MND)	180	6.0
Láb - Slovakia (located in Slovakia, used for Czech Rep.)	500	6.0
Dolní Bojanovice - used for Slovakia only (SPP Bohemia)	(576)	
Total UGS sites for use by Czech Republic	**2 917**	**56.2**

* Working gas capacity = total gas storage minus cushion gas.

** Peak output = the maximum rate at which gas can be withdrawn from storage.

Source: Ministry of Industry and Trade.

Access to storage facilities is negotiated. As access is critical for new entrants, significant progress has been made in allowing access to storage and also in preventing companies affiliated with the incumbent from speculatively increasing prices. The regulator has introduced new rules for storage capacity booking which will support the development of storage capacity through the extension of existing storage facilities and the construction of new facilities by giving clear pricing and investment signals. Auctions for storage capacity allocation are organised with constraints for traders, part of the same group as the storage system operator, and which have more than 80% of the capacity of the virtual storage operated by the storage system operator. Storage capacity has been divided between "existing storage capacity" and "new storage capacity" put on stream after 1 January 2010. The ways of booking these two types of storage capacity differ in terms of both the time limits within which capacity can be requested and the duration and type of the gas storage agreement. For example, existing capacity is sold for up to five years and the new capacity for 15 years.

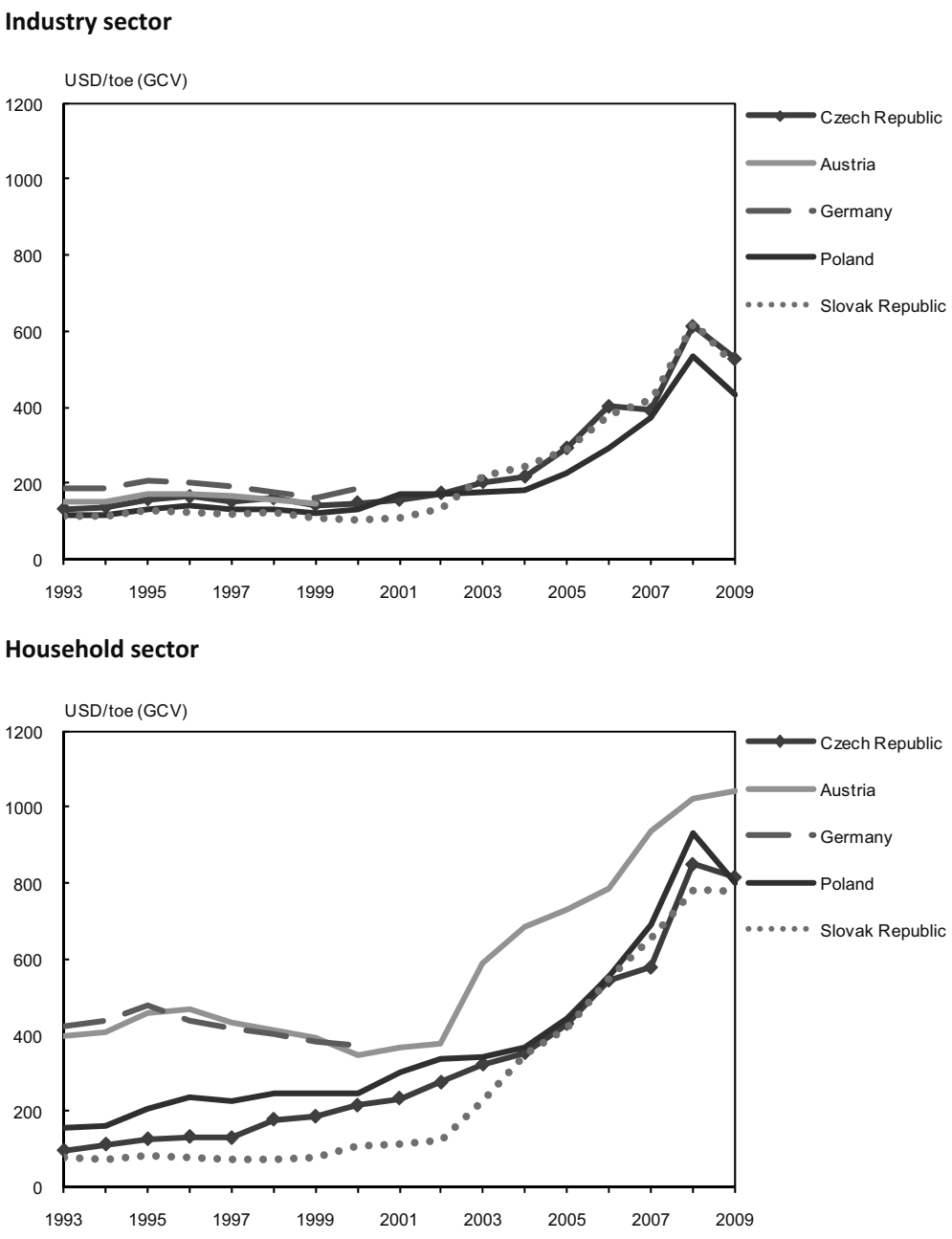
For security of supply reasons, the Czech Republic aims to increase the storage capacity from the current 30% of annual demand to 40%. Extensions of existing facilities are already planned: RWE Gas Storage will increase the capacity of Tvrdonice by 245 mcm, and of Třanovice by 290 mcm. MND plans the construction of the Uhřice-Jih underground gas storage (UGS) facility with a capacity of 80 mcm. Once completed, these expansions will raise total capacity available to the Czech Republic from the current 2.9 bcm to 3.5 bcm and the total withdrawal capacity from 56.2 mcm/d to 65.6 mcm/d.

The Czech Republic does not have strategic reserves or fuel switching potential for responding to a gas crisis. Following the crisis of January 2009, the government put in place over a short period of time and ahead of the 2009/10 winter season a response plan for dealing with a reduction in gas supplies. This plan relies on co-ordination with industry in order to optimise gas storage use and implement demand-side measures in a crisis. The government has also sought to improve the reversibility, and thus the flexibility, of its transmission grid. These steps have been instrumental in preparing for an emergency.

PRICES

Prices for gas transmission and distribution are regulated by the Energy Regulatory Office (ERO). Some components of the gas price such as the cost of natural gas purchase and the supplier's gross margin, are not regulated. Traders determine the selling prices to large users individually. The margin covers suppliers' costs such as transmission and storage. Suppliers determine the period of validity of the unregulated components of the gas price. The regulator does not regulate the end-user price. At the beginning of the liberalisation process, RWE Transgas was the only supplier on the market and the ERO decided to introduce a cap on gas supply prices as of January 2006. At that time, there was a maximum selling price and a maximum price for gas storage charged by RWE Transgas, and a maximum price of gas supply for eligible customers to be charged by gas traders that bought gas from RWE Transgas. This regulation was discontinued on 31 March 2007.

Figure 16. Gas prices in the Czech Republic and in other selected IEA member countries, 1993 to 2009



Note: Values missing for Austria and Germany.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2010.

Gas transmission prices charged by the transmission system operator (TSO) are fixed, and set for the calendar year (from 1 January to 31 December). Gas transmission charges are mainly set per unit of booked capacity for each of the entry and exit points in the transmission system, but the users of the transmission system also pay quantity-related charges. Gas distribution prices are set for the distribution system operators (DSOs) as fixed prices for the calendar year and consist of two components. The variable

component relates to the quantity of energy distributed at a particular supply point. The other component is fixed; for supply points taking up to 63 MWh per year, it is a standing monthly charge for available capacity; for supply points taking more than 63 MWh per year, it is an annual charge for daily available capacity.

The prices for small business customers and for residential customers are published in each supplier's price list. The published average prices are total prices of gas supply and contain the commodity charge, including the trader's margin, the distribution charge, the transmission charge and the charge for structuring. The wholesale prices reflect the prices on spot markets, mainly in Germany and Austria, and also partly the buying price of the dominant trader.

MARKET REFORM AND INDUSTRY STRUCTURE

The Czech Republic transposed and implemented the second EU Directive 2003/55/EC on gas markets in 2005. This triggered the process of phased liberalisation of the domestic gas market, with the individual categories of customers gradually gaining the right to choose their own supplier. Consumers with annual gas use higher than 15 mcm – power and heat generators – became eligible in January 2005, while all non-residential consumers became eligible in January 2006. All natural gas final customers became eligible in January 2007, in line with the second EU directive requiring the complete market opening by July 2007. As part of the market opening, RWE Transgas was legally unbundled. An independent transmission system operator was established on 1 January 2006, and the storage activity was unbundled in January 2007. Independent distribution system operators were established with effect from 1 January 2007. The main market players are now the following:

- RWE Transgas Net: the transmission system operator and owner of the transmission system;
- RWE Gas Storage: an owner and operator of the underground gas storage facilities;
- RWE Energie: a gas supplier, formed by the merger of Středočeská plynárenská, Západočeská plynárenská and Severočeská plynárenská unbundled from the distribution systems;
- Východočeská plynárenská (VČP): a gas supplier unbundled from the distribution system;
- Severomoravská plynárenská (SMP): a gas supplier unbundled from the distribution system;
- Jihomoravská plynárenská (JMP): a gas supplier unbundled from the distribution system.

Gas distribution systems are owned, operated and maintained in each region by STP Net, ZČP Net, SČP Net, VČE Net, JMP Net and SMP Net. The city of Prague is supplied by Pražská plynárenská and Southern Bohemia by E.ON Energie. Traders include VEMEX, Wingas, Lumius, spol. s r.o., Česká plynárenská a.s., and Pragoplyn, a.s.

During 2007, new gas traders appeared on the market and triggered switching in the large- and medium-customer categories. In 2008, supplier switching took place down at the level of households. As of 2009, 339 customers with an annual consumption greater than 400 000 m^3 had switched supplier and 272 customers with consumption less than 400 000 m^3 had switched. The switching is more limited for smaller users as only 2 595 small businesses and 9 800 households changed suppliers.

In 2010, an independent gas market operator will be established. The gas market operator will mainly be responsible for imbalance clearing and for organising day-ahead and intra-day gas markets. RWE has a dominant position with 85% of imports and 69% of final sales (as of 2008). The company also controls six out of the eight main distribution companies. Nevertheless, several new gas traders have appeared. The most important of them is VEMEX s.r.o., a Gazprom subsidiary, which supplies the large users. There are some smaller gas traders, such as Lumius, Česká plynárenská, and Pragoplyn, but their share is limited.

Table 9. Gas companies in the Czech Republic, ranked by sales, 2008

	Natural gas sales in 2008 (bcm)	Number of customers
RWE Energie, a.s.	2.346	799 463
Jihomoravská plynárenská, a.s (JMP)	1.820	637 846
Severomoravská plynárenská, a.s. (SMP)	1.267	577 620
Pražská plynárenská, a.s.	1.024	450 011
Východočeská plynárenská, a.s. (VČP)	0.847	287 693
VEMEX s.r.o.	0.509	45
E.ON Energie, a.s.	0.355	111 301
Wingas GmbH	0.163	5
Pragoplyn, a.s.	0.057	300
Lumius, spol. s r.o.	0.036	71
MND, a.s.	0.029	10
Others	0.224	2 492
Total	**8.678**	2 866 857

Source: Ministry of Industry and Trade.

EMERGENCY RESPONSE POLICY AND EMERGENCY ORGANISATION

As regards its emergency response policy for natural gas, the government set in place an action plan in October 2009 which prioritises users and sets a supply interruption hierarchy based on the level of the disruption. Emergency response to a natural gas disruption is under the responsibility of the Ministry of Industry and Trade (MIT). In dealing with a crisis, the MIT would primarily work with the Energy Regulatory Office and the State Energy Inspection agency, and in close co-operation with the TSO and industry.

The legal framework for natural gas is mainly found in Act No. 458/2000 on business conditions and public administration in the energy sector (the Energy Act as amended in 2009). The current action plan for dealing with a gas supply disruption is based on Decree No. 334/2009 of 1 October 2009. This decree sets measures and actions to be taken during the periods of early warning up to emergency crisis levels.

The early warning system requires transmission and distribution system operators and all gas traders to report to the ministry any indications of potential disruption to supplies. In such an event, the government would seek agreement from industry to maximise the use of delivered gas (and minimise drawing on gas from storage) in the period before any physical reduction in supply. It would also seek ways to secure additional supplies from alternative sources and potentially reverse gas flows from West to East.

In the event of a disruption to gas supplies, a scale of crisis severity levels would be used to determine the level of restrictions or cuts to end-users. Customers are divided into seven groups (A, B1, B2, C, D, E and F) according to the volume and type of consumption (*e.g.* gas used for heating or production, the importance of use for ensuring state functions). Disruptions would be rated by severity levels, determining the degree to which specific consumer groups would have their supplies restricted or stopped. There are five levels in which supplies would be reduced and another five levels in which supply cut-offs would be imposed. The last consumer group, F, consists of small businesses and households which would be supplied in all but the most severe disruptions.

The gas industry is also seeking to expand gas storage, as noted above, to 3.5 bcm and increase the total withdrawal capacity to 65.6 mcm/d. This compares to the country's winter consumption range of 30 to 65 mcm/d and a single-day record high of 67.6 mcm/d. If completely full, storage could supply peak demand for approximately 50 days.

CRITIQUE

Since the last in-depth review, progress achieved in terms of improving security of supply is commendable and should be continued further. The provisional reserve flow capacity from Germany at 19 mcm/d, high storage withdrawal and Norwegian supplies enabled the Czech Republic to face a disruption of Russian gas while maintaining deliveries to all essential customers. In the short term, work has to be pursued so that the reverse flow at the north-west entry point with Germany is available on a permanent basis.

The government had a proactive approach to co-ordinating with industry in order to prepare potential emergency response measures for the 2009/10 winter season. Such co-operation with the transmission, storage and distribution system operators is vital in responding to a disruption, and is essential to rapidly prepare a response plan for the coming winters. The government should take steps to formalise emergency response organisation and measures for natural gas, and develop detailed contingency plans for scenarios with disruptions caused by both domestic (*e.g.* pipeline accidents) and international incidents.

With regard to gas infrastructure, the Czech Republic has done a commendable job in developing system resilience, including establishing reversibility on its main pipelines and expanding capacities and withdrawal rates of underground gas storage facilities. The government should continue its efforts in this regard, for example by shortening the time necessary to make pipelines reversible and going through with planned capacity expansions. The government should also consider the possibility of requiring that a portion of the commercial underground gas storage be held for emergency purposes. Efforts to develop new interconnectors with Germany and Poland are also commendable and would enhance supply diversification.

While gas use in the transformation sector is relatively limited at the moment, there are plans by industry to build gas-fired electricity generation capacity in the coming decade. This could lead to a greater level of demand for gas than is currently envisioned. The government should require any newly built gas-fired power plants to have the ability to switch to alternative fuel sources during a gas supply disruption.

The expected start of Nord Stream in 2011/12 will have consequences for the Czech Republic in terms of transit and security of supply for which the country must be prepared. Most of the gas that had been transiting through Ukraine and the Czech Republic to Waidhaus can be expected to flow through the Nord Stream and Gazelle

pipelines instead, but there might still be a loss of transit volumes in the short term. Regional co-operation with Germany, the Slovak Republic and the Czech Republic is needed to determine how new capacity will be used if flows from the East are disrupted. This should involve in particular the TSOs. The cost of the Gazelle pipeline should not be borne entirely by Czech customers as they would only partly benefit from it.

In the long term, further interconnections with neighbouring countries are recommended if the corresponding supply projects move forward but their cost-effectiveness should be evaluated. On the demand side, customers have been divided into seven categories of consumption and sensitivity, and measures to limit consumption have been introduced. This is a welcome step.

The Czech Republic is planning to increase storage capacity from 30% to 40% of annual consumption. While an increase in storage capacity appears justified by the high seasonality of gas demand (1:8) and demand from shippers, there should not be over-investments as the ratio of working capacity to demand is already high compared with most European countries. Access to storage is critical for new entrants. Progress has been made to allow access to storage and also to prevent companies affiliated with the incumbent from speculatively increasing prices. However, the duration of bookings (15 years) for new storage built after 2010 appears excessive. Most countries tend to favour a certain share of short-term contracts for storage capacity to avoid capacity hoarding.

RWE still has a dominant position with 85% of imports and 69% of final sales. The company also controls six out of eight of the main distribution companies. Legal unbundling of the transmission and storage companies has been implemented, a positive step in the direction of liberalised gas markets. Ownership unbundling of the transmission company should not be implemented if fair and transparent access to transmission is given. There should be strict monitoring by the Regulator and the Office for the Protection of Competition over access to pipelines to avoid capacity hoarding at entry points. In particular with the implementation of reverse flow and the construction of the Gazelle pipeline, traders should be given the possibility to source gas from spot markets in Continental Europe. As of 2009, spot prices are about half as high as the long-term oil-linked gas prices. There is also progress to be made about the provision of information to residential customers about the ability to switch, as this is currently only available on Internet.

RECOMMENDATIONS

The government of the Czech Republic should:

- ☐ *Persist in efforts to increase diversity of supply, both in sources and routes.*
- ☐ *Continue efforts to establish permanent reverse flow operations in the North-West.*
- ☐ *Enhance regional co-operation with neighbouring countries on emergency preparedness in case of supply disruptions.*
- ☐ *Improve market conditions for new entrants, continue to monitor market concentration and disseminate information on choice of supplier more widely to residential customers.*
- ☐ *Ensure consistency between short-term market developments and the long-term strategy for gas demand in the transmission and power generation sectors.*

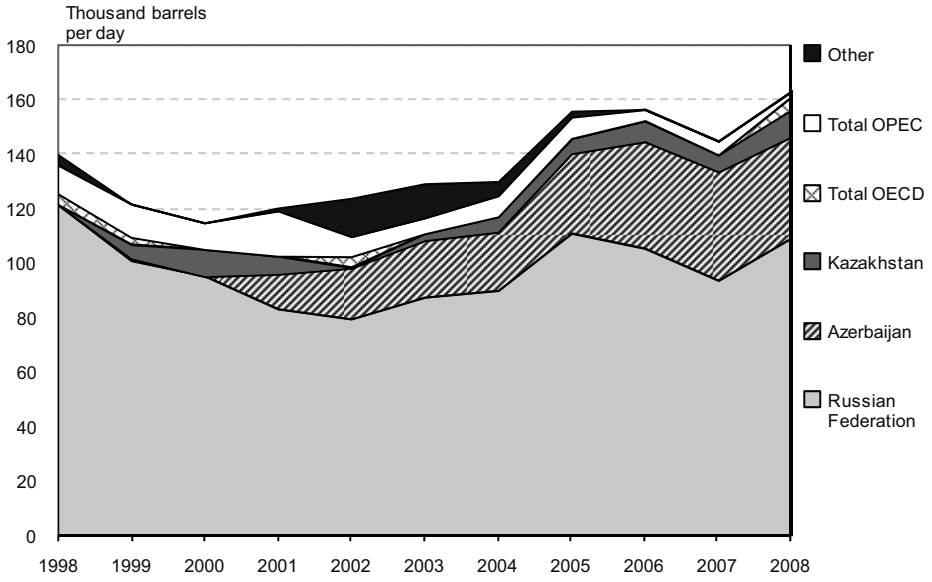
7. OIL

SUPPLY, DEMAND AND IMPORTS

Oil represented 21% of the Czech Republic's total primary energy supply in 2008. Over 97% of the 213 thousand barrels per day (kb/d) in oil demand is met by imports, largely in the form of crude oil from countries of the former Soviet Union.

The Czech Republic does not have significant natural reserves of crude oil. Indigenous production, averaging around 5 kb/d, equates to roughly 3% of the country's total oil demand. Producing fields are located in the sout-east of the country, in Southern Moravia, and connected by pipeline to the Kralupy refinery.

Figure 17. Crude oil imports by source



Source: IEA Annual Oil Statistics.

Czech refineries processed some 8.25 million tonnes (Mt) of crude oil, or roughly 165 kb/d, in 2008. Crude oil imports in the same year averaged just over 160 kb/d, supplied almost entirely by republics of the former Soviet Union. Russia is the single largest source of crude oil imports and provided two-thirds of the total in 2008. Imports from Azerbaijan have steadily grown over the past decade, reaching nearly a quarter of total imports, 40 kb/d, in 2008.

Oil demand in the Czech Republic totalled some 9.9 Mt in 2008, or an average of 213 kb/d. Demand growth has remained flat since 2005 when demand peaked following

a period of steady growth. Diesel was the driving factor for increased oil demand in the period 2000 to 2005 when total demand increased at an annual average rate of 4.6%. While the growth in total oil demand has been zero since 2005, demand for diesel has continued to grow and averaged 2.8% in the period 2005 to 2008.

Oil demand is not expected to grow significantly in the coming years. The government expects demand for both gasoline and diesel to decline slightly from the 2008 levels in both 2009 and 2010, but has not devised medium- or long-term scenarios for oil demand. According to the IEA's *Medium-Term Oil & Gas Markets* report (June 2010), Czech oil product demand is expected to grow by 0.2% per year on average over 2009-2015 to 210 kb/d. Gasoil, which currently accounts for 41% of total demand, is projected to expand by 0.4% per year over the forecast period.

The transport sector accounts for two-thirds of all oil used in the Czech Republic. Diesel is the single largest component in the mix of oil products used in the country. In 2008, it represented 39% of total oil demand and 60% of transport fuels consumed. Automotive diesel has a price advantage for consumers owing to a lower tax rate compared to gasoline. The government maintains excise taxes on diesel (EUR 0.399/litre in 2008) that are lower than taxes on motor gasoline (EUR 0.475/litre). Accession to the European Union in 2004 is also seen as a significant contributing factor to the increase in diesel demand, as it has led to more heavy–duty vehicles transiting the country.

In addition to the 185 kb/d of refined products produced from domestic refineries in 2008, the Czech Republic imported 56 kb/d of refined products, or 27 kb/d net of exports. Trade in refined products was almost entirely conducted with neighbouring IEA member countries, principally the Slovak Republic.

BIOFUELS

In 2008, 2.2% volume of gasoline (petrol) was replaced by bioethanol and 2.5 % volume of diesel was replaced by fatty acid methyl ester (FAME), in the form of adding low percentage volumes of biofuels into these transport fuels. In 2009 the obligatory share of biofuels replacing both gasoline and diesel had grown up to 3.5% volume in gasoline and 4.5% volume in diesel, of total annual consumption.

The EU Biofuels Directive 2003/30/EC sets an indicative target for biofuels consumption of 5.75% for gasoline and diesel used for transport in 2010 and Directive 2009/28/EC requires each member state to ensure a 10% share of energy from renewable sources in transport by 2020. The Czech Republic is currently producing enough biofuels and has sufficient refining capacity to meet this target, but only when the pure biofuels (FAME) and high-percentage biofuel mixtures (E85, E95, SMN 30 – mixed diesel containing 30% biofuels) are included.

OIL INDUSTRY STRUCTURE

The company MND (Moravské naftové doly) operates domestic crude oil production. MND is also involved in natural gas production and the construction and operation of underground gas storage facilities.

The state-owned companies MERO and ČEPRO respectively operate the country's crude oil and refined product pipelines and storage terminals. While self-financing, both

companies remain fully owned by the State because of the government's views about their strategic importance.

There are two companies operating in the Czech refining industry: Česká rafinérská, which operates the Litvínov and Kralupy refineries, and Paramo, operator of the refinery in Pardubice. Unipetrol, part of the PKN Orlen group since 2004, has full ownership of Paramo and a majority share in Česká rafinérská. The remaining shares in Česká rafinérská are held by Eni (32%) and Shell (16%).

Benzina, also fully owned by Unipetrol, is the largest operator of petrol stations in the country. The other main oil companies operating on the Czech retail and wholesale oil markets include Eni/AGIP, OMV, Lukoil, Slovnaft, Shell, Total and Tesco stores. ČEPRO also owns and operates a network of 192 petrol stations. ExxonMobil no longer operates on the Czech market since it sold its retail outlets to Eni in 2007. ConocoPhillips also no longer operates in the country, having sold its retail outlets to Lukoil in 2006 and its shares of Česká rafinérská to Eni and Unipetrol in 2007.

Members of the Czech Association of Petroleum Industry and Trade (ČAPPO) include all the main oil companies operating in the country and represent roughly 90% of all oil products sold on the Czech market.

OIL SUPPLY INFRASTRUCTURE

REFINING

There are three refineries in the Czech Republic that contribute to a total crude atmospheric distillation capacity of 198 kb/d, or 9.7 million tonnes per year (Mt/year). The two main refineries, Litvínov and Kralupy, account for over 90% of this capacity. There is a fourth facility located in Kolín, near the Pardubice refinery, which manufactures lubricants but has no atmospheric distillation capacity.

Domestic refining capacity is not sufficient for meeting oil demand in the country. Refined product output from the three domestic refineries totalled 185 kb/d in 2008. With the exception of jet kerosene, domestic refinery production was able to meet 80% or more of demand for each individual product. For example, domestic production of diesel was able to meet some 85% of domestic demand, while jet kerosene amounted to some 40%, requiring imports to meet the remaining share. Domestic refining capacity has increased since the previous in-depth review in 2005, including improvements to the Kralupy refinery, which was upgraded in 2007 for greater desulphurisation capacity.

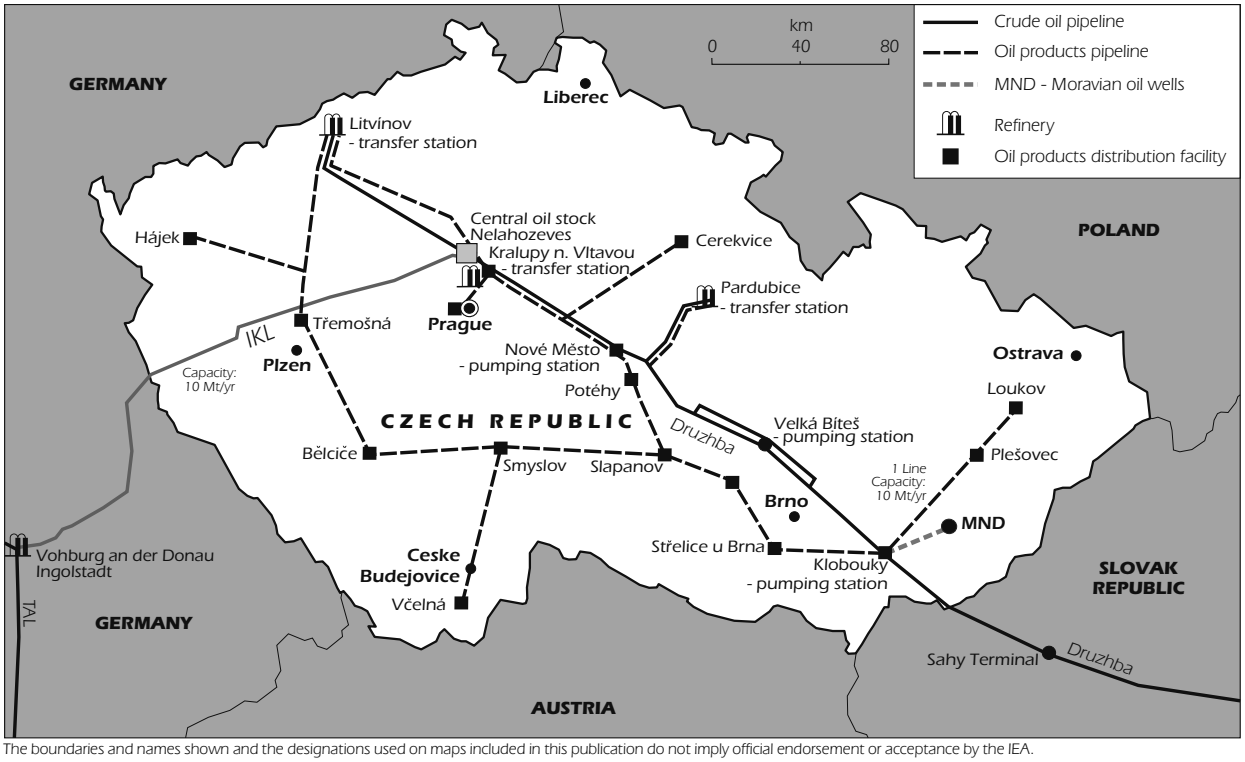
PIPELINES

An oil products pipeline network operated by the state-owned company ČEPRO connects the main consumer regions of the country to the domestic refineries. The pipeline system is also connected to the Slovnaft refinery in the Slovak Republic, which enables the import and export of oil products by pipeline. The flow direction of the product pipeline network within the Czech Republic is fully reversible.

The main crude oil supply channel is the Druzhba pipeline. Originating in Russia and transiting Belarus, Ukraine and Slovakia before terminating in the Czech Republic at Litvínov, this pipeline is able to deliver Russian and domestic crude oil to all three of the

country's refineries. The Czech section of the Druzhba has a flow capacity of 9 Mt/year (~180 kb/d). Roughly two-thirds of this capacity is used at present. The flow is fully reversible on the section between Kralupy and the Slovak border.

Figure 18. Oil infrastructure



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: Ministry of Industry and Trade.

The Ingolstadt-Kralupy-Litvínov pipeline (IKL) has a capacity to bring 10 Mt/year (~200 kb/d) of oil via Germany. A new pump station was commissioned in 2009 which, when operational, will raise the line's capacity to 11.5 Mt/year (~230 kb/d). The IKL line is connected, in Germany, to the international Trans-Alpine pipeline (TAL) originating in Trieste and offers the potential for diversification of imports. Approximately one-third of the Czech Republic's annual crude oil imports are typically sourced through the IKL.

In 2008, roughly 40% of the total 8.3 Mt of crude oil imported into the Czech Republic was supplied via the IKL. This represented a record volume of oil flows through this pipeline, and was primarily the result of increased flows to compensate for flow reductions on the Druzhba pipeline that occurred in the year. Druzhba flows to the Czech Republic were significantly curtailed at the end of June 2008. They returned by the end of the following month, but were subsequently reduced to some 80% of normal levels until the end of November 2008.

The IKL/TAL route is an important alternative for the Czech Republic's crude oil supply flows, particularly in light of the past incidence of reduced flows on the Druzhba pipeline. However, Czech users of the line have no shareholding in the joint venture of companies operating the TAL pipeline and therefore must compete for available spare capacity on the pipeline. The TAL has a capacity of 850 kb/d. However, it is the supply

line of four refineries (one in Austria and three in Germany) that have a total refining capacity of 650 kb/d, as well as a possible backup supplier to the 300 kb/d Karlsruhe refinery in Germany. Thus, obtaining available capacity on the TAL in order to source oil through the IKL could prove a limiting factor for the IKL as an alternative import route.

STORAGE CAPACITY

Total storage capacity in the Czech Republic is some 4 mcm, or 25.4 million barrels (mb). This is roughly split evenly between crude oil and refined products. Additional product storage for motor fuels will be added in 2011, raising the country's total storage capacity to 4.2 mcm (26.3 mb).

MERO and ČEPRO provide storage facilities for crude and products, respectively, for the public stocks of the Administration of the State Material Reserves (ASMR), as well as for industry's commercial storage needs. In addition to the storage facilities of MERO and ČEPRO, storage capacity among industry participants totals some 3.8 mb.

MERO's crude storage capacity at the end of 2008 was 11 mb (~ 1.73 Mt), including 1.3 mb of storage at its facilities in Vohburg, Germany. Its central tank farm near Kralupy (Nelahozeves), which was fully modernised in 2003, offers considerable scope for more capacity expansion. In 2008 two new tanks added over 1.5 mb in capacity to the site.

ČEPRO has 17 storage sites along its product pipeline network, with a total product storage capacity of approximately 10 mb. Additional tanks will be operational in 2011, raising ČEPRO's total capacity to nearly 11 mb. Three-quarters of ČEPRO's storage capacity is reserved for the use of public stocks, with the remainder available for use by all fuel trading companies in the Czech Republic. In addition to being a stockholding enterprise, ČEPRO is a refined product trading company, which facilitates its ability to assure the necessary stock turnover.

EMERGENCY RESPONSE POLICY AND EMERGENCY ORGANISATION

EMERGENCY RESPONSE POLICY

The Czech government has placed energy security at the core of its energy policy over the past two years. An Expert Group on Energy Security was established by the State Security Council, and the Raw Materials and Energy Security Department was created within the Ministry of Industry and Trade in October 2009. The ministry published a draft State Energy Concept which highlights a variety of strategic priorities centred on energy security. This concentrates on security of supply and the maintenance of the Czech Republic as a net electricity exporter thanks to a diversified energy mix (notably by increasing the share of nuclear and renewable energy sources) and the maximisation of all available indigenous resources. The ministry is planning to prepare a comprehensive energy security strategy in 2010.

The Czech Republic would likely contribute to an IEA collective action with the release of public oil stocks from the Administration of the State Material Reserves (ASMR). In the event of disrupted oil supplies to the domestic market, the government's emergency response policy relies initially on industry participants responding to a supply disruption. This is exemplified in the Oil Emergency Procedures detailed in the Oil Emergency Plan,

where industry consultation and voluntary actions are sought in the early stages of a response. If this is deemed insufficient to deal with a supply disruption, the chairman of the National Emergency Sharing Organisation (NESO) would seek a government declaration of an emergency and the release of public oil stocks. Demand restraint measures would also be considered in parallel to the use of emergency stocks, where the specific measures and the degree of implementation would be adjusted according to the severity and anticipated duration of the crisis.

The government is in the process of establishing a 30-day stockholding obligation on industry, which would be phased in over the period 2012 to 2021 (see section below on Emergency Oil Reserves). Such an industry-based emergency reserve, once in place, will provide the government with the option of releasing these industry stocks as an alternative to the release of public stocks by the ASMR in the event of a supply disruption.

EMERGENCY ORGANISATION

The Administration of the State Material Reserves (ASMR) is responsible for the emergency response to oil disruptions. The NESO structure with respect to oil has not changed since the previous review. The chairman of ASMR serves as head of the NESO, with the responsibility for initiating and co-ordinating a response to an oil supply disruption. Within the ASMR, the Oil Security Division has the leading role in co-ordinating the NESO and maintaining liaison with industry, as well as communicating with the IEA Secretariat regarding emergency responses. The Ministry of Industry and Trade and the Czech Statistical Office also play a central role in the NESO body. The wider NESO structure includes other ministries, as well as industry representatives, who meet at least twice a year.

The chairman of the ASMR may respond to an oil crisis by using emergency reserves, independently of the government declaring a state of emergency (see Emergency Oil Reserves). When such a declaration is necessary, the chairman would submit proposals to the government specifying the use of emergency oil reserves and possible demand restraint measures.

LEGISLATION

Act 189 of 1999, on Emergency Oil Stocks and Managing States of Oil Emergency, is the legal basis for emergency policy, providing the principal statutory authority for the ASMR's role in an oil crisis. Ordinance No. 452/2002 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 obligations.

Additional legislation concerning oil supply security include: Act No 97/1993 of 25 February 1993, which is the legal basis for the functioning of the ASMR; Act No. 241/2000 of 29 June 2000 on Economic Measures for Crisis Situations; and, Ordinance No. 498/2000 on Planning and Implementation of Emergency Economic Measures.

EMERGENCY OIL RESERVES

The ASMR is responsible for stockpiling and supply security of the main resources considered essential for the protection of public interests during crises. It operates under the control of the Ministries of Finance and of Industry and Trade, but is independent in deciding its daily operations.

Total stocks in the Czech Republic cover well beyond the 90-day IEA obligation, ranging between 107 and 129 days. Public stocks of the ASMR have represented a growing share of the total. At the end of 2008, the public stocks represented 85 days of net imports. In terms of demand cover based on the EU stockholding methodology, these public stocks represented 99 days.

Act 189 specifies that oil stocks held by the ASMR must be no less than 90 days of consumption, as required by the EU, while also requiring that levels be no less than the amount necessary for the Czech Republic to meet its IEA stockholding obligation. The chairman of the ASMR is able to draw upon stocks held in excess of the legal minimum level required by law, and is thus in a position to respond to domestic supply issues with loans to industry or to rapidly participate in an IEA collective action without seeking the approval of the Czech government.

Public oil stocks are held by the state-owned companies MERO and ČEPRO (and to a smaller extent by the three domestic refineries and other private companies) on behalf of the ASMR. While MERO has storage facilities in Germany, as noted above, all of ASMR's crude stocks are currently held in MERO's central storage facilities near Kralupy or at the domestic refineries. Up to 60% of ASMR oil stocks may be held in the form of crude oil. However, in practice, the ASMR holds under half of the total as crude.

There is currently no minimum stockholding obligation on industry; however, Article 5 of Act 189 provides statutory powers over industry stocks in a declared state of emergency.

The government is in the process of establishing a stockholding obligation on industry, equivalent to 30 days of net imports. This would be phased in over the period 2012 to 2022. Legislation is expected to be passed in 2011/12 (depending on the legislative process) and would establish a structure, referred to as the Fund, which would fall under the jurisdiction of the ASMR. The organisational structure of the Fund will include members of the public administration, in both the executive and the supervisory bodies. The specific methodologies for operations and financing of the Fund are being developed with the co-operation of the Czech oil industry association ČAPPO, in order to minimise the administrative burden on industry.

The Fund would collect fees from all industry participants, in proportion to the volume of oil supplied to the domestic market, and would be responsible for acquiring volumes of crude oil and refined products, as well as maintaining the stocks with respect to renewing and processing. In case of a disruption, volumes would be released by the Fund to industry according to the proportion of fees they paid.

Czech industry typically holds oil stocks of between 20 and 30 days of forward demand, including crude oil stocks of around eight days. This compares to averages for European industry oil stock coverage of around 60 days, with crude oil stocks typically around 25 days.

OIL DEMAND RESTRAINT

Oil consumption in the Czech Republic is primarily in the transport sector, which represented 66% of all oil use in 2007, the latest year for which data on consumption by sector are available. Industry accounted for the second-largest share, representing 28%. The remainder of oil was consumed in the commercial/agriculture (4%) and transformation (2%) sectors.

Act 189 empowers the government during a declared emergency to implement demand restraint measures. These include the ability to limit motor vehicle speed, and use on certain days or for specific purposes, impose usage restrictions based on odd/even car plates, limit the use of railway and aviation facilities, regulate petrol station operations, introduce rationing, and limit or prohibit oil exports. A rationing system is also available as a policy measure in more extended disruptions; a card system for priority users and a coupon distribution to private vehicles has been devised and could be implemented quickly in a severe disruption. The Act also gives the government the power to order private companies to draw down (or limit draw-down) their stocks in an emergency. The legislation assigns responsibility for assuring compliance with these different measures to various components of the Czech government.

Implementation of demand restraint measures would likely be in conjunction with the use of public stocks. In the case of a public stock release not requiring government approval, as described above, appeals to the public for voluntary measures would be made. This would be through a media campaign, educating the public about fuel-efficient driving techniques and calling for the increased use of public transportation and car-pooling.

In the event an emergency is declared, demand restraint measures would be specified in the proposal presented by the chairman of the ASMR to the government. Once approved, a process which could take between two and six days, a press conference would take place and a mass media campaign would be initiated. The Administration estimates that implementation of the measures would be possible in two to five days following the public announcement.

The enforcement of demand restraint measures would the responsibility of the police and transportation boards, which have the authority to impose fines as defined in Act 189. ASMR, in conjunction with the Czech Statistical Office, would be responsible for monitoring the effectiveness of the measures.

The last time demand restraint measures were tested was in 2009, when an exercise simulating an oil emergency was conducted to test the rationing system at petrol stations. This served as training for state and local authorities, police and security services, and the personnel of the designated petrol stations. It also served as a public awareness campaign, as the media followed and reported on the event.

CRITIQUE

The Czech Republic is strongly reliant on imports of crude oil. The main import source is Russia, through the Druzhba pipeline, which until recently supplied approximately 67% of Czech oil demand (the share was 59% in 2008). Other oil imports are delivered from several countries through the TAL/IKL pipelines.

Since the last in-depth review, the volumes of crude oil transported by IKL have increased. This is a positive development, as it has enhanced the diversity of oil supply routes and suppliers. The fall in deliveries through the Druzhba pipeline in 2008 and the offset by increasing supplies through the IKL shows that the measures taken by the Czech government since the last in-depth review have borne fruit. The IKL pipeline capacity covers the entire oil demand for the Czech Republic, but the availability of capacity in the TAL pipeline can represent a bottleneck. The government has made securing capacity in the TAL pipeline a priority. The IEA strongly supports this to enhance oil supply security.

The transport sector is the main consumer of oil in the country. The government expects both total demand and this ratio to remain more or less stable until 2030. The government states that future consumption is difficult to estimate in the present economic climate. The main uncertainties are the impacts of economic growth, problems and crises, and the share of biofuels in energy demand over the next few years. The passenger vehicle stock is expected to continue to increase.

The Czech Republic's targets concerning the share of bioethanol in motor gasoline have been met, and there are ambitious plans to further increase these targets.

The Czech Republic's stockholding regime guarantees sustained compliance with the IEA 90-day obligation, with total stockholding in the country well above this minimum level. However, in general oil stocks held by industry are relatively low compared with the average in European countries, particularly in the case of crude oil where refineries often hold less than 10 days of stock. In the recent past, relatively small-scale domestic disruptions led refineries to ask the ASMR to release crude oil from the strategic reserves. The Czech government plans to place an obligation on industry to participate in a collective holding of emergency reserves which would cover an additional 30 days of net imports. This scheme would help avoid an over-reliance on public stocks by industry when dealing with commercial supply fluctuations and bring greater industry involvement in providing for security of supply.

RECOMMENDATIONS

The government of the Czech Republic should:

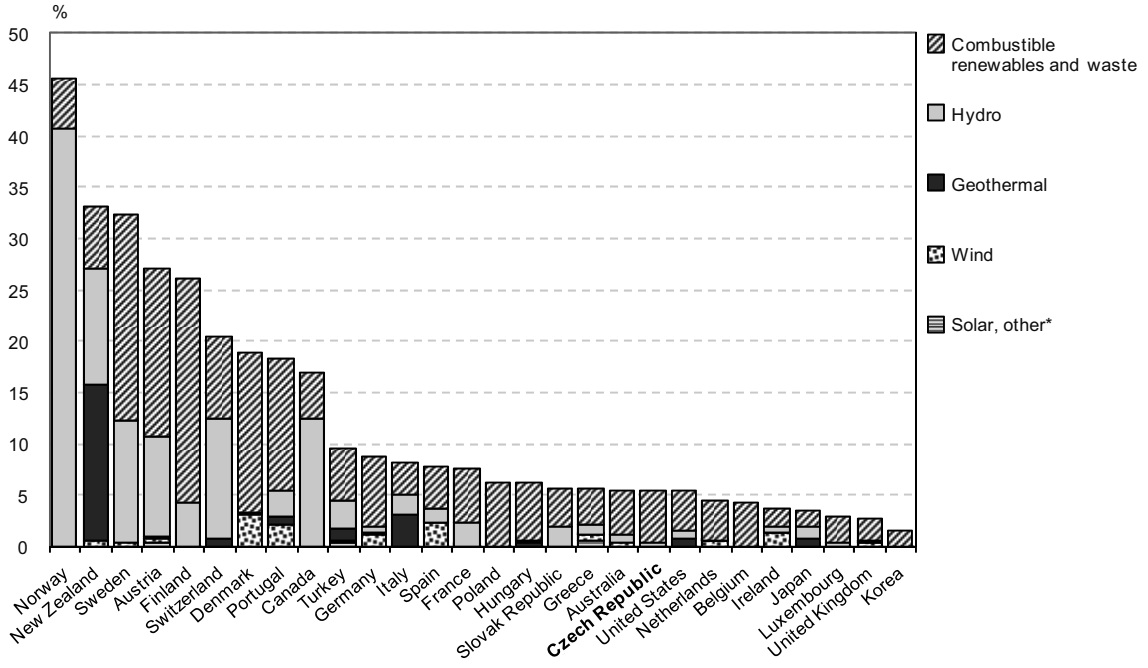
- ☐ *Sustain efforts to secure capacity in the TAL pipeline given uncertainties in the reliability of the Druzhba pipeline.*
- ☐ *Implement the planned obligation on industry to participate in a collective holding of emergency reserves, which would cover an additional 30 days of net imports.*
- ☐ *Assess ways to reach the ambitious biofuels goals, given the current vehicle stock, and ensure that biofuels are produced in an environmentally sustainable way.*
- ☐ *Develop low, medium and high oil demand scenarios, so as to prepare for a range of possible outcomes.*

8. RENEWABLE ENERGY

RENEWABLE ENERGY SUPPLY

The Czech government plans to expand the role of renewable energy sources in its energy mix to meet its stated energy security objectives and its obligations under EU directives. According to IEA statistics, the share of renewable energy sources in total primary energy supply (TPES) increased from 2% in 2000 to 5.4% in 2008. The share of renewable energy in TPES ranks the Czech Republic in the twentieth position among the 28 IEA member countries (Figure 19). Combustible renewables and waste, mostly wood chips, wood waste and black liquor, represented 91% of total renewable energy supply in 2008 (Figure 20).

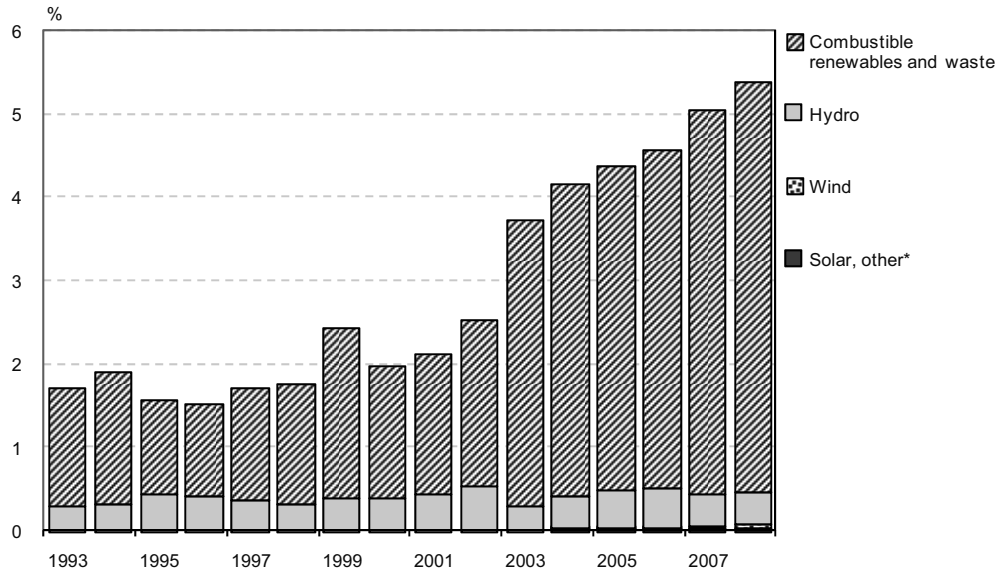
Figure 19. Renewable energy as a percentage of total primary energy supply in IEA member countries, 2008



* *Other* includes ambient heat used in heat pumps (negligible).

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2009.

Figure 20. Renewable energy as a percentage of total primary energy supply, 1993 to 2008



* *Other* includes ambient heat used in heat pumps (negligible).

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2009.

Table 10. Electricity generation from renewable energy sources in the Czech Republic, 2008

	Gross electricity generation (GWh)	Share in renewables (%)	Share in total generation (%)
Hydropower: total	2 024	54	2.4
Of which: < 1 MW_e	*492*	*13*	*0.6*
1 MW_e – 10 MW_e	*475*	*13*	*0.6*
> 10 MW_e	*1 057*	*28*	*1.3*
Biomass: total	1 171	31	1.4
Chips, bark, wood waste	*603*	*16*	*0.7*
Black liquor	*458*	*12*	*0.6*
Briquettes, pellets	*84*	*2*	*0.1*
Other	*24*	*1*	*0.03*
Biogas: total	267	7	0.3
Urban sewage sludge gas	*74*	*2*	*0.09*
Industrial sewage sludge gas	*4*	*0.1*	*0*
Landfill gas	*97*	*3*	*0.1*
Other	*92*	*3*	*0.1*
Municipal solid waste	12	0.3	0.01
Wind	245	7	0.3
Photovoltaics	13	0.4	0.02
Total	**3 731**	**100**	**4.5**

Source: Ministry of Industry and Trade, *Renewable Energy Sources in the Czech Republic 2008*, available at www.mpo.cz.

The share of renewables in electricity generation has steadily increased, from 3.4% in 2000 to 4.5% in 2008 (Table 10). The largest increases were in photovoltaics (PV) and wind, although starting from a low base. The Energy Regulatory Office estimates that solar PV installed capacity increased from 39.5 megawatt (MW) in 2008 to 464.4 MW at the end of 2009, and that wind capacity increased from 150 MW to 193.2 MW over the same year.[18] According to the *EurObserver*, the Czech Republic is the eighth-largest producer of electricity from small hydropower installations (<10 MWe) in the EU, generating nearly 1 000 gigawatt-hour (GWh) in 2008, about half of total hydropower production.

HEAT PRODUCTION FROM RENEWABLE ENERGY SOURCES

In 2008, gross heat production from renewable energy sources was 48 307 terajoules (TJ), some 7% of total heat production. Solid biomass accounted for nearly 90% of heat production from renewable energy sources. Heat production from municipal solid waste represented nearly 4%, heat pumps 2.5% and biogas some 2%. In 2008, gross non-household production of heat from biomass was 15 463 TJ, up from 10 126 TJ in 2003. Heat production in households increased from 21 820 TJ to some 28 000 TJ over the same period. In 2008, heat pumps provided 1 200 TJ and solar thermal collectors, 202 TJ. Over 4 000 heat pumps were sold in 2008. Solar collector sales increased from 10 215m^2 in 2003 to 34 535 m^2 in 2008. Total installed area was 164 650 m^2 in 2008.

See Chapter 7 on Oil for information on the use of biofuels in the transport sector.

RENEWABLE ENERGY TARGETS

Czech renewable energy policy is mainly driven by EU policies and by the government's efforts to increase the share of domestic resources in the energy mix. The mandatory targets set for the Czech Republic by Directive 2009/28/EC on the promotion of renewable energy sources are:

- 13% share of renewable energy resources in final energy consumption by 2020;[19]
- 10% share of renewable energy in the transport sector energy consumption by 2020.

The indicative targets set by Directive 2007/71/EC and the Biofuels Directive 2003/30/EC are to achieve an 8% share of renewable energy sources in gross electricity consumption by 2010 and a 5.75% share of biofuels in transport fuel in 2010.

By 30 June 2010, each EU member state must present a national renewable energy action plan, setting out national targets for the share of energy from renewable sources consumed in transport, electricity, and heating and cooling in 2020, and taking into account the effects of other policy measures relating to energy efficiency on final consumption of energy. Each national renewable energy action plan should also include adequate measures to be taken to achieve overall national targets, including co-operation between local, regional and national authorities, planned statistical transfers or joint projects, and national policies to develop existing biomass resources and

18. Capacity figures for 2009 will be published in September 2010. For more information see http://www.mpo.cz/en/energy-and-raw-materials/statistics/#category120

19. According to IEA statistics, this share was 6.4% in 2007.

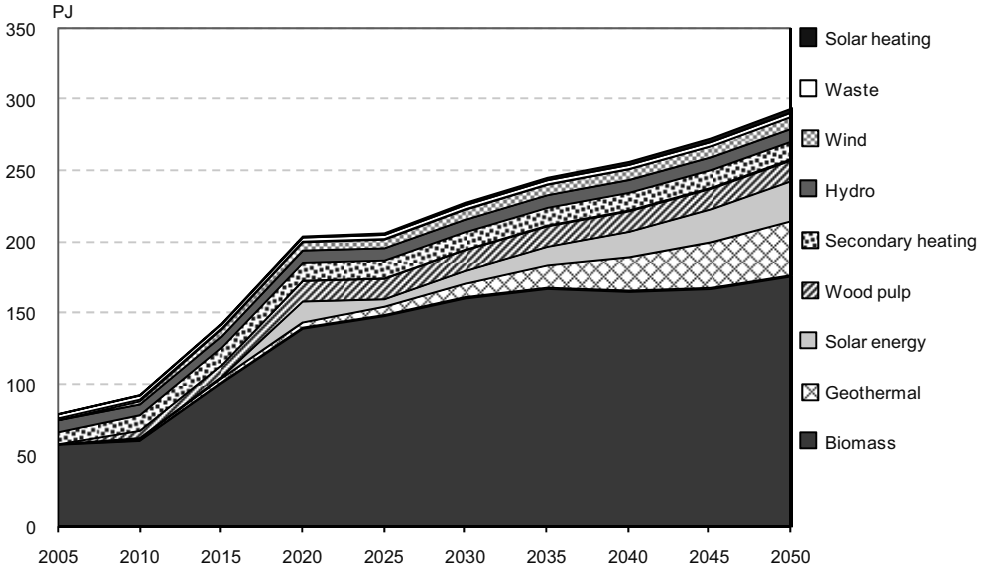
mobilise new biomass resources for different uses. As of mid-July 2010, the Czech government had not submitted its action plan.

In addition to the EU obligations, the Czech government, in 2004, set the following domestic targets:

- 16% to 17% share of renewable energy sources in gross electricity generation by 2030;
- 6% share of renewable energy sources in TPES by 2010 and 15% to 16 % by 2030.[20]

In the updated draft State Energy Concept 2009, it is anticipated that biomass will account for most of the increase in renewable energy supply over the period to 2030 (Figure 21). Over the longer term, the shares of geothermal heat and solar energy are expected to increase. The Czech government acknowledges that achieving the EU and national targets will be very challenging and will require considerable support.

Figure 21. Consumption of renewable and secondary energy resources, 2005 to 2050



Source: Ministry of Industry and Trade.

SUPPORT MECHANISMS FOR RENEWABLE ENERGY

The Act No. 180/2005 on Support for the Use of Renewable Sources of Energy, which transposed the EU Directive 2001/77/EC into Czech legislation, took effect on 1 August 2005. Its key features are:

- preferential connection to the grid; there is an obligation for the transmission system operator and operators of the regional grid systems to purchase all electricity from renewable sources;
- the guarantee of revenue per unit of electricity produced over a 20- to 30-year period as of the date a plant is put into operation;

20. In the updated draft State Energy Concept, the targets are a share of renewable energy in TPES of 13% in 2020 and 16% in 2050.

- the possibility of choosing between minimum feed-in tariffs and green bonuses;
- the support of electricity used for internal consumption (*i.e.* industrial on-site consumption and residential and commercial use not supplied to the grid).

FEED-IN TARIFFS AND GREEN BONUSES

A feed-in system for renewable energy sources came into force in 2002. This scheme supported investments in new renewable energy installations and in retrofitting existing ones. The 2005 Act extended the support system by offering a choice between a feed-in tariff (that is, a guaranteed price) or a green bonus (that is, an amount paid on top of the market price). Feed-in tariffs apply to electricity supplied and metered at the delivery point between the generating plant and the respective distribution system operators. Green bonuses apply to electricity supplied and metered at the delivery point between the generating plant and the regional system operators, and supplied by the generator to an electricity trader or eligible customer. Producers can choose to sell electricity at the feed-in tariff rate or offer it to traders at the market price and simultaneously receive green bonuses, which are paid by ČEPS, the transmission system operator. The Energy Regulatory Office (ERO) determines the feed-in tariffs and green bonuses shown in Table 11.[21] The tariffs are based on technology and investment costs and are reviewed annually. They may not be lower than 95% of the value of the previous year. Prices are differentiated according to the renewable energy source and by the year of commissioning. The cost of supporting renewable energy is passed on to final electricity consumers.

Table 11. Range of feed-in tariff and green bonus rates
(eurocents per kWh)

	2006	2007	2008	Duration (years)*
Feed-in tariff				
Wind	9.6-12.3	9.6-12.8	9.6-12.8	20
Small hydro	6.5-9.2	6.8-10.2	6.8-10.2	30
Biomass (solid)	9-11.5	9.5-16.5	9.5-16.5	20
Biogas	8.7-10.2	9.1-15.3	9.1-15.3	20
PV	24.6-51.6	25.7-52.7	25.7-52.7	20
Geothermal	14.2-17.6	17.6	17.6	20
Green bonus				
Wind	7.9-10.6	7.6-10.5	-	20
Small hydro	2.9-5.6	2.5-5.2	2.1-5.5	30
Biomass (solid)	2.1-7.7	1.9-8.8	0.9-11.5	20
Biogas	4.9-7.9	4.5-7.5	4.1-10.2	20
PV	22.2-49.3	22.3-49.9	22.5-49.5	20
Geothermal	10.9-14.2	13.7	13.2	20

* Number of years an investor is entitled to support.

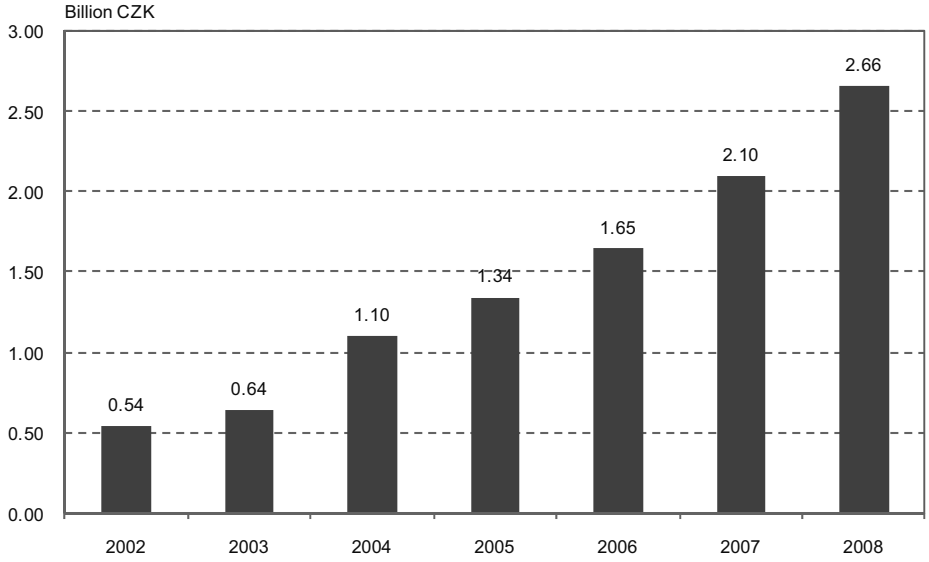
Source: Ministry of Industry and Trade, *Renewable Energy Sources in the Czech Republic 2008*, available at www.mpo.cz.

The feed-in tariff for PV led to a substantial increase in investments in this technology. Investment costs fell faster than expected while the cost to consumers has risen substantially. Support to PV installations accounted for 40% of total support to renewable energy technologies and energy savings projects in 2009.

21. Prices are available on the Energy Regulatory Office website, http://www.eru.cz/dias-browse_articles.php?parentId=145

Distribution companies reported that, as of 1 January 2010, some 8 063 MW of wind and PV projects had been approved for grid connection. Applications for grid connection of wind and PV with connection contracts already established amounted to 2 352 MW. It is expected that 1 985 MW will be installed in 2010.[22]

Figure 22. Support of renewable energy sources, 2002 to 2008*



* Estimates for 2008.

Source: Energy Regulatory Office.

STATE PROGRAMME FOR ENERGY SAVING AND THE USE OF RENEWABLE ENERGY SOURCES

Investors in renewable energy power plants can receive aid from the State Programme for Energy Saving and the Use of Renewable Energy Sources. The programme is co-ordinated by the Ministry of Industry and Trade and the Ministry of the Environment. MIT provides subsidies to cover 100% of the capital cost of non-investment projects. The subsidies are capped at CZK 2.8 million (EUR 0.11 million). The Ministry of the Environment provides subsidies covering up to 90% of the capital costs to households, local governments (municipalities) and non-profit organisations. It also provides subsidies of up to 40% of capital costs to businesses. Funding is available for switching from coal boilers to solar collectors for heating water. In 2007, the two ministries allocated CZK 33.9 million (EUR 1.28 million).

EUROPEAN UNION STRUCTURAL FUNDS

Since 2007, investors in electricity generated from renewable sources (renewable electricity) projects can obtain aid from the EU's Structural Funds through the

22. On 16 March 2010 the transmission system operator issued a press release which stated that the approval of new connections of wind and PV into the grid would be stopped in order to ensure the reliability of the transmission system. Contracts already established should be honoured.

Operational Programmes (OP). The Operational Programmes for 2007-2013 focus mainly on the construction and rehabilitation of power plants using renewable energy sources.

The OP Enterprise and Innovation (2007–2013) is implemented in the Czech Republic through the programme Eco-energy. The EU's contribution to the programme is approximately CZK 286 million (EUR 10.8 million). Subsidies cover up to 50% of capital costs, but are capped at CZK 100 million (EUR 3.78 million). Eco-energy is mainly focused on supporting the use of renewable energy sources and energy efficiency in small and medium-sized enterprises. In the first call for projects, 76 were approved and CZK 1.25 billion (EUR 47.3 million) in subsidies was granted.

The OP Environment (2007–2013) is the second-largest programme in the Czech Republic, with EUR 5.2 billion from the Cohesion Fund and the European Regional Development Fund. In 2007, 1 288 applications for grants were registered for CZK 21 billion (EUR 0.79 billion). This programme supports projects aimed at the sustainable use of energy resources, particularly renewable energy sources and energy savings. The long-term goal of the programme is to increase renewable energy use in the production of electricity and heat and enhance efficiency in the use of waste heat.

Legislation to support heat from renewable energy sources through the Operational Programmes is being prepared by the Ministry of the Environment.

SUPPORT FOR ENERGY CROPS

The programme "Support for cultivating crops for energy use in 2007" specifies the conditions for granting subsidies. In the Czech Republic the conditions are stipulated by Government Order No. 80 of 11 April 2007 laying down the conditions for the provision of a payment for growing energy crops. The objective is to promote the establishment and maintenance of standing crops for energy use with an aid of CZK 3 000 (EUR 113) per hectare. A plot of arable land with an area of at least one hectare must be used for the purpose. Energy crops must be grown on the land as the main crop in the year concerned and primarily for energy use. In 2007, 1 771 hectares have been sown with energy crops. As of August 2007, applications for aid for the cultivation of energy crops on approximately 59 920 hectares had been registered.

SUPPORT FOR BIOFUELS

The EU Biofuels Directive 2003/30/EC sets an indicative target for biofuels consumption of 5.75% for gasoline and diesel used for transport in 2010 and Directive 2009/28/EC requires each member state to ensure a 10% share of energy from renewable sources in transport by 2020.

The addition of biofuels to petrol and diesel is obligatory for producers, distributors and importers. Government Resolution No 1080 of 20 September 2006 gives the minimum quantity of biofuels to be added to a range of motor-vehicle fuels. On the basis of this resolution, an amendment was made to Act No 86/2002 Coll. on Air Protection, which requires that a minimum amount of biofuels be made available to the market. The amendment introduces the following minimum share of biofuels to be blended into fuels:

- as of 1 January 2009, 3.5% of the total amount of motor-vehicle gasoline;
- as of 1 January 2009, 4% of the total amount of motor-vehicle diesel fuel.

The obligation can be fulfilled either in the form of a low-percentage mixture of biofuels with petrol and diesel (in accord with Directive 2009/30/EC and the standards EN 228 and EN 590) or by distributing a pure biofuel (FAME/RME - rapeseed oil methyl ester) or blended fuel (blended diesel fuel – SMN 30, fuel E85, fuel E95).

In 2008, the government approved the Multi-year Programme to Support Further Use of Biofuels in Transport. On the basis of this programme, the Amendment to the Act on Consumption Tax (Law No. 292/2009 Coll. of 22 July 2009) − which gives a tax benefit to pure biofuels used in transport and to high-percentage blends − was approved by the government and came into force in August 2009.

PLANNING PROCEDURES

Renewable energy installations can be constructed in the Czech Republic after a building permit is issued by the local building authority. One of the main conditions for issuing such permit is the submission and approval of an environmental impact assessment. After obtaining a licence, the renewable energy plant operator must demonstrate its professional and financial capacity to operate the plant. Renewable energy plants of less than 1 MW can apply for tax relief for the first five years of operation.

With regard to wind plants, one of the greatest obstacles to their development is zoning restrictions. Obtaining a zoning permit takes at least one year. Since 2005, 2 000 MW of wind projects have been proposed but fewer than 200 MW have been approved. It typically takes seven years to connect wind plants to the grid.

PUBLIC AWARENESS

The Ministry of Industry and Trade set up EFEKT – a state programme for energy saving and the use of renewable energy sources − to complement energy programmes supported by EU Structural Funds.[23] Grants are provided for information and awareness-raising activities on the potential for energy savings. The programme focuses on the promotion and running of energy consultancy centres (EKIS), which provide the public with information about savings and renewable energy sources (RES), subsidies for conferences and training seminars, and publications on energy savings and renewable energy systems. From 2003 to 2006, CZK 383.8 million (EUR 14.5 million) was allocated. In 2007 the financial incentives amounted to CZK 67.2 million (EUR 2.5 million), and in 2008 to CZK 59.6 million (EUR 2.25 million).

Public acceptance of renewable energy is low in the Czech Republic. This could prove to be a stumbling block in the government's efforts to expand the role of renewable energy to meet energy security and climate change goals. In many cases, local and regional authorities are not in favour of developing renewable energy resources because they are not fully aware of their benefits. For example, the environmental impact assessments of renewable energy projects focus on the negative impacts without taking into account the positive benefits of the projects.

23. See "Report on the Fulfilment of the Indicative Target for Electricity Production from Renewable Energy Sources for 2008" (page 22) http://www.mpo.cz/dokument12942.html for more information.

CRITIQUE

The Czech Republic has set targets and adopted measures to foster renewable energy deployment. Since the last in-depth review, the share of renewable energy in TPES has been steadily increasing. The largest increase was recorded in solar PV and wind, albeit from a very low base. This development is commendable given that renewable energy plays a fundamental role in tackling climate change and energy security risks.

There is concern, however, that the Czech Republic may not achieve EU targets of a 13% share of renewables in final energy consumption and 8% in electricity generation by 2010 with its current policy measures. Meeting the long-term goals for 2030 is even more challenging. The country's northern latitude has implications for the potential for solar power and, as a landlocked nation, wind speeds are generally moderate. In addition, as high wind potential is often found in mountainous regions that also tend to be national or local parks, its development is fought against on environmental grounds.

Explicit projections for the different renewable energy technologies are incorporated into the updated draft State Energy Concept. The cost-effectiveness of policies and measures should be carefully evaluated to ensure that the overall renewable energy objectives are met without putting an excessive burden on consumers through taxes or tariffs. Particular attention should be given to the cost of each renewable technology. In the medium term, biomass is expected to account for most of the increase in renewable energy, which makes sense given the country's resource potential, but current policies do not reflect the government targets. It is important that the government decreases incentives for specific technologies over time, in order to move them towards market competitiveness and reduce the burden on consumers and the budget.

A well-designed feed-in tariff system can give sufficient security to invest in renewable energy projects. If not well designed, the incentives for cost reduction may not be strong and it may be the producers, not the consumers, who enjoy the benefit of any cost reductions, unless they are passed through as a result of competitive pressure. The level of feed-in tariffs and budget allocations must be regularly evaluated and reduced, if necessary, to encourage continued advancements and cost reduction of the technologies. The feed-in tariffs for PV resulted in impressive growth in this technology but at considerable cost to consumers while investment costs fell faster than expected.

The effectiveness of renewable energy policies can be improved further if the Czech government assesses the entire policy framework into which incentive schemes are placed. In particular, the government should address non-economic barriers, such as administrative hurdles, obstacles to grid access, lack of public awareness and social acceptance issues. One specific area for improvement is in the permitting procedures for the construction of renewable energy projects in municipalities. Enhancing public acceptance for renewable energy policy will also be important as the number of renewable energy plants being planned and built is increasing.

The planned substantial increase in generation from renewables, including from intermittent sources such as wind, will require more flexible operation of the electricity system. The Czech government needs to ensure that the transmission system operator prepares for the effects on the grid and encourages co-operation with regional partners. The Czech Republic could gain valuable experience from efforts made in neighbouring countries, such as Germany, to connect electricity from renewable sources to the grid.

RECOMMENDATIONS

The government of the Czech Republic should:

- ☐ *Develop a comprehensive strategy for the deployment of different renewable energy technologies based on a scientific assessment of both their technical potential and the short- and longer-term prospects for competitiveness.*
- ☐ *Consider the scope for new legislation to ensure that planning procedures in municipalities more clearly reflect national energy and climate policies.*
- ☐ *Enhance public awareness of the benefits of renewable energy.*
- ☐ *Carefully monitor the effects of feed-in tariffs and green bonuses and be prepared to consider adjusting levels of support over time to optimise the overall effectiveness of these policies in deploying renewables.*

9. ELECTRICITY AND HEAT

OVERVIEW

Electricity generation in the Czech Republic was some 83.5 GWh in 2008, nearly 60% coal-fired. Nuclear accounted for 30%. The Czech Republic is the third-largest net electricity exporter in the European Union in absolute terms, after France and Germany. About a quarter of total generation is exported to the Slovak Republic, Germany and Austria. The Czech Republic is a net importer of electricity from Poland. Heat production was 120 000 TJ in 2008, predominantly from coal and gas.

The retail electricity market was fully liberalised as of January 2006, in line with EU directives. In 2007, a wholesale market, Prague Energy Exchange (PXE), was created. The partly state-owned utility, ČEZ, owns and operates most of the major coal-fired plants and all nuclear plants. ČEZ's current share of total generating capacity is nearly 75%, slightly more than in 2005 when the last in-depth review took place. ČEZ also has a dominant share (62%) in the retail market. Switching rates on the low-voltage level in the Czech Republic are still low compared to other IEA countries.

Thanks to adequate network capacity, there is very little congestion within the domestic network. However, the electricity network infrastructure was built essentially in the 1970s and 1980s and focuses primarily on the east-west grid. Moreover, as the average age of the Czech coal-fired power plants is 50 years, many plants are in need of refurbishment. Refurbishing existing assets is one of the key challenges for the industry.

The Czech Republic has sufficient capacity which enables it to cover domestic demand and to export the remaining surplus, while maintaining a healthy reserve margin. Planned capacity additions are sufficient to meet expected demand growth, but there is some uncertainty over the country's role as an electricity exporter in the future.

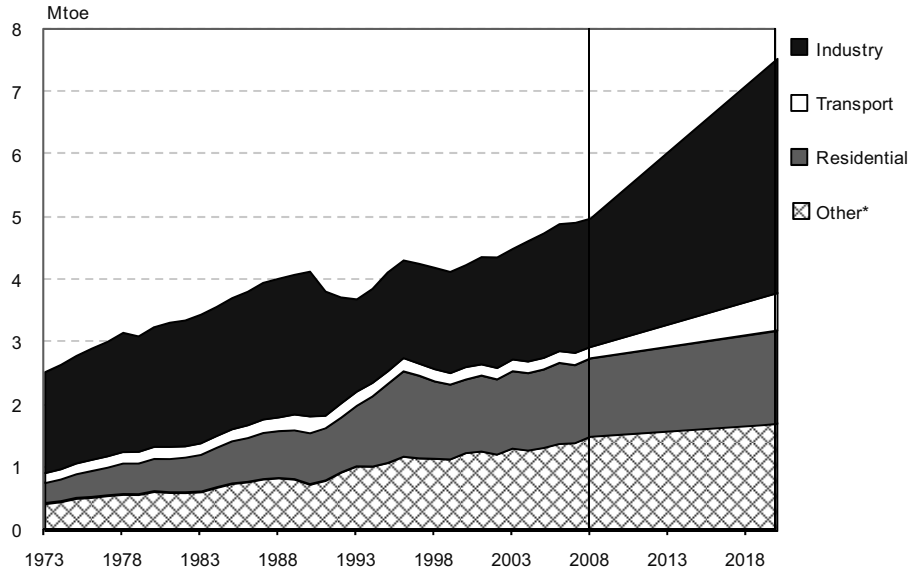
District heating and co-generation play a predominant role in heat generation. Combined heat and power (CHP) production is the third-highest in the IEA, after Denmark and Finland.

ELECTRICITY AND HEAT DEMAND

Figure 23 shows electricity demand by sector in the Czech Republic. The industry sector is the largest consumer, accounting for 35% of total demand in 2008. Demand in the buildings sector (households and services) was 30%. Because of the global downturn, electricity demand in the industry sector started declining in 2008 (Table 12). Final heat demand decreased by about 20% from 2005 to 2008, primarily as a result of a fall in demand in the buildings sector. Heat demand in the residential sector accounted for 38% of total heat demand in 2008 (Table 13).

The government anticipates demand increases in the industry sector over the medium term and in the transport sector over the longer term, according to projections for economic growth and on the basis of the efficiency and transport-related policy objectives outlined in the updated draft State Energy Concept.

Figure 23. Final consumption of electricity by sector, 1973 to 2020



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

Note: The graph shows historical data until 2008 and the government's forecasts from 2009 to 2020.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2009 and country submission.

Table 12. Electricity consumption by sector, 2005 to 2008
(GWh)

	2005	2006	2007	2008
Industry	23 145	23 613	24 173	23 870
Energy Sector	2 373	2 406	2 512	2 437
Other	17 427	18 205	18 421	19 467
Residential	14 719	15 198	14 646	14 703
Total	**57 664**	**59 422**	**59 752**	**60 477**

Source: Czech Statistical Office.

Table 13. Final heat consumption by sector, 2005 to 2008
(Mtoe)

	2005	2006	2007	2008
Industry	0.692	0.704	0.707	0.640
Energy	0.338	0.366	0.367	0.423
Other	1.786	1.609	1.388	1.412
Of which: Residential	*1.168*	*1.113*	*0.924*	*0.949*
Total	**2.816**	**2.679**	**2.462**	**2.475**

Source: Czech Statistical Office.

ELECTRICITY AND HEAT GENERATION

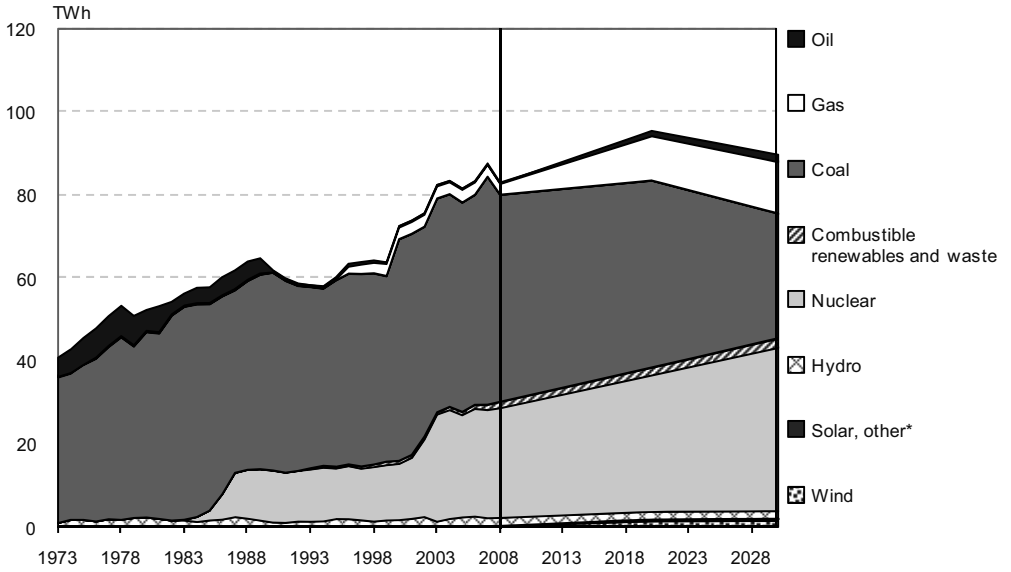
Electricity is generated largely from domestic coal and nuclear (Table 14), whereas natural gas is mainly used as complementary fuel in multi-fired units and for peaking purposes. The use of domestic resources has the advantage of enhancing security of supply and the Czech Republic is a net exporter of electricity. However, given the current limits on coal mining in some areas, there is the risk that future production could limit the potential for electricity exports. An additional 8.6 GW of coal-fired capacity, all super-critical plants, are planned in the period to 2030, and over 12 GW of coal-fired capacity will be decommissioned so a small loss of generating capacity is expected by 2030 compared to the previous decade (Table 15).

Table 14. Installed capacity and generation, 2008

	Installed capacity (GW)	Share in total (%)	Generation (TWh)	Share in total (%)
Coal-fired	10.7	60	51.2	61
Nuclear	3.8	21	26.6	32
Hydro	2.2	12	2.4	3
Gas-fired	1.0	5	3.1	4
Renewables	0.2	1	0.3	0.3
Total	**17.7**	**100**	**83.5**	**100**

Source: Energy Regulatory Office.

Figure 24. Electricity generation by source, 1973 to 2030



* *Other* includes electricity produced from heat from chemical sources (negligible).

Note: The graph shows historical data until 2008 and the government's forecasts from 2009 to 2020.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2009 and country submission.

Table 15. Net electricity generating capacity additions

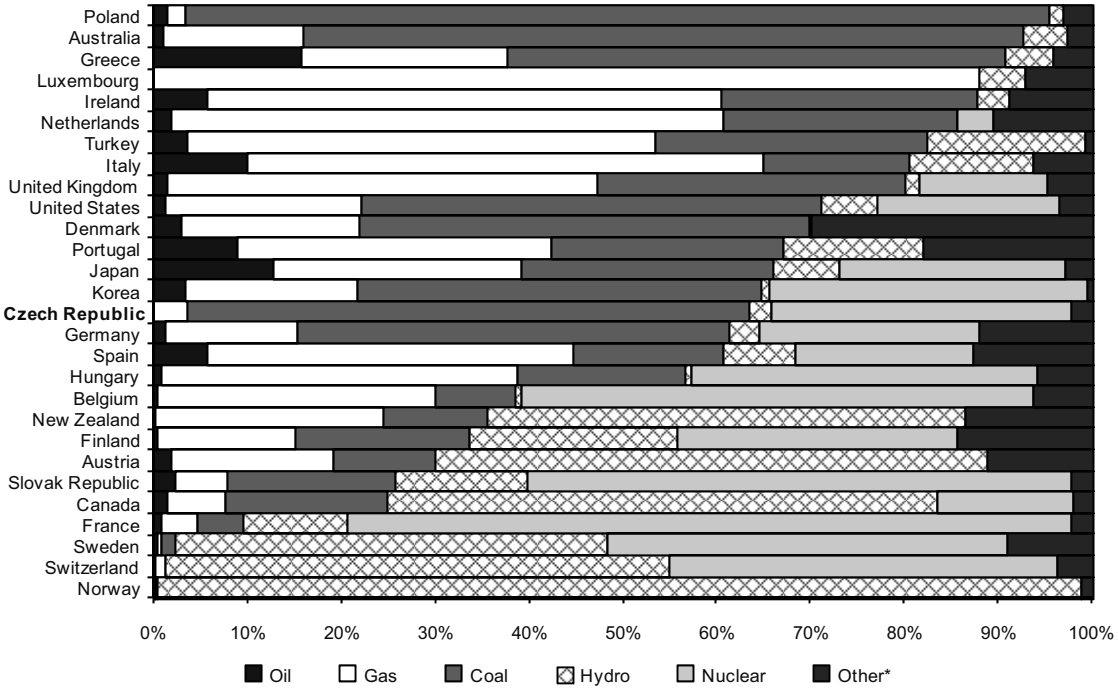
(GW)

	2009-2020*	2021-2030
Coal-fired – planned	3.1	5.4
Coal-fired – decommissioned	-4.7	-7.7
Nuclear – planned	1.2	1.2
Nuclear – decommissioned	0	-1.2
Hydro	0	0
Gas-fired – planned	1.7	3.0
Gas-fired – decommissioned	-0.6	-3.2
Oil-fired – planned	0.1	0.1
Wind	0.5	0.6
Solar	1.6	1.0
Combustible renewables and waste	0.1	0.1
Net additions	**3.0**	**-0.7**
Total operating capacity (at end of period)	**19.69**	**18.99**

*Includes plants under construction.

Source: Energy Regulatory Office.

Figure 25. Electricity generation by source in IEA member countries, 2008



* *Other* includes geothermal, solar, wind, tide/wave/ocean energy, and combustible renewables and waste.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2009.

CHP constitutes one-third of electricity generation and over 40% of overall heat production, making the country the third-largest in CHP utilisation after Denmark and Finland (see Chapter 4 on Energy Efficiency for more details on CHP). Heat production is based largely on domestic coal, but there is a significant share of imported gas. The share of district heating in the overall heat supply was 21% in 2008.

ELECTRICITY INDUSTRY AND MARKET OPERATION

COMPETITIVE STRUCTURE

The Czech Republic's generation sector is highly concentrated, with ČEZ accounting for some 75% of total generation in 2008. This share has risen slightly since the last in-depth review in 2005. Competition is limited in the Czech electricity sector. Given the size of ČEZ's market share, it has the ability to control the market and create barriers to new entrants, although there is no clear evidence that this has occurred. In November 2009, ČEZ was the target of an EC investigation over anti-competitive behaviour. The authorities are investigating whether ČEZ blocked power plant projects and monopolised the brown coal trade. ČEZ denies all culpability in the investigation, which is ongoing.

TRANSMISSION

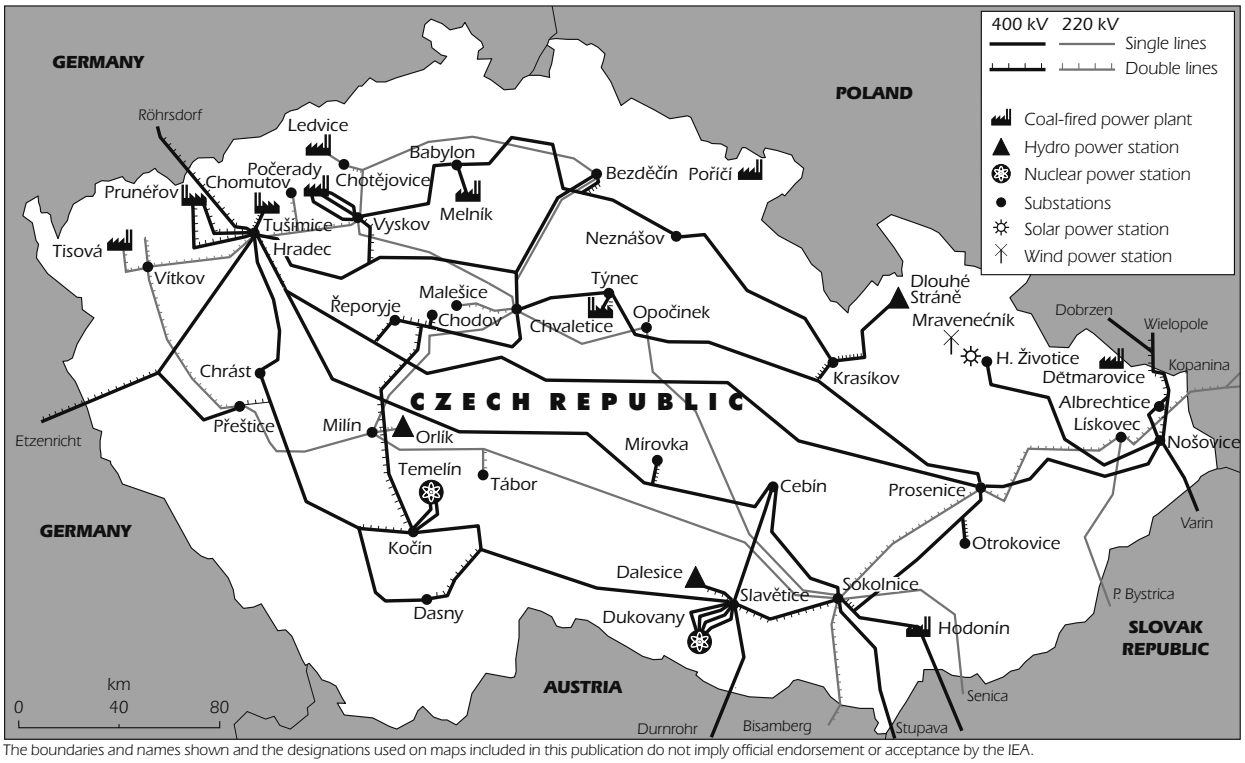
The state-owned transmission system operator (TSO) ČEPS owns all of the transmission assets and is the only TSO in the country. Its network is comprised of 68 transformers of 400/110 kilovolts and 220/110 kV located at 38 transformer stations, 3 479 km of 400 kV lines and 1 910 km of 220 kV lines (Figure 26). One 110 kV substation and 94 kilometres of 110 kV lines are also part of the system. Investment plans, included in the national Critical Infrastructure Plan, over the next three decades are presented in Table 16.

Table 16. ČEPS investment plans, 2009 to 2026

	Number
New substations 400 kV	9
New substations 220 kV	1
Modernisation of present substations 400 kV	15
Modernisation of present substations 220 kV	4
New lines 400 kV	9
Modernisation or doubling present lines 400 kV	32
Modernisation of present lines 220 kV	7
Transformers 400/220 kV (exchange)	2
Transformers 400/110 kV (new or exchange)	45
Transformers 220/110 kV (new or exchange)	15

Source: Ministry of Industry and Trade.

Figure 26. Electricity transmission lines



The boundaries and names shown and the designations used on maps included in this publication do not imply official endorsement or acceptance by the IEA.

Source: ČEPS.

The Energy Act (458/2000) obliges the transmission system operator to provide access to the transmission grid to all market participants (including distribution system operators) in a non-discriminatory manner. Such obligation is fulfilled on the basis of a signed Transmission Contract or Cross-Border Transmission Contract if appropriate. The main prerequisites for the contract are:

- applicant identification;
- technical specifications:
  - requested start date and duration of transmission services;
  - requested quantity of the reserved transmission capacity (maximal power of transmission) at the delivery point (the total reserved power at the delivery point, including all foreseen contracts of electricity supply or electricity take-off).

In the contract, ČEPS commits itself to reserve the requested transmission capacity in favour of the market participant and to deliver electricity via the transmission grid. The amount of reserved capacity is part of an application for the contract; any potential future request for its change is reconsidered against the technical possibilities determined by ČEPS.

The transmission fee consists of two parts: the grid usage fee (derived from the actual delivered amount of electricity) and the fixed fee for the reserved transmission capacity. The National Regulatory Authority annually sets both fees. The grid usage fee is not applied to generators connected to the transmission grid.

CROSS-BORDER INTERCONNECTIONS

The transmission network is highly interconnected with neighbouring networks. The transmission system operator, ČEPS, has eleven 400 kV cross-border tie-lines and six 220-kV cross-border tie-lines. The Czech Republic has interconnection capacities with bordering countries: Germany (2 100 MW), Austria (750 MW), Slovak Republic (1 500 MW) and Poland (1 200 MW) totalling 5 550 MW or almost 32% of the country's domestic installed capacity. Thanks to the country's substantial reserve margin, this interconnection capacity is equal to 49% of the all-time historic peak.

Two new 400 kV cross-border lines are planned to be built before 2026: one between the Czech Republic and Germany (from Vítkov to Mechlenreuth), the other one between the Czech Republic and Slovakia (from Otrokovice to Považská Bystrica). In addition, the government plans to modernise four of the existing 400 kV cross-border lines.

The main prerequisite for the Cross-Border Transmission Contract is a valid registration of the market participant with the Czech Market Operator, OTE, ensuring also that the appropriate licence for electricity trade has already been issued. The effective contract gives to the market participant the right to transmit electricity through all profiles between ČEPS and neighbouring TSOs after reserving the capacity in an auction procedure when necessary. Afterwards, ČEPS is obliged to ensure the cross-border electricity delivery free of charge.

Cross-border transmission capacity is reserved by market participants on all relevant interconnectors via auctions. The capacity can be reserved in yearly, monthly or daily auctions. Since 2005, the prevailing allocation method has been co-ordinated auctions which take place on the common borders with ČEPS, PSE Operator S.A., Transpower Stromübertragungs GmbH and 50Hertz Transmission GmbH. Bilateral auctions are organised on the interconnectors between the Czech Republic and Austria (ČEPS and APG grid). The Czech Republic and the Slovak Republic have integrated their national electricity markets and no cross-border capacities will be allocated in auctions on the CZ/SK intersection in 2010.

Auction participants are allowed to transfer their paid long-term capacities to other auction participants. The main prerequisite for using allocated capacity is an agreement for transmission services/balancing contract concluded with the respective TSO.

Market participants may also apply for intra-day transmission on the neighbouring profiles ČEPS/APG, SEPS, TPS and 50Hertz. The respective capacities are allocated free of charge on the first-come-first-served principle, when it is technically feasible, with respect to the safe and reliable operation of the transmission system.

Offered capacities and auction results of bilateral auctions between the Czech Republic and Austria are published on the e-portal DAMAS (daily auctions) and on the Austrian Auction Office website (yearly and monthly auctions). ČEPS publishes the available tradable capacities (including forecasts) on its website.

ČEPS co-operates with the TSOs in other Central and Eastern European countries to improve co-ordination of the allocation process. In July 2008, the Central Allocation Office GmbH (CAO) was established in order to develop and implement co-ordinated congestion management solutions in the region. CAO is owned by the regional TSOs on an equal share. CAO is the single point of contact for market participants regarding explicit transmission capacity auctions in this region from the year 2010.

ČEPS organised intra-day procedures on all its cross-border lines, except for the border with Poland (PSE Operator).

CROSS-BORDER TRADE

Its geographical location and significant cross-border connections with neighbouring countries make the Czech Republic a strategic trading partner and a major electricity exporter in Western Europe. In 2009, net exports totalled 13.6 TWh (Table 17).

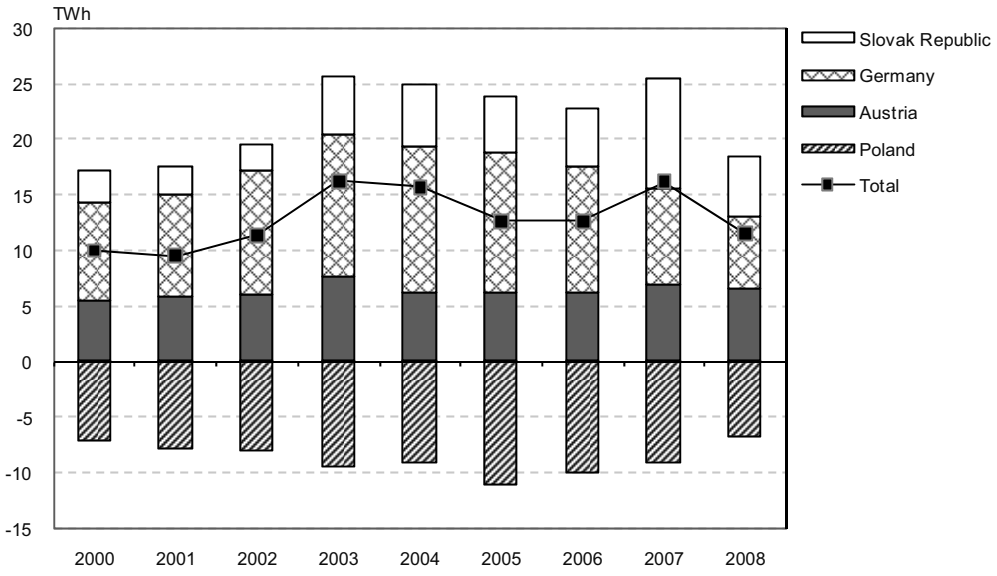
Table 17. Electricity exports and imports, 2005 to 2009
(TWh)

	2005	2006	2007	2008	2009
Exports	21.0	19.5	25.6	21.9	22.2
Imports	-8.3	-6.9	-9.5	-10.4	-8.6
Net exports	12.6	12.6	16.2	11.5	13.6

Source: Ministry of Industry and Trade.

The next EU action plan for the power industry sector (2010-2013) will be adopted by member states in 2010. One of the priorities will be to strengthen external relations. In the updated draft State Energy Concept (SEC), the Czech government sets out the objective to further develop interconnections between the Czech Republic and other Central European countries. The government intends to maintain an excess power balance and adequate power reserves. However, in the draft SEC, electricity exports are projected to be sharply reduced from current levels in the reference scenario. This could have a profound impact on neighbouring countries' electricity supply-demand balance. The Slovak Republic currently imports roughly 40% of its electricity consumption from the Czech Republic, while Austria imports roughly 10% (Figure 27).

Figure 27. Electricity exports from the Czech Republic, by country, 2000 to 2008



Source: Ministry of Industry and Trade.

In May 2006, the Czech Transmission System Operator, ČEPS, together with its Slovak counterpart SEPS enabled 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 Czech and Slovak Republics' trading areas were coupled into a common market area, and no auctions of cross-border capacities have been executed since then. Intra-day market is currently functional on cross-border interconnections with Germany and Austria.

DISTRIBUTION

There are three large distribution companies in the Czech Republic:

- ČEZ Distribution which includes the area of Western, Northern, Central and Eastern Bohemia and Northern Moravia;
- E-ON Distribution which includes the area of Southern Bohemia and Southern Moravia;
- PRE Distribution which includes the area of Prague.

There are also 278 local distribution companies. The ČEZ Distribution, with 3.5 million customers, accounts for some 62% of total distribution (34 TWh/year). E-ON Distribution is the second-largest distribution company, with 1.4 million customers and 14.3 TWh/year. PRE Distribution is owned by the City of Prague, GESO, RWE, ČEZ and the Czech government, and services 0.7 million customers. Distribution is 7.2 TWh/year.

MARKET REFORM AND REGULATION

Electricity market liberalisation in the Czech Republic as in other European Union states is driven by the directives of the European Parliament and of the Council (Directive 96/92/EC and Directive 2003/54/EC). The directives lay down the general conditions that should be in place to assure the creation of a single internal electricity market (IEM) in Europe. The three major implementation aspects of the directives relate to market opening, third-party access and the independent system operator:

- all non-household customers are eligible from 1 January 2005 and all consumers are eligible from 1 January 2006;
- regulated third-party access is imposed and a regulator must be appointed to approve the distribution tariffs, monitor congestion management and act as a dispute-settlement authority;
- transmission and distribution companies have implemented legal unbundling.

Other positive developments since the last in-depth review include:

- intra-day trading was launched in May 2006 by the Market Operator;
- the Prague Energy Exchange was founded in 2007; trading started from 17 July 2007.

The system of trading on the electricity market was changed when annual auctions organised by ČEZ, a.s. were replaced by continuous trading on the Prague Energy Exchange, now called the Power Exchange Central Europe. Together with the high volatility of energy commodity prices throughout 2008 and a broader range of products

offered by electricity suppliers to final customers, this has helped to strengthen the competitive environment in the electricity market.

Improvement of primary and secondary energy legislation continued in the Czech Republic in 2008. In this respect, the most important step was the comprehensive amendment to the Energy Act, which the Czech Parliament started to debate in the latter half of 2008. The amendment, Law No. 158/2009 Coll., was published on 4 June 2009 (valid as from 4 July 2009).

The Czech Republic devoted extreme attention to the third liberalisation package. For its EU presidency in the first half of 2009, it set the endorsement of the package as one of its priorities. The country therefore made considerable efforts to amend the directives on common rules for the internal electricity market. The Czech Republic is a country with highly above-average volumes of electricity transmission, and therefore considers the development of a high-quality legislative environment, in conjunction with the TSOs of European networks, to be crucial. This environment is expected to considerably contribute to the next stage of the energy market's development.

The Czech government expects that the European TSOs, together with the European Commission and other market players, will proceed without delay to develop common grid codes and commercial codes. These and other documents will clearly determine the character of the internal energy market for the coming years and facilitate the overcoming of regional differences to help give rise to the EU single market.

DISTRIBUTION/RETAIL MARKET

The liberalised electricity market functioned for the third year in 2008. Although all final customers were already entitled to select their electricity supplier, only 2% used this opportunity at the moment of the electricity market opening. Recent data recorded by the Market Operator OTE are shown in Table 18.

The fact that ownership of distribution companies is still very vertically integrated could be a barrier to new entrants in the retail market.

Table 18. Status of retail market distribution

	2007		2008	
Type of supply	Numbers changing supply point	Switching (%)	Numbers changing supply point	Switching (%)
High-demand customers, EHV, HV	4 353	19.0	6 549	28.6
Low-demand business customers, LV	5 733	0.7	35 351	4.3
Households	15 385	0.3	15 764	0.3

Source: Market Operator OTE.

REGULATION

The Energy Regulatory Office (ERO) is responsible for licensing, price regulation and setting rules for the electricity market. The Market Operator OTE is responsible for the organisation of the short-term electricity market, the settlement of imbalances in the system and the central registry of greenhouse gas emission allowances. The State Energy Inspection (SEI) monitors competition and has the right to impose fines for anti-competitive behaviour.

ELECTRICITY PRICING

The Energy Regulatory Office does not collect data on the average price of electricity for large customers connected to the extra high-voltage (EHV) and high-voltage (HV) networks. Suppliers do not publish their quoted prices for these customers who are offered individual prices on the basis of their load profile and the current prices of energy in each of the various time bands on the wholesale market and energy exchanges. Thus, it is not feasible to clearly determine the average price for regulated activities (network services) in the case of large customers. This price is influenced by the voltage level and also by the capacity booked in the period under review. The amount of booked capacity reflects the nature of each particular customer's consumption and in general is different for each one.

For small business customers and households connected to the low voltage (LV) network, the structure of the price quoted by most suppliers corresponds to the structure of distribution tariffs, *i.e.* according to the distribution tariff that the customer has selected, the respective energy product is offered. Suppliers publish these energy products and customers can compare the prices quoted for these products. At the same time, because of the relatively large number of supply points (more than 800 000 for small business customers and almost 5 million for households), it is possible to define an average for each category of customers. Table 19 shows the evolution of the average prices of regulated services and energy for both customer categories connected to the low-voltage network.

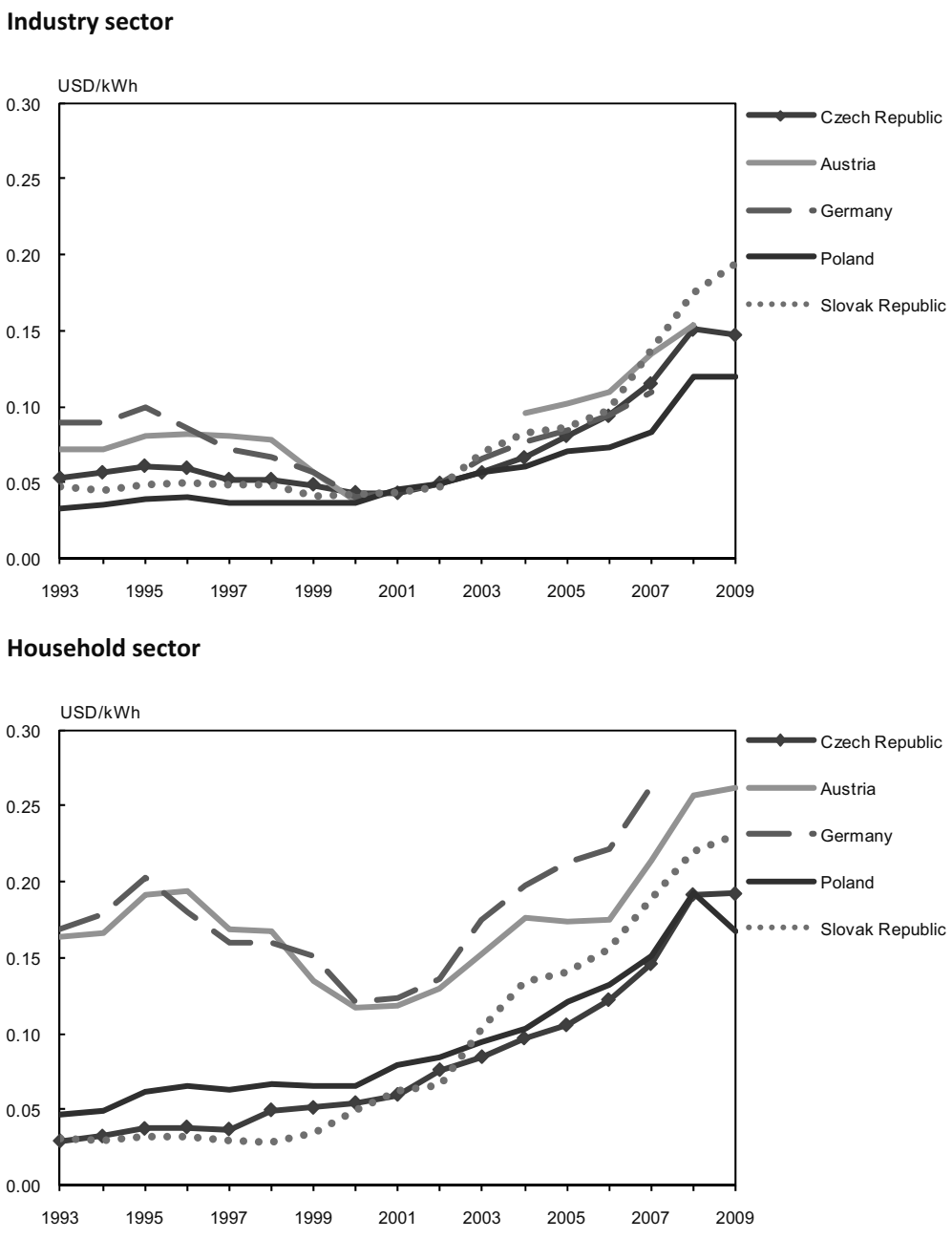
Table 19. Average electricity prices for small businesses and households
(EUR/MWh)

Households	**2005**	**2006**	**2007**	**2008**	**2009**
Regulated components	49.54	50.42	51.02	52.32	56.11
Electrical energy, including margin	41.50	48.51	55.76	64.84	74.98
Total	**91.04**	**98.93**	**106.78**	**117.15**	**131.09**

Small businesses	**2005**	**2006**	**2007**	**2008**	**2009**
Regulated components	52.40	53.96	55.30	56.94	61.29
Electrical energy, including margin	41.50	51.62	60.28	69.80	82.36
Total	**93.90**	**105.58**	**115.58**	**126.74**	**143.65**

Source: Market Operator OTE.

Figure 28. Electricity prices in the Czech Republic and other selected IEA member countries, 1993 to 2009



Note: Values missing for Austria and Germany.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2010.

Final customers pay for electricity on the basis of the point at which they are connected to the system (in general, prices differ by the voltage level and the regional distribution system). All of the fixed and variable costs incurred by network operators (the TSO, DSOs) are paid only by final customers; they are not charged to electricity producers. The structure of the payments for transmission/distribution is composed of a fixed component and a variable one.

For customers connected to the transmission system and to the EHV and HV networks, there is a standing monthly charge for booked capacity depending on the voltage, and for small business customers connected to the LV network the standing monthly charge depends on the size of the circuit breaker. The variable component covers the cost of losses. The bill also shows separate items: the price for system services, contribution to support renewables and CHP, and the market operator's services of imbalance clearing.

Figure 28 compares electricity prices in the Czech Republic with other IEA member countries.

CRITIQUE

The Czech Republic has the highest level of per-capita electricity consumption among the emerging market economies in Central and Eastern Europe. The energy-intensive industrial sector has been the main driver of the growth in electricity demand. Demand increases are anticipated mainly in the industry sector over the medium term and in the transport sector over the longer term. The Czech Republic has managed to keep a sufficient reserve margin in its generating capacity and remains the third-largest net electricity exporter in the European Union.

The draft SEC anticipates further development of CHP in light of the prospects for meeting electricity and heat demand in a more efficient manner. However, consumers have recently been disconnecting from the district heating network and switching to gas boilers which are more efficient. The majority of CHP plants are coal-fired, which provides benefits in terms of security of supply but poses challenges for environmental sustainability.

The updated draft SEC envisions a self-sufficient and export-oriented electricity sector, largely motivated by the government's perception of risks related to energy security. Major pillars of this strategy are preferential use of domestic coal resources through the removal of existing mining limitations, significant expansion in nuclear capacity, development of renewable sources, in particular biomass and waste, and maintaining excess generation for exports. The draft SEC outlines indicative targets for domestic resources, including nuclear fuel, with 90% and 80% shares in overall electricity and district heating, respectively.

Energy security benefits based on targets to maximise the use of domestic resources should be complemented by detailed assessments and comparisons of economic efficiency and the environmental sustainability of the desired outcomes, with greater reliance on imports. Further focus and detailed road-maps are essential for ensuring optimality in long-term strategies, particularly in the areas pertaining to efficiency improvements, the development and deployment of advanced combustion technologies, sustainable coal and other low-carbon technologies, and flexible and wider use of fuel-switching options. Given the energy-intensive structure of the Czech economy and the strong seasonality in electricity and heat demands, facilitation of demand-side measures, in particular with participation from industry, should contribute to the efforts of the Czech Republic to enhance energy security and environmental sustainability in a cost-effective manner.

The Czech electricity system has provided stable operation, through diversified output of generation according to the size of the units, provision of sufficient reserves, and effective operation and maintenance of the overall electricity grid. The updated draft SEC puts emphasis on sufficient expansion of the electricity grid capacity as well as on its

modernisation through the development and wider use of new technologies. The Critical Infrastructure Plan under preparation also includes measures for maintaining and further improving the security and stability of the electricity network. The recent decline in system service charges is one indication of the stabilisation of the system as well as the competitive environment achieved for ancillary services.

On the generation side, efficiency improvements and timely and effective replacement of coal-fired plants that are retired will be essential for maintaining a surplus as desired by the government. The average efficiency of coal-fired power plants in the Czech Republic, at some 32%, is among the lowest in IEA countries. The IEA average in 2007 was estimated to be about 37%. Generation investments are subject to authorisation, while tendering is also being considered in the updated draft SEC among the new options for capacity additions. Licensing activities were mostly focused on small generation units, in particular photovoltaics, in 2008. In general, the duration of realisation of all types of new generation investments remains considerably long. Streamlining and improving the permitting, authorisation and connection-related procedures and removing the remaining non-technical barriers are essential for facilitating capacity expansion in a timely and feasible manner. Continuous monitoring and evaluation of the supply-demand balance with further co-ordination among the Ministry of Industry and Trade, the Energy Regulatory Office (ERO) and the Transmission Company (ČEPS) is also necessary for providing clear signals to the market to achieve the desired growth targets for the Czech electricity system. Competitiveness should remain the core aspect of any action to direct generation investments in parallel with the long-term policy goals of the Czech Republic.

The country has achieved some progress regarding the development of a liberalised electricity market since the last in-depth review. On the wholesale level, the Market Operator OTE launched the intra-day trading in 2006. The creation of the Prague Energy Exchange (PEX), now the Power Exchange Central Europe, in 2007 replaced the principle of wholesale electricity sales based on auctions by continuous options for long-term trading. While the volume traded at the public platforms is growing, most of the wholesale market operates on bilateral contracts.

The end-user supply market was liberalised in 2006. The electricity market has been developing in the segments of large and medium-sized customers, where a sufficient number of traders are actively operating. Compared with other new EU member states that have started to liberalise their markets at the same time as the Czech Republic, the latter performs better than the others in the field of supplier switching. In 2009, so far, 66 out of 113 supply points connected to the high-voltage network have been switched. Also, the tendency is positive for households' switching, especially in 2009, with households switching supply points being three times more than in 2008, even if the figures remain below the EU average. The amendments to the Energy Act in 2009 mandated the Energy Regulatory Office (ERO) to further focus on monitoring and evaluation of the market.

End-user prices are relatively high compared to the EU average and have been rising over the past few years, as a consequence of the rise in wholesale power prices (as opposed to grid tariffs or margins of power retailers), caused itself primarily by the rising prices of global commodities and CO_2 regulation. The total price of electricity supply to end-users is calculated as the sum of the costs of power at the wholesale electricity market and own costs and overheads. Since the opening of the electricity market to end–users, the major impact on the development of electricity prices to end-users has

primarily been the development of power prices at the wholesale electricity market. Despite the fact that ČEZ accounts for about 75% of generation and owns five of the former eight distribution companies, it is not clear that it has abused its market power to manipulate prices. Nevertheless, the Czech Republic should intensify its efforts for more effective oversight of the market by the ERO and for timely and accurate implementation of the EU third liberalisation package.

The Czech Republic's transmission system could enable electricity exchange options with all its neighbours. The net transfer capacity of the existing interconnections of 17 cross-border lines is over 30% of Czech installed capacity. In 2008, the 42-km 400 kV line to Austria was refurbished as part of ČEPS long-term investment plan for the reinforcement of transmission from north to south. Further extension of the infrastructure through the construction of new lines and modernisation of existing lines is planned for the period to 2026. These developments are consistent with the export-oriented strategies of the Czech Republic. Explicit auctioning mechanisms are implemented on a periodical basis for all available cross-border lines. Nevertheless, further development of cross-border infrastructure will be necessary for the establishment of regional and EU-wide physical electricity markets.

One recent development in terms of regional markets is the launching of a common day-ahead market between the Czech Republic and Slovakia, which was formulated on the principle of implicit auctions. In the case of the Polish, Slovak and both German interconnections, co-ordinated explicit auctions are also organised in co-operation with the neighbouring TSOs. These developments are positive for the establishment of a regional electricity market. In this context, the Czech Republic should continue to co-operate with its neighbours towards functioning electricity markets, without any restrictions on imports. The sufficient cross-border capacity combined with third-party access through co-ordinated auctions allows for trading with surrounding countries. This process leads to the formation of one power price in these power markets (price convergence is visible, for example if day-ahead or forward prices are compared among Czech OTE/PXE and German EEX). The integration of the Czech power market into the broader Central Europe area is vital for its proper functioning.

RECOMMENDATIONS

The government of the Czech Republic should:

- ☐ *Improve the economic efficiency and environmental sustainability of the electricity and heat sectors, in particular by implementing policies, including through the EU-ETS, to:*
  - *increase efficiency;*
  - *provide flexible and wider use of fuel-switching options and low-carbon technologies;*
  - *promote demand-side measures, such as facilitating the installation of smart meters.*
- ☐ *Improve the investment climate, in particular for new capacity investments, and ensure the realisation of the long-term policy targets within competitive market conditions, by providing clear signals through periodic assessments of the supply-demand balance and infrastructure plans.*

- *Ensure that there are no barriers to competition in the overall electricity market, and make certain that ČEZ does not abuse its dominant position.*
- *Enhance greater dissemination of information on choice of supplier to residential customers.*
- *Strengthen co-operation with neighbouring countries to develop a functioning regional electricity market.*

10. NUCLEAR

OVERVIEW

The Czech Republic has a longstanding history of development and deployment of indigenous nuclear technology. In 1958, the Czechoslovak government commenced construction of a gas-cooled heavy-water reactor at the Bohunice site, now in the Slovak Republic.

Today, nuclear energy plays a very important role in the Czech energy mix. Two nuclear power stations at Dukovany and Temelín, with a total of six *Vodo-Vodyanoi Energetichesky Reactor* (VVER) operating units, accounted for 21% of installed generating capacity and 31% of electricity production in 2008. According to the Czech government, if the total electricity output of the Dukovany and Temelín nuclear power plants were replaced by coal-fired power plants, CO_2 emissions in the Czech Republic would increase by 17%.

All of the nuclear power plants are operated by ČEZ, the partially state-owned utility (28% of its shares are currently publicly listed).[24] The government representatives in ČEZ report to the Ministries of Finance and of Industry and Trade.

The updated draft State Energy Concept (SEC) strongly supports independence and security of supply through the maximisation of use of domestic primary resources and identifies the future expansion of nuclear capacity as one of its major pillars. In August 2009, ČEZ launched a public tender to select a contractor for the construction of two nuclear units at the Temelín site.

NUCLEAR POWER PLANTS

Four pressurised light-water reactors of Russian design are in operation at the Dukovany nuclear power station in Southern Moravia. The original capacity of these reactors was 1 760 MW_e (4 x 440 MW_e). A programme for modernisation and upgrade of the Dukovany power station commenced in 1995 and will continue up to 2015. The programme includes:

- power uprates of each of the units;
- plant safety upgrades to create the conditions for potential lifetime extensions;
- refurbishment of instrumentation and control (I&C) systems.

For each unit, the power uprate programme envisages a capacity rise from 440 MW_e to 500 MW_e by 2012, which will increase the gross output of the plant by 240 MW_e. Between 2005 and 2008, initial uprate of the gross capacity was 456 MW_e in all four units, obtained through the replacement of low-pressure turbines. Two units have

24. See Chapter 9 for more information.

recently been running at 462 MW_e and, while updating and investments continue, a 38 MW_e uprate was announced in May 2009 for unit 3, bringing its capacity to the target power output of 500 MW_e. This output gain was achieved through the adoption of improved fuel, the replacement of high- and low-pressure turbine components, and the refurbishment of generator and output transformers.

Concurrently, ČEZ has launched the Long-Term Operations (LTO) Dukovany Preparation Project, aimed at enhancing plant safety, efficiency and reliability. The goal of the project is to create the conditions for potential lifetime extensions (up to 50-60 years). The programme contains approximately 230 specific actions and modifications to be implemented between 2009 and 2015. The modifications include modernisation, maintenance or repair works (some 160 items), namely for the environmental and seismic qualification of systems and components, the refurbishment of systems in terms of physical protection, fire protection, and radiation control. Further substantial investments have been made to refurbish the instrumentation and control systems.

The Dukovany plant has improved its operational and safety indicators such as safety system unavailability, number of starting failures and fuel reliability. Moreover, according to the Czech government, the collective dose[25] at this plant is now among the lowest worldwide.

On the site of Temelín in Southern Bohemia there are two pressurised light-water reactors (PWRs) of Russian design, with a total installed capacity of 2 000 MW_e. The Temelín station was originally planned to host four PWRs VVER-1000 units. Construction of the first two units commenced in 1986, in a regulated electricity market. However, plans to construct units 3 and 4 were abandoned in 1990 and work on units 1 and 2 slowed down. In 1993, following the separation of Czechoslovakia into the Czech and Slovak Republics, the government decided to upgrade the design of Temelín units in order to meet international safety standards. The upgrade delayed completion of the plant and greatly increased its cost.

Another significant obstacle to the plant operation was Austria's reluctance to have a nuclear power station near its border, which was resolved through a bilateral agreement, the Melk Agreement, signed under the auspices of the European Union. Under this protocol, Austria and the Czech Republic agreed to a safety review process before commercial operation of the plant and a regular exchange of information thereafter. Temelín units 1 and 2 became fully operational on 11 October 2004. The operating results of the Temelín nuclear power plants have been steadily improving. In 2008, the implementation of the programme "Achieving excellence in human performance" resulted in a reduction of human factor-related incidents by 80% below the 2007 level.

A major modernisation project of the high-pressure turbine components took place between 2004 and 2007, giving rise to a significant improvement in plant efficiency. A further upgrade is planned to bring the gross unit output to 1 050 MW_e.

In 2008, the two Temelín reactor units produced 12 103 403 MWh of electricity, accounting for nearly 20% of total generation of the CEZ Group. The plant also supplies heat to facilities on site and to customers in the nearby town of Týn nad Vltavou, providing 190 000 GJ in 2008.

25. The collective dose is a measure of the total amount of effective dose (of radiation) related to (multiplied by the size of) the exposed population. It is a safety indicator.

RECENT DEVELOPMENTS

The Czech government envisaged the construction of two or more large reactors in its 2004 State Energy Policy. The increase of the nuclear share in the energy mix has also been presented as one of the major pillars of the updated draft State Energy Concept (SEC) 2009. In July 2008, ČEZ announced a plan to build two more units at Temelín. In August 2009, ČEZ opened a public tender for the construction of the new units, after having asked the Ministry of the Environment to undertake the environmental impact assessment. The completion of the assessment, requested in mid-2008, is expected to take approximately two and a half years. The contractor will be selected by the end of 2011, with construction due to start in 2013. The administrative process is likely to last some seven or eight years, so that the new third-generation pressurised-water reactors should come on line between 2020 and 2025. The amount of additional capacity will depend upon the design chosen for the new plants.

According to the assessment of GHG mitigation potentials of different measures included in the draft Climate Protection Policy, the deployment of the new Temelín units would reduce emissions of CO_2 by 8.4 Mt of CO_2-eq through the replacement of 8.4 TWh currently generated by coal-fired plants.

The Temelín tender also seeks to give ČEZ the option of ordering up to three more reactors for other locations in Europe. ČEZ has a 49% stake in plans for a large new reactor at Bohunice in the Slovak Republic. A shareholder agreement for a joint venture was stipulated in 2009 between ČEZ and the Slovakian state-owned nuclear and decommissioning company, JAVYS. A feasibility study is being conducted with plans to start construction in 2013 and begin commercial operation around 2020.

REGULATORY AND LEGAL FRAMEWORK

The general act governing all activities in the field of nuclear energy and ionising radiation is the Act on Peaceful Utilisation of Nuclear Energy and Ionising Radiation. The Act, usually referred to as the Atomic Act, was adopted and entered into force in 1997. It has undergone numerous amendments.

According to the Atomic Act, primary responsibility for nuclear safety and radiation protection of nuclear facilities resides with the operator, while supervisory functions and competencies fall under the jurisdiction of the State Office for Nuclear Safety (SÚJB). Thus, ČEZ is accountable for the safe construction, operation and decommissioning of nuclear plants as well as for radioactive waste management.

The national regulatory body SÚJB maintains lower-level legislation and has issued 19 decrees[26] related to the Atomic Act which are constantly updated to achieve full harmonisation with international requirements and recommendations. Furthermore, SÚJB co-operates with the International Atomic Energy Agency (IAEA) and the European Commission in the field of safeguards. Inspectors from the European Commission and IAEA, accompanied by those from SÚJB, are authorised to scrutinise nuclear material and the accounting and control systems, in order to ensure the fulfilment of the EURATOM Treaty, the Non-Proliferation Treaty and the Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the

26. www.sujb.cz/?r_id=29

Seabed and the Ocean Floor and in the Subsoil thereof. SÚJB has competencies to negotiate international treaties both between governments (in co-operation with the Ministry of Foreign Affairs) and between regulatory bodies, having the faculty to propose accession to international conventions to the Cabinet.[27]

The most important international conventions signed and ratified by the Czech Republic in the nuclear field are:

- the Convention on Nuclear Safety;
- the Joint Convention on the Safety of Spent Fuel Management in Waste Management;
- the Convention on Early Notification of a Nuclear Accident;
- the Convention on Assistance in the Case of Nuclear Accident or Radiological Emergency;
- the Treaty on the Non-Proliferation of Nuclear Weapons;
- the Convention on the Physical Protection of Nuclear Material;
- the Comprehensive Nuclear Test Ban Treaty;
- the Convention on Civil Liability for Nuclear Damage.

According to the Atomic Act, SÚJB is the competent body for granting licences to nuclear operators. SÚJB inspectors appointed by the chairperson verify whether licensees are adhering to the licence conditions and the Act's provisions. In case of non-compliance, SÚJB can enforce remedial actions, amend or even revoke a licence. Inspectors are permanently present at the Dukovany and Temelín plants. Facilities such as the three research reactors, radioactive waste and spent fuel interim storage as well as the low-level radioactive waste repository are also supervised by SÚJB.

The Ministry of Industry and Trade develops national legislation and intergovernmental treaties in the nuclear field, proposing government strategies and policies. The Ministry of the Environment regulates nuclear activities to ensure compliance with environmental laws, including the application of the environmental impact assessment procedures, as a prerequisite for a nuclear licence. The Ministry of the Interior is responsible for establishing details of regional crisis plans and emergency plans.

The Atomic Act incorporates third-party liability provisions in accordance with the Vienna Convention under which the nuclear operator must bear responsibility for damages caused to any third party. In 2009, this liability was increased to CZK 8 billion (EUR 0.3 billion) per nuclear installation and CZK 2 billion (EUR 0.08 billion) for other facilities, including transport. The nuclear operators must be insured for liability. To cover these liability claims, a nuclear insurance pool was established in July 1995. The government is obliged to compensate for amounts exceeding insurance coverage.

URANIUM PRODUCTION

Annual uranium requirements in the Czech Republic are approximately 680 tonnes of uranium (tU) and 410 t SW,[28] accounting, on a fairly equal basis for the demand of the two plants. In meeting uranium demand, domestic resources played a substantial role until 2006.

27. A list of concluded agreements is available at www.sujb.cz/?r_id=67

28. Separative work units (SW) measure the amount of separation done by an enrichment process to provide the enriched fuel.

Beginning in 1946, Czechoslovakia embarked on a large-scale programme for the production of uranium for military and nuclear electricity generation purposes. Up to 1990, cumulative uranium production amounted to 105 351 tU, peaking at some 3 000 tU/year in the 1960s. However, because of the progressive exhaustion of economically recoverable resources, production significantly decreased and was gradually phased out during the 1990s. Czech uranium production has declined steadily from 507 tU in 2000 to 309 tU in 2007. Currently 19 of the 20 mines are closed. Dolní Rožínka is the only mine still in operation, with production of about 240 tU in 2008. Although production activities were due to cease in 2002, owing to the quality of the ore, the closure has been repeatedly postponed. Recently the Czech government has decided to further prolong its operation, given favourable conditions in the global uranium market.

In promoting security of supply through the maximum use of domestic primary resources, the draft SEC envisages the prospective further exploitation of uranium, if economical feasibility is confirmed through geological surveys.

The Czech Republic, as many other countries in Eastern Europe and Central Asia, faces a very significant ecological and economic challenge: remediating the legacies of past uranium production. There is a lack of both financial and technical resources for these activities in the Czech Republic. Funding of remediation activities amounts to tens of billions of Czech crowns and requires, in some cases, international support by the European Union or the World Bank. However, it is very important that remediation takes place in a systematic and swift manner, as decisive actions to address the environmental problems caused by the previous mining practices will strongly influence public acceptance of new facilities.

Decommissioning and restoration of closed mining and milling sites are carried out by DIAMO s.p., the state-owned company responsible for mining activities. The programme covers some 20 sites and aims to mitigate the environmental impact of past operations. Rehabilitation activities are expected to continue until 2040 and include:

- remediation of sites following *in situ* leach (ISL) mining;
- remediation of tailing ponds at milling plants removal;
- reprocessing and reclaiming of waste dumps;
- long-term mine water treatment.

The most severe remediation project is taking place at the Stráž deposit owing to ISL mining. The draft updated SEC envisages that investments will continue until rehabilitation is complete.

NUCLEAR FUEL CYCLE

Different approaches have been applied with respect to procurement of uranium and nuclear fuel for the two plants. Most fuel has been sourced within the country, with conversion, enrichment and fuel fabrication undertaken in Russia. A contract for the supply of fuel for the Dukovany nuclear power station was signed with the Russian company JSC TVEL before the Czech Republic became a member of the EU. This was "grandfathered" by the Euratom Supply Agency. Fuel was initially purchased as a "partial bundle", including conversion and enrichment services, while ČEZ supplied uranium

concentrates purchased from the domestic producer DIAMO s.p. Until 2002, uranium needs for the reactors at the Dukovany site were fully covered by domestic sources. Today, as production has significantly decreased, a growing portion of fuel is being purchased from TVEL as a "complete bundle" (including uranium).

Fabrication of fuel for the reactors at the Temelín plant was previously provided by Westinghouse, while uranium and related processing services were procured on the basis of long-term contracts with a diversified portfolio of suppliers. However, as a result of a recent tender, JSC TVEL has been selected to replace Westinghouse as from 2010 in fabricating fuel for the Temelín plant. Rather than gradually introducing the fuel supplied by TVEL, as initially envisaged, ČEZ has decided to switch to the new supply immediately for the two units. Fuel has already been entirely replaced in the core of Unit 1. As of 2010, all fabricated fuel will be from Russia. ČEZ has recently signed a contract for the enrichment of Temelín fuel at the Georges Besse II enrichment plant in France, which will ensure some long-term diversification of the fuel supply.

Although fuel fabrication services had previously been outsourced, the updated draft SEC envisages the possibility of developing fuel-cycle facilities for the processing of uranium concentrate, the fabrication of fuel and the reprocessing of spent fuel. This would enhance security, diversification of supply and utilisation of resources, and would allow a more efficient treatment of spent fuel. However, the implementation of such facilities requires significant investments and regional co-operation.

DECOMMISSIONING AND NUCLEAR WASTE

Under the provisions of the Atomic Act, licensees are obliged to make financial provision for the decommissioning of nuclear facilities. Funds must be available at the required time for decommissioning preparation and activities, in an amount commensurate with the methods proposed by the licensee and approved by the State Office for Nuclear Safety. The estimated cost of decommissioning is verified by the Radioactive Waste Repository Authority (RAWRA) and licensees are obliged to update their evaluation every five years. It is estimated that the cost of decommissioning the four Dukovany units would be CZK 16.4 billion (EUR 0.62 billion) and the cost for the two Temelín units, CZK 13.7 billion (EUR 0.52 billion). These are, in nominal terms, the figures confirmed by the Czech government for 2008.

The Atomic Act and its implementing decrees form the legislation framework for all spent fuel and radioactive waste management activities, including the provision of a radioactive waste categorisation.[29] The policy adopted by the Czech government in 2002 – also referred to as the Radioactive Waste Management Concept[30] – identifies objectives, priorities and roles of various organisations and interest groups, providing the strategy in relation to the generation and management of radioactive waste and spent nuclear fuel.

The State Office for Nuclear Safety, created under the Atomic Act, is the body responsible for nuclear safety and radiation protection supervision.

The Czech government is responsible for guaranteeing the safe disposal of all radioactive waste, including monitoring and supervision of repositories after their closure. For this

29. Decree No. 307/2002 Coll.
30. Resolution No. 487/2002.

purpose, the Ministry of Industry and Trade established RAWRA in 1997, funded through levies imposed on generators of radioactive waste. In compliance with international principles, the latter are required by Governmental Order No. 416/2002 to bear all the costs of radioactive waste management from production to disposal, including the cost of monitoring repositories after their closure and the cost of the associated research and development. Funds are accrued in the Nuclear Account, lodged with the Czech National Bank and managed by the Ministry of Finance. As part of the governmental assets and liabilities, the fund may only be used for tasks specified in the Atomic Act through the intervention of RAWRA. The latter establishes payment rates, currently set at CZK 0.05 (EURcents 0.2) per kWh. The balance of the Nuclear Account increased from CZK 1.3 billion (EUR 0.049 billion) in 2003 to CZK 13.5 billion (EUR 0.51 billion) at the end of 2009.

Short-lived low- and intermediate-level waste (LILW-SL) constitutes the largest volume of radioactive waste, with activity decaying to very low levels after 200 to 300 years. Hence, this typology of waste can be deposited in near-surface repositories, by adopting processing and disposal techniques which are very well developed. A LILW-SL disposal facility is located on the Dukovany site for the disposal of operational waste produced by both the Dukovany and the Temelín nuclear power stations. Two facilities have been designated for the disposal of institutional waste, generated by industry and research and medical activities: the Richard disposal facility, located near the town of Litoměřice; and the Bratrství repository, located in a former uranium mine near the town of Jáchymov.

High-level waste (HLW) and spent nuclear fuel, if declared as waste, represent the most hazardous category of radioactive waste, although the volume of this category of waste is relatively low, amounting to less than a tenth of the volume of all radioactive waste generated in the Czech Republic. The levels of long-lived radionuclide activity and concentrations are, however, high, hence requiring long-term disposal in a deep geological repository. In the interim, following temporary storage at reactor pools, ČEZ has adopted a concept of dry storage in dual-purpose, transport/storage containers, to be kept on the premises of the plants and continuously monitored. Since March 1997; a 600-tonne interim dry storage facility has been operational on the Dukovany site. This has been recently extended with the addition of a new dry storage facility of 1 340 tonnes capacity. At Temelín, the initial storage capacity was sufficient for nine years of operation and is currently being expanded with the construction of a new dry storage facility. This additional capacity, due for completion in 2014, was approved by the Minister of the Environment in November 2005. Spent fuel from research reactors is stored at the Nuclear Research Institute at Řez.

In the long term, the final storage of spent fuel and radioactive waste management will be in a national deep geologic repository (DGR). Since 1993, activities to implement a DGR have continued to be developed step by step, as follows:

- selection of candidate sites and the structure of the engineered barrier system;
- proposal of the final site and corresponding design of the engineered structures;
- confirmation of the safety of the DGR by safety analysis;
- construction operation and closure of the DGR.

It is expected that a DGR will be constructed in granitic rock formations. On the basis of geological data, 30 potential locations were initially identified in the Czech Republic.

With RAWRA having completed the regional mapping phase, six candidate sites have now been selected for further study. Two military areas are also being considered for geological investigation. According to the Radioactive Waste Management Concept, two candidate sites should be included in regional plans by 2015. The target date for the selection of the final site is 2015, with commissioning activities of the repository starting after 2065.

Containers are currently being designed for the direct disposal of spent nuclear fuel or processed high-level waste. Insulation materials are being analysed and will be ultimately selected on the basis of geological and hydrogeological conditions at the identified site.

The Czech government recognises that public involvement in the DGR site selection process is very important. According to its Programme Proclamation,[31] the government's search for a geological repository for spent nuclear fuel will be carried out in a transparent manner. The agreement of the respective communities will be a condition *sine qua non*. In an attempt to raise public acceptance, RAWRA members provide technical information to each affected community. However, public opposition to a potential DGR siting in the affected municipalities was still very vigorous during the geological survey for DGR development. This led the government to decide to discontinue such geological surveys in 2005.

Although the Czech Republic has adopted an open nuclear fuel cycle, alternative options are not being excluded. Spent fuel reprocessing capabilities and the use of new technologies leading to the reduction of spent fuel volume and toxicity are being monitored and evaluated, including advanced methods for the separation and transmutation of long-lived radionuclides. Equally, as the possibility of shared disposal facilities is increasingly discussed in international forums, the Czech government does not rule out the option of high-level waste and spent nuclear fuel disposal in an international regional repository. If such a project became feasible in future, the knowledge acquired in the development of a deep geological repository in the Czech Republic would be valuable for its realisation.

R&D AND HUMAN RESOURCES

With respect to the continuous advancement of nuclear technologies including generation IV (Gen IV) reactors and the perspective of closing the fuel cycle, the Czech Republic's engagement in international programmes is recognised as very important. Czech organisations, and notably the Nuclear Research Institute Řez, have been involved in the research and development of advanced and new-generation reactor systems, including, among others, research activities on the advanced high-temperature reactor, fast reactors (with sodium, helium and lead-bismuth coolant) and the molten salt reactor. Recently, a new large R&D facility has been built at Řez to simulate selected reactor loops of Gen IV systems and their components. The project is funded by the European Community under the umbrella of the "Sustainable Energy" programme, promoting regional research and development centres.

Research institutions and universities have been engaged in activities covered by various Euratom programmes and the Czech Republic is also a member of the IAEA International

31. Government Decree No. 44 of 17 January 2007.

Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO). The updated draft SEC further encourages expanding this already established involvement of the Czech Republic in such an international framework.

The Czech Republic shares with other countries a significant scarcity in human resources stemming from the ageing of the current workforce and emerging gaps resulting from the stagnation in nuclear research in previous decades. The safe design, operation and regulation of nuclear systems can only be achieved with sufficient and competent staff. ČEZ has been engaged in several initiatives and education programmes with schools, in order to raise the awareness and level of information of young people on scientific and technological matters in general, and on topics related to energy sources and power generation, nuclear power in particular. The programmes include the distribution of educational material, the organisation of lectures, discussions and debates, co-operation with selected universities as well as support for talented students (through scholarships). Both nuclear power plants have information centres which receive a significant number of visitors annually. A variety of models, exhibitions and tools are provided, especially to students, so that they can learn plant details and gain general information on nuclear power. Further encouragement of educational programmes and enhancement of co-operation between research centres, academia and industry by the government would help to encourage young professionals into nuclear careers and increase technical awareness and competencies.

CRITIQUE

Nuclear energy plays a very important role in the Czech energy mix. Future expansion of nuclear capacity has been presented as one of the major pillars of the updated draft SEC which strongly supports independence and security of supply through maximum use of domestic primary resources.

The average availability factor at the Dukovany plant has consistently been around 90% in recent years, reflecting an unplanned capability loss factor well below the world average. Efficiency has also been enhanced through programmes of modernisation and upgrading carried out at the Dukovany and Temelín plants in recent years. These have improved operational and safety indicators and will create the conditions necessary for the potential life extension of the Dukovany units. The technical and safety performance of the nuclear units in operation at Dukovany is satisfactory according to the IAEA and other international bodies. These results are laudable.

To ensure security of supply and reduce emissions of greenhouse gases and solid pollutants, the Czech government envisages the construction of additional reactors in the updated draft SEC. Recently, the key operator ČEZ has decided to build new nuclear facilities at Temelín and launched, in August 2009, a public tender to select a contractor for the construction of two nuclear units of pressurised-water design (Gen III. or III+).

The development of additional nuclear facilities will, in the first place, be aimed at replacing thermal power plants at the end of their lifetime. The role of the regulator and the Office for the Protection of Competition will continue to be central in monitoring market developments as ČEZ already has a dominant position in the Czech electricity market.

While some of the Czech Republic's neighbours have nuclear facilities or are considering their development, other countries either do not have nuclear plants or are considering

shutting them down. In this environment, the Czech Republic should consider supporting co-operation among governments and system operators at the regional level in order to avoid excess capacity over the longer term. Regional co-operation could also be encouraged with regard to radioactive waste storage/repository facilities.

The government has important responsibilities in ensuring the safe and secure deployment of nuclear systems throughout their life cycle, including obligations with respect to nuclear safety, decommissioning and radioactive waste management, R&D and necessary educational and legal frameworks. At the political level, a consistent approach to developing a safe nuclear programme is needed to maintain public acceptance, especially for those living near a nuclear installation or uranium mines. Efforts to hold public meetings and debates with all the interested stakeholders at the national and local levels should be continued.

According to a recent public opinion survey, 77% of the population is in favour of using nuclear energy. This is an impressive share at the country level, but it is also reported that there is a very high public resistance among people living near candidate sites for future radioactive waste repository facilities and possible mining sites. The continuous and transparent involvement of the population, in particular in local communities, is a prerequisite for a fair, effective and successful process of siting a deep geological repository. RAWRA has made efforts to communicate with the public and promote the dissemination of information. These efforts, however, have not been sufficient, and public resistance in communities near proposed sites remains very high. The government should continue to enhance the involvement of local communities and consideration should be given to providing incentives.

According to the Czech law, yearly transfers are to be made to the Nuclear Account by ČEZ and other radioactive waste generators in order to finance the future development of a permanent high-level radioactive waste repository facility. However, as cost estimates for the facility have changed over time,[32] it is important that the government regularly monitors these provisions to ensure the adequacy of the Nuclear Account in covering the projected costs of waste management and final disposal of low-, intermediate- and high-level radioactive waste and spent fuel, as well as the cost of decommissioning existing nuclear power plants. The government should continue to guarantee that the money dedicated to these long-term costs is not used for other purposes, even in case of financial difficulties.

Dolní Rožínka is the only uranium mine still operating in the Czech territory. Recent government legislation has decreed that DIAMO s.p., the state-owned company responsible for mining activities, including for the management of remediation programmes, should continue mining and processing uranium ore in the mine as long as it is economically feasible. Through DIAMO, the Czech government has continued the clean-up of closed uranium mines. Remediation programmes for the decontamination of polluted groundwater covers 19 closed mining sites and it will require considerable effort over several decades (up to 2040). These activities need adequate funding, which should be planned and allocated over the long term and in a systematic manner. Prolonged, unproductive or costly programmes in the restoration of the closed mines may have a significantly negative impact on public opinion. The government should intensify its efforts to remediate closed uranium mines. The updated draft SEC envisages the possible future exploitation of uranium, if economical feasibility is confirmed

32. Since the last in-depth review, estimates have increased from CZK 43.3 billion (EUR 1.64 billion) to CZK 50 billion (EUR 1.89 billion).

through geological surveys. In this regard, any prospective opening of mines should be conducted through the application of modern technology and high environmental standards and should obtain the acceptance of local communities.

It is commendable that numerous high-level R&D projects are being sustained in nuclear fission technology, including generation III and IV reactors, notably in the Nuclear Research Institute, building on the national strengths and capacities and engaging in prominent international programmes.

The safe design, operation and regulation of nuclear systems can only be achieved with sufficient and competent staff. The Czech Republic shares with other countries the significant problem of scarce human resources as the current workforce ages and emerging gaps resulting from the stagnation in nuclear research in previous decades.

RECOMMENDATIONS

The government of the Czech Republic should:

- ☐ *Support co-operation among governments and transmission system operators at the regional level, in order to ensure that growth in nuclear electricity supply is compatible with the regional supply and demand balance.*
- ☐ *Continue pursuing comprehensive waste management and decommissioning programmes, including:*
  - *a transparent public consultation process, with efforts to improve public acceptance;*
  - *a sustained commitment to R&D for waste management solutions;*
  - *consideration of regional co-operation in defining approaches to management;*
  - *assurance that adequate financing is built up and ring-fenced for the radioactive waste management plan and for decommissioning activities.*
- ☐ *Apply modern technologies if new mines are to be exploited and make efforts to ensure that environmental safeguards and social acceptance objectives are met.*
- ☐ *Continue to pursue and intensify the rehabilitation of closed uranium mines, ensuring, where possible, long-term planning and adequate funding of remediation activities.*
- ☐ *Promote educational programmes and enhance co-operation between research centres, academia and industry to encourage young professionals into nuclear careers and increase technical competencies.*

PART III
ENERGY TECHNOLOGY

11. ENERGY TECHNOLOGY AND R&D

GENERAL R&D POLICY STRUCTURE

The Czech research and development (R&D) system is centralised, with a nearly equal balance between public and private funding. Foreign companies play a dominant role in private R&D investment. Their share in total private R&D investment is one of the highest in the European Union (EU). Public R&D is carried out by institutions of higher education and the Czech Academy of Sciences.

Research, development and innovation (RDI) policy is implemented under the auspices of the Czech Parliament. The conceptual and strategic management of the policy is under the competency of the Prime Minister. The operational management is entrusted to the Research, Development and Innovation Council. Public funding is an integral part of the state budget, administered by the Ministry of Finance. The Council provides funds for research conducted at universities. The Ministry of Education, Youth and Sports (MEYS) is responsible for international R&D co-operation. MEYS and the Academy of Sciences represent the largest providers. The former provides funds for universities and is also responsible for international co-operation R&D.

A specific role is also assigned to the Ministry of Industry and Trade which is responsible for industrial R&D and is the main body responsible for public support for private R&D (competitive grants for the private sector and collaborative grants between the public and private sectors). In addition, several Czech sectoral ministries have significant R&D budgets and also act as important R&D funders (in the form of both project and institutional funding). Before the recent reform of R&D funding, there were 22 public bodies funding R&D in the Czech Republic. Energy is one of eight national R&D priorities.

RECENT DEVELOPMENTS

In November 2007, the Czech government announced plans to increase R&D spending by 7% to 8% annually until 2010 (representing a EUR 38 million annual increase). This reconfirmed the crucial role attached to R&D by the current government and its commitment to reforming the Czech R&D system.

The Council for Research and Development announced its proposal for a thorough reform of the R&D system in January 2008. In March 2008 the Czech government approved the Act on the Reform of the System of Research, Development and Innovation. Key aspects of the reform are:

- simplifying the entire system, including an introduction of institutional funding based on results;
- reducing the number of funding bodies (from 22 to 11), including the establishment of a Technology Agency for applied R&D;

- supporting excellence in R&D and ensuring the use of results for innovation processes;
- making the programme support from public sources conditional on co-funding of R&D activities from third parties (commercial partners);
- enhancing the flexibility of the organisational structure of public R&D;
- safeguarding personnel for R&D and innovation;
- increasing international co-operation in R&D, such as through the Technology Platform for Sustainable Energy.

It is expected that the reform steps will be introduced gradually. The Technology Agency is expected to commence operations in 2010. This agency is expected to ensure the effective implementation of applied R&D funding. Some of the measures to stimulate collaboration with industry will likely be operational in the very near future. The Technology Platform for Sustainable Energy was introduced in May 2009 and is expected to be the main tool for Czech business and research partners to implement the European Strategic Energy Technology Plan (SET-Plan).

As part of the reform, the number of funding bodies for R&D is to be reduced to the following: the Czech Science Foundation (basic research); the Technology Agency; the Ministry of Education, Youth and Sports (international R&D collaboration, including the funding of major research infrastructures); the Ministry of Industry and Trade (industrial R&D); the Ministry of Health (health research); the Ministry of Agriculture (agricultural research); the Ministry of the Interior (security research); the Ministry of Defence (defence research); and the Ministry of Culture (research on national culture and identity).

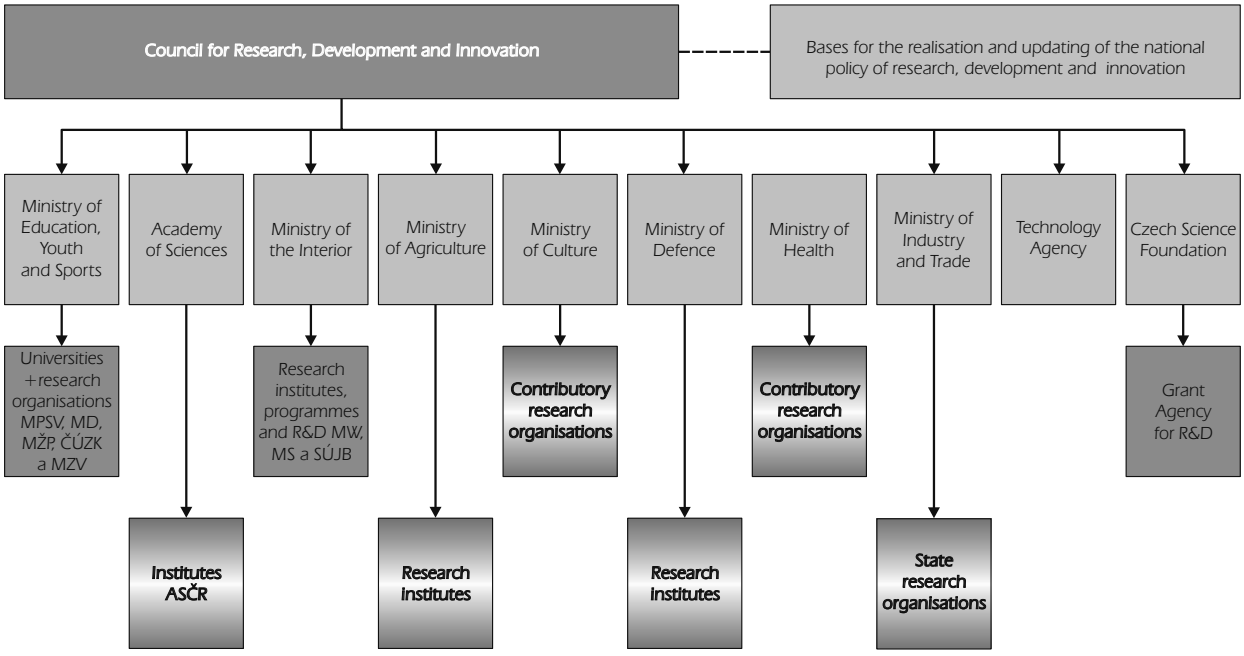
Because the reform process is still in progress, the National Research Programme (NRP III) has been replaced by the National Policy for Research, Development and Innovation 2009-2015 (discussed below) prepared by the Research, Development and Innovation Council and by the Ministry of Education, Youth and Sports in March 2009.

RESEARCH INSTITUTIONS AND INFRASTRUCTURE

The institutional framework of RDI is shown in Figure 29. The main responsibilities of the Research, Development and Innovation Council consist of advising the government on R&D policy issues, including preparing the R&D budget proposal, allocating the budget to individual R&D funders and preparing mid-term budgetary plans, drafting R&D-related policy documents such as the annual Analysis of Czech R&D, and managing an information system for R&D results, which also serves in part as the basis for future budget allocations.

The Ministry of Industry and Trade is the central authority of the state administration for state industrial and trade policy, issues of small and medium-sized enterprises, industrial research, and the development of engineering and technologies.

Figure 29. Framework of research, development and innovation as of July 2009



ASČR: Academy of Sciences of the Czech Republic
ČÚZK: Czech Geodesic and Land Register Office
MD: Ministry of Transport
MPSV: Ministry of Labour and Social Affairs
MS: Ministry of Justice
MV: Ministry of Interior
MŽP: Ministry of the Environment
MZV: Ministry of Foreign Affairs
SÚJB: State Office for Nuclear Safety

Source: Ministry of Industry and Trade.

OTHER INSTITUTIONS

The Czech Rectors' Conference plays an important informal consultative role in R&D policy design and represents the interests of higher education institutions.

The Association of Research Organisations (AVO) represents and promotes the interests of applied research organisations, including both privately owned applied research centres and businesses. It has an important consultative and advisory role in the R&D policy debate and is also represented in the R&D Council.

The Czech Science Foundation, an independent legal entity which funds basic research projects, has its own board and five thematic scientific advisory committees (technical, natural, medical, social and agricultural), each with a number of sub-committees. Each committee has an informal consultative and advisory role in the design of the overall R&D policy. It controls the third-largest public R&D budget in the Czech Republic (after the two key research ministries) and funds basic research predominantly in public R&D organisations, especially in universities and institutes of the Academy of Sciences.

Other institutes and organisations acting at the central and regional levels are regional and district branches of the Czech Chamber of Commerce, information and advisory agencies, the Association of Research Organisations, the Association of Innovative Entrepreneurship, the Science and Technology Parks Association, the Czech Association of Development Agencies, and other associations and societies.

The technical universities play a major role in basic research and the Academy of Sciences plays a key role. The prevailing trend in energy research is in applied research. Its own specific programmes govern nuclear research. In accordance with the core principles of the new RDI policy, the Technology Agency will be responsible for the management of energy research.

R&D POLICY AND KEY ENERGY RESEARCH AREAS

The National Policy for Research, Development and Innovation 2009–2015 is an outcome of the recent reform process. Previously, there was a lack of co-ordination of R&D funding, primarily the result of its dispersion in 22 budgetary chapters. The difficulties in co-ordinating funding were largely responsible for a failure to formulate sufficiently concrete priority areas for R&D. Other challenges addressed in the new National Policy are the low degree of collaboration between public and private sectors' R&D efforts, the lack of appropriate support structures for the commercialisation of R&D results, and a lack of awareness of intellectual property right issues. The Czech Republic, as a founder of the World Trade Organization, implements the TRIPS (trade-related aspects of intellectual property rights) Agreement.

The priority areas of the RDI Policy 2009-2015 relating to energy reflect intensive dialogue between private stakeholders and the government. They include:

- Competitiveness and sustainable development
  - safe and economic transport;
  - use of natural resources;
  - production processes and systems;
  - buildings and construction;
  - advanced materials;
  - emerging technologies.
- Energy for the economy and society
  - safe and effective nuclear power engineering;
  - use of coal and coal products;
  - rational use of energy and renewable energy sources.

More specific priorities in the field of nuclear energy are to:

- ensure safe, reliable and economic operation of existing nuclear power plants with lifetime extended to 60 years, including determining a solution for radioactive waste management;
- strengthen the development and innovation of Gen III and III+ nuclear power plants and research and development of Gen IV plants;
- expand the use of heat for industrial applications, *e.g.* for the production of hydrogen.

Thermonuclear fusion is another area of R&D. Main research in this area includes high-performance materials, plasma stability and development of high-speed performance laser diodes.

For fossil fuels, research and development is focused on new technologies with high efficiency (*e.g.* combustion, multi-fuels) allowing more efficient use of fossil fuels and the reduction of greenhouse gas emissions.

In the field of renewable and alternative energy sources, R&D is focused on biomass, specifically second-generation biofuels, wind and thermal energy, solar energy through photovoltaic materials and new types of efficient photovoltaic cells. In the future, R&D will increasingly be devoted to developing a hydrogen economy and to the use of hydrogen in fuel cells or combustion engines for transport, or decentralised energy, and to smart grids.

R&D FUNDING

Between 2002 and 2007, public spending on energy R&D remained relatively unchanged. Compared to other IEA countries, the Czech Republic spends less on a per-GDP basis. In 2008, spending was 0.03% of GDP, the eighth-lowest among IEA member countries (Figure 30).

In 2007, the Czech government started increasing the annual budget allocations by approximately CZK 1 billion (EUR 38 million). Public spending on R&D thus represents one of the few budgetary chapters where funding has increased and the share of R&D investment in the budget should, as a consequence, rise.

Under the financial plan approved by the Czech government in 2007, the energy R&D budget increased from CZK 20 billion (EUR 0.76 billion) in 2007 to just under 23 billion (EUR 0.87 billion) in 2008 to CZK 24.8 billion (EUR 0.94 billion) in 2009 and to CZK 26.8 billion (EUR 1.01 billion) in 2010. For 2011, a budget of 28.9 billion (EUR 1.09 billion) has been earmarked.

Because of the strategic importance of the energy sector, outdated research infrastructure and future energy needs, the Czech government has chosen to strengthen operating and investment funds in R&D. For the period 2010-2015, public and private funding will increase from CZK 3.8 billion (EUR 0.14 billion) in 2010 to 6.5 billion (EUR 0.25 billion) in 2015 (Table 20).

In the new EU Cohesion Policy programming period (2007–2013), the Czech Republic, together with most of the new EU member states, plans to invest substantial amounts of Structural Funds in the field of RDI, mainly through two Operational Programmes (OP), OP R&D for Innovation, and OP Education for Competitiveness. The Czech government submitted these documents to the European Commission in March 2007.

As mentioned above, funding for R&D was distributed through 22 funding agencies, resulting in an excessive fragmentation of public support for R&D, and thus making support of complex research projects of an interdisciplinary character difficult. The recent reduction in the number of funding agencies is a positive step in this regard.

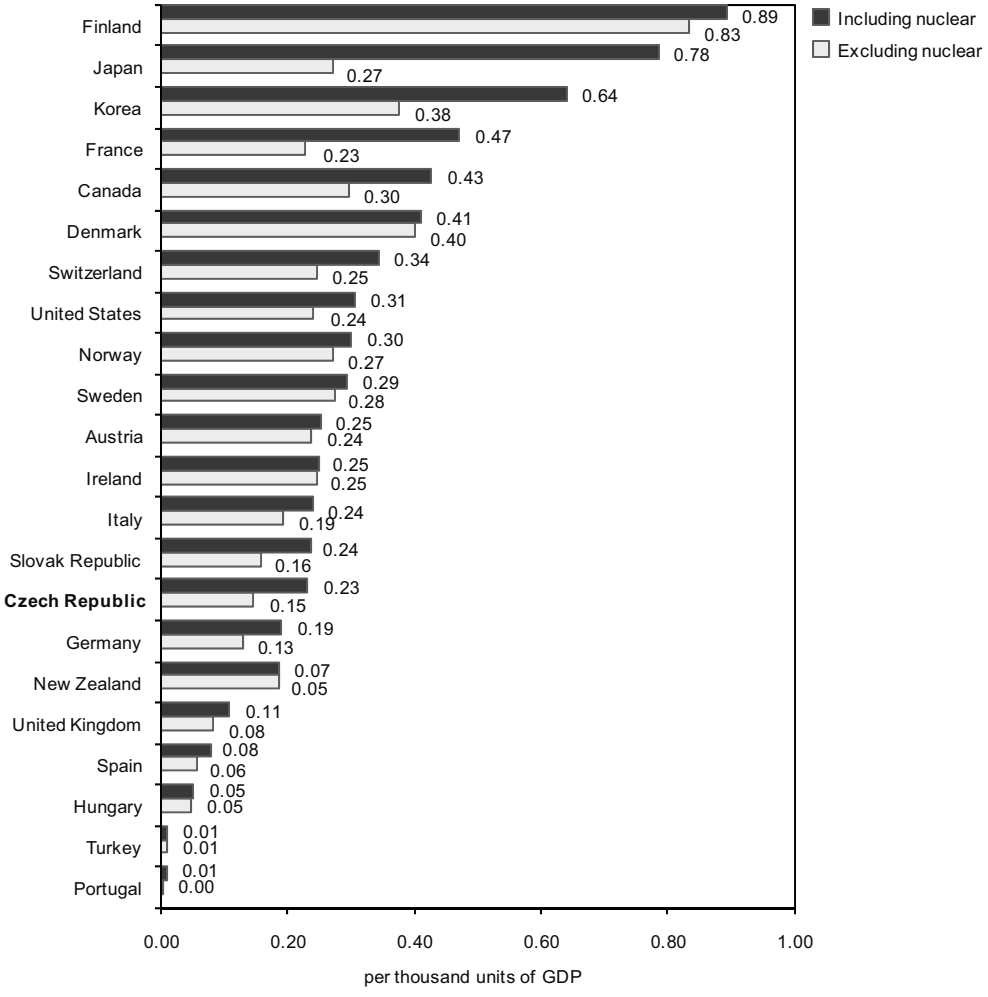
The most significant providers of institutional support for R&D are the Ministry of Education, Youth and Sports, and the Academy of Sciences, which together distribute more than 86% of the institutional resources for R&D. In 2007, of the CZK 21.5 billion (EUR 0.8 billion) total national resources of public support for R&D and innovation, 44.4% was targeted/project-based and 55.6% was institutional.

Energy production, distribution and rational utilisation accounted for 30% of total R&D, slightly below the EU-15 average. Energy R&D is concentrated in two main areas: nuclear

fission and renewables, though a considerable portion (26%) is also carried out on energy systems analysis. Hydrogen for transport has received some attention since the previous in-depth review in 2005. The breakdown of the R&D budget for 2007 was as follows:

- 31% renewable (61% bioenergy, 27% solar);
- 37% nuclear (fission only);
- 26% energy systems analysis;
- 5% hydrogen;
- 1% fossil fuels (coal combustion only).

Figure 30. Government R&D budgets in IEA member countries as a percentage of GDP, 2008



Data not available for Australia, Belgium, Greece, Luxembourg, the Netherlands and Poland.

Sources: *OECD Economic Outlook*, OECD Paris, 2009 and country submissions.

Table 20. Projected public and private funding for R&D, 2010 to 2015
(million CZK)

	2010	2011	2012	2013	2014	2015
Public	2 325	2 790	3 100	3 410	3 600	3 900
Private	1 500	1 800	2 000	2 200	2 400	2 600
Total	3 825	4 590	5 100	5 610	6 000	6 500

Source: Ministry of Industry and Trade.

PRIORITY SETTING AND EVALUATION

In 2004, the *Evaluation of R&D and its Results* was approved by the government. Since this time, evaluation has come to play an increasingly prominent role in Czech R&D. A unified central methodology has been elaborated which is used for the evaluation of all projects in the central R&D Information System managed by the Research and Development Council. This system collects data on R&D projects and measures the effectiveness of public R&D expenditure through a set of quantitative indicators (output in terms of publications, applied research results such as patents or prototypes, and other indicators). These are, in turn, used to inform decisions about the future allocation of public R&D funds. Greater weight has recently been given to the applicability of results. The experience so far suggests that this mechanism resulted in an increased output of publications and applicable results. Targets in individual energy R&D segments, however, are still not evaluated.

Regular evaluation of research supported by public resources is carried out on the basis of Governmental Decree No. 644 (23 June 2004). The methodology of this evaluation is updated every year by an Interdepartmental Working Group made up of representatives from the Research, Development and Innovation Council, the Ministry of Education, Youth and Sports, R&D support providers, universities, industry and the Academy of Sciences.

HUMAN RESOURCES

The quality of the output of public R&D in the Czech Republic has been adversely affected by an ageing pool of researchers and by young scientists going abroad. Other challenges are the structure of public R&D spending which places more emphasis on institutional funding than on project funding, which can be demotivating for researchers. The share of experts and people with university education is low compared with other EU countries (17% vs. 31% in EU15). The anticipated number of university and secondary school graduates between 2010 and 2016 will not be sufficient to replace researchers who will retire over this period.

Expanding the number and quality of personnel in the energy sector is one of the strategic priorities in the updated draft State Energy Concept 2009. The Czech government has outlined steps to remedy the deficiency in human resources. In the area of science and research, individual support programmes within grant schemes are planned. However, there is no long-term strategy for supporting specific areas and no mechanism for its fulfilment.

INTERNATIONAL COLLABORATION

The Czech Republic exhibits a low degree of internationalisation and participation in international collaborative networks, including integration into the European Research Area (ERA), participation in the EU Framework Programme and IEA Implementing Agreements. Collaborative efforts are concentrated on fossil fuel power, waste management and alternative energy sources. In the case of multilateral co-operation, effort is focused on Framework Programmes, COST and EUREKA. While R&D centres in the Czech Republic have been intensifying their participation in international programmes, particularly in the field of nuclear energy, better progress can be made in other sectors.

The Czech Republic participates in two IEA Implementing Agreements, Buildings and Community Systems, and Fluidised Bed Conversion. They rely heavily on EU Framework Programmes and EURATOM for international co-operation in energy research. As the Implementing Agreements provide the framework to engage with both public and private partners; the government could consider participating in those Agreements that dovetail with larger sectors of their economy, such as second-generation biofuels, or industrial energy efficiency.

CRITIQUE

Recognising the deficiencies in its R&D policy, the Czech government started reforming the system of research, development and innovation in 2008. The reforms are being introduced gradually. Special energy-related research priorities have been defined and are specified in the National Policy for Research, Development and Innovation 2009-2015. However, it is unclear how the Czech government plans to incorporate the energy research strategy into energy and climate policies.

The institutional structure of the national energy R&D policy has not seen similar fundamental changes. The structure is still very diverse with responsibilities shared among a number of ministries, which has resulted in a very general formulation of a long-term energy R&D strategy. The Ministry of Industry and Trade could act as a leading co-ordinator within the ministries.

The government budget for energy R&D is concentrated mainly on renewable energy sources and nuclear fission. Funding has increased since 2007, but is still low compared to what IEA member countries spend. Problems in co-ordinating funding have been responsible for the formulation of insufficiently concrete R&D priority areas.

All projects are collected in the central “R&D Information System” managed by the Research and Development Council. This represents a major improvement in evaluation at the level of individual projects and partly also at programme level. The system not only collects data on R&D projects but also aims to measure the effectiveness of public R&D expenditures. The Czech government should be commended for such a high level of evaluation, which is rare among IEA member countries. Nonetheless, evaluation is only slowly being established as a standard R&D policy-making mechanism and, especially at the level of the sectoral ministries, it still plays a relatively minor role in policy making and funding.

The research areas mainly represent the current short and mid-term priorities of industry. The Czech government should expand its research portfolio to meet longer-term energy objectives. For example, electricity storage, smart grids, and especially carbon capture and storage are possible cross-cutting areas that could benefit the Czech Republic.

The average age of the workforce in the energy sector is higher than in other sectors. Moreover, the share of employees in the energy sector with a university degree is low compared to the EU average. Thus, there is a risk that the education system will not provide enough staff for the power, especially nuclear, industry. Plans to address this in the updated draft State Energy Concept 2009 are encouraging.

RECOMMENDATIONS

The government of the Czech Republic should:

- ☐ *Develop a comprehensive, long-term energy R&D strategy, building on the country's technical strengths and taking account of energy and climate policy priorities.*
- ☐ *Review the energy R&D strategy and institutional structure on a regular basis to ensure it is clearly defined and operates in a manner that allows for co-ordination, information sharing, decision making and evaluation.*
- ☐ *Continue to increase public energy R&D funding and ensure that plans to evaluate cost-effectiveness and other outputs are put into place to guide the allocation of this funding.*
- ☐ *Continue to increase efforts in energy-related educational programmes in order to renew the ageing R&D personnel pool and to maintain technical expertise.*
- ☐ *Expand national energy R&D capacities through international collaboration, for example through the IEA Implementing Agreements.*

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 Prague from 23 to 27 November 2009. The team met with government officials, energy suppliers, interest groups and various other organisations. The report was drafted based on 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 express its appreciation to the Director of the Department of Power Engineering, Roman Portužák, for his personal engagement in supporting the team during the visit. The team members also wish to convey their gratitude to Deputy Minister Tomáš Hüner in briefing them on current Czech energy policy issues. Finally, they wish to thank Judr. Lubomir Mazouch and other staff of the Ministry of Industry and Trade, in particular Ms. Olga Svitáková, Ms. Vlasta Veselská and Ms. Kristýna Křižanová, for their professionalism and unfailing goodwill displayed in preparing and guiding the visit.

The team members were:

Tim ABRAHAM (team leader), United Kingdom

Olivier AUBOURG, France

Bora Sekip GURAY, Turkey

Fredrik VON MALMBORG, Sweden

Kristin MYSKJA, Norway

Christoph REICHLE, Germany

Chris BOLESTA, European Commission

Maria Elena URSO, OECD Nuclear Energy Agency

Anne-Sophie CORBEAU, International Energy Agency

Shinji FUJINO, International Energy Agency

Teresa MALYSHEV, International Energy Agency

Teresa Malyshev organised and managed the review team visit, and drafted the report with the exception of Chapter 6 on Natural Gas drafted by Anne-Sophie Corbeau, the Emergency Preparedness sections on Oil and Natural Gas in Chapters 6 and 7 drafted by Jason Elliot, and Chapter 10 on Nuclear Energy drafted by Maria-Elena Urso. Elena Merle-Beral finalised the draft for publication, with Georg Bussman's help.

The report also benefited from comments of many IEA experts, including Richard Baron, Ulrich Benterbusch, Aad van Bohemen, Ian Cronshaw, Zuzana Dobrotkova, Jason Elliot, Rebecca Gaghen, Tom Kerr, Jan Kubat, Sara Moarif, Francois Nguyen, Samantha Olz, Carrie Pottinger, Brian Ricketts, Lisa Ryan and Julien Smith.

Monica Petit, Georg Bussmann and Bertrand Sadin prepared the figures. Alex Blackburn and Karen Treaton provided support on statistics. Viviane Consoli provided editorial assistance.

ORGANISATIONS VISITED

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

Government agencies and regulatory authorities

Ministry of Industry and Trade

Ministry of the Environment

Ministry of Foreign Affairs

Ministry of Transport

Ministry of Education, Youth and Sports

Energy Regulatory Office

Administration of the State Material Reserves

State Office for Nuclear Safety

Radioactive Waste Repository Authority

Office for the Protection of Competition

Czech Mining Office

Council for Research and Development

Independent Energy Commission

Companies, research institutions, non-governmental organisations and other stakeholders

Association of the Large Scale Energy Managers (AOM)

Association of Industry and Transportation

Association of the Renewables Producers (Avoze)

Calla Green Movement

ČEZ Group

Chamber of Commerce

Czech Pipelines and Oil Pipelines a.s. (CEPRO)

Czech Transmission System a.s. (ČEPS)

Czech Gas Union (CPU)

Czech Society for Wind Energy (CSVE)

Czech Coal a.s.

Czech Hydrometeorological Institute

Czech Nuclear Society

Czech Refineries

Ekowatt

Environ Ltd.

E-ON Distribution a.s.

Greenpeace

International Oil Pipeline Company a.s. (MERO)

Nuclear Research Institute (NRI)

Ostrava-Karvina Mines a.s. (OKD)

Power Exchange Central Europe (PEX)

Rainbow green movement

RWE Gas Storage

RWE Transgas

SEVEn Energy Ldt

Severoceske doly a.s. Northern Bohemia Mines a.s.

SKODA a.s.

Sokolovska uhelna a.s.

State Environmental Fund (SFZP)

VEMEX Ltd.

ANNEX B
ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2000	2007	2008	2020	2030
TOTAL PRODUCTION		**38.51**	**40.10**	**29.93**	**33.75**	**32.82**	**30.16**	**24.78**
Coal		37.82	36.31	25.05	23.80	22.79	18.40	10.90
Peat		0.19	-	-	-	-	-	-
Oil		0.04	0.21	0.38	0.39	0.31	0.40	0.40
Gas		0.36	0.20	0.17	0.16	0.16	0.30	0.30
Comb. Renewables & Waste[1]		-	-	0.64	2.34	2.40	2.10	2.50
Nuclear		-	3.28	3.54	6.85	6.94	8.60	10.30
Hydro		0.09	0.10	0.15	0.18	0.17	0.17	0.17
Wind		-	-	-	0.01	0.02	0.14	0.15
Geothermal		-	-	-	-	-	-	0.00
Solar/Other[2]		-	..	..	0.02	0.03	0.05	0.06
TOTAL NET IMPORTS[3]								
Coal	Exports	2.56	7.26	5.78	5.46	5.13	2.50	1.10
	Imports	0.15	1.57	1.04	2.30	2.04	1.40	1.60
	Net Imports	-2.41	-5.69	-4.74	-3.16	-3.10	-1.10	0.50
Oil	Exports	0.03	6.55	1.08	1.03	1.35	1.60	1.80
	Imports	8.88	15.13	8.59	10.62	10.98	10.60	11.00
	Int'l Marine and Aviation Bunkers	-0.24	-0.22	-0.16	-0.34	-0.33	-0.80	-0.90
	Net Imports	8.61	8.36	7.35	9.24	9.30	8.20	8.30
Gas	Exports	0.01	-	0.00	0.33	0.79	-	-
	Imports	0.73	4.78	7.48	7.04	7.81	13.00	14.00
	Net Imports	0.72	4.78	7.48	6.71	7.02	13.00	14.00
Electricity	Exports	0.44	0.76	1.61	2.27	1.72	0.40	0.40
	Imports	0.25	0.70	0.75	0.88	0.73	0.60	0.60
	Net Imports	-0.19	-0.06	-0.86	-1.39	-0.99	0.20	0.20
TOTAL STOCK CHANGES		**-0.08**	**1.26**	**1.10**	**0.85**	**-0.22**	**-**	**-**
TOTAL SUPPLY (TPES)[4]		**45.16**	**48.76**	**40.25**	**45.78**	**44.63**	**50.46**	**47.78**
Coal		35.40	31.46	21.58	21.27	19.66	17.30	11.40
Peat		0.19	-	-	-	-	-	-
Oil		8.66	8.72	7.71	9.56	9.48	8.60	8.70
Gas		1.01	5.26	7.50	7.18	7.12	13.30	14.30
Comb. Renewables & Waste[1]		-	-	0.64	2.11	2.20	2.10	2.50
Nuclear		-	3.28	3.54	6.85	6.94	8.60	10.30
Hydro		0.09	0.10	0.15	0.18	0.17	0.17	0.17
Wind		-	-	-	0.01	0.02	0.14	0.15
Geothermal		-	-	-	-	-	-	0.00
Solar/Other[2]		-	-	-0.00	0.02	0.03	0.05	0.06
Electricity Trade[5]		-0.19	-0.06	-0.86	-1.39	-0.99	0.20	0.20
Shares (%)								
Coal		*78.4*	*64.5*	*53.6*	*46.5*	*44.0*	*34.3*	*23.9*
Peat		*0.4*	-	-	-	-	-	-
Oil		*19.2*	*17.9*	*19.1*	*20.9*	*21.2*	*17.0*	*18.2*
Gas		*2.2*	*10.8*	*18.6*	*15.7*	*15.9*	*26.4*	*29.9*
Comb. Renewables & Waste		-	-	*1.6*	*4.6*	*4.9*	*4.2*	*5.2*
Nuclear		-	*6.7*	*8.8*	*15.0*	*15.6*	*17.0*	*21.6*
Hydro		*0.2*	*0.2*	*0.4*	*0.4*	*0.4*	*0.3*	*0.3*
Wind		-	-	-	-	-	*0.3*	*0.3*
Geothermal		-	-	-	-	-	-	-
Solar/Other		-	-	-	-	*0.1*	*0.1*	*0.1*
Electricity Trade		*-0.4*	*-0.1*	*-2.1*	*-3.0*	*-2.2*	*0.4*	*0.4*

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

Unit: Mtoe

DEMAND							
FINAL CONSUMPTION BY SECTOR	**1973**	**1990**	**2000**	**2007**	**2008**	**2020**	**2030**
TFC	**31.35**	**33.49**	**24.96**	**26.98**	**27.00**	**31.30**	**31.57**
Coal	19.06	13.39	4.66	3.03	2.98	2.50	1.60
Peat	0.19	-	-	-	-	-	-
Oil	7.75	8.20	7.29	9.26	9.14	7.30	7.30
Gas	1.81	4.80	5.91	5.92	6.08	9.20	10.20
Comb. Renewables & Waste[1]	-	-	0.23	1.75	1.76	1.10	1.40
Geothermal	-	-	-	-	-	-	-
Solar/Other	-	-	-	0.00	0.01	0.01	0.02
Electricity	2.54	4.14	4.25	4.92	4.99	7.55	7.05
Heat	-	2.96	2.62	2.09	2.05	3.64	4.00
Shares (%)							
Coal	*60.8*	*40.0*	*18.7*	*11.2*	*11.1*	*8.0*	*5.1*
Peat	*0.6*	-	-	-	-	-	-
Oil	*24.7*	*24.5*	*29.2*	*34.3*	*33.8*	*23.3*	*23.1*
Gas	*5.8*	*14.3*	*23.7*	*21.9*	*22.5*	*29.4*	*32.3*
Comb. Renewables & Waste	-	-	*0.9*	*6.5*	*6.5*	*3.5*	*4.4*
Geothermal	-	-	-	-	-	-	-
Solar/Other	-	-	-	-	-	-	-
Electricity	*8.1*	*12.4*	*17.0*	*18.2*	*18.5*	*24.1*	*22.3*
Heat	-	*8.8*	*10.5*	*7.8*	*7.6*	*11.6*	*12.7*
TOTAL INDUSTRY[6]							
Coal	11.24	6.97	3.32	2.48	2.43	1.60	0.90
Peat	0.19	-	-	-	-	-	-
Oil	5.27	4.62	2.79	2.82	2.91	2.70	2.70
Gas	0.46	2.65	2.60	2.52	2.48	4.70	5.00
Comb. Renewables & Waste[1]	-	-	0.14	0.52	0.52	0.40	0.40
Geothermal	-	-	-	-	-	-	-
Solar/Other	-	-	-	-	-	-	-
Electricity	1.61	2.32	1.63	2.08	2.05	3.75	3.95
Heat	-	1.08	0.78	0.71	0.64	1.64	2.00
Shares (%)							
Coal	*59.9*	*39.5*	*29.5*	*22.3*	*22.0*	*10.8*	*6.0*
Peat	*1.0*	-	-	-	-	-	-
Oil	*28.0*	*26.2*	*24.8*	*25.4*	*26.4*	*18.3*	*18.1*
Gas	*2.4*	*15.0*	*23.1*	*22.7*	*22.5*	*31.8*	*33.4*
Comb. Renewables & Waste	-	-	*1.2*	*4.6*	*4.7*	*2.7*	*2.7*
Geothermal	-	-	-	-	-	-	-
Solar/Other	-	-	-	-	-	-	-
Electricity	*8.6*	*13.1*	*14.5*	*18.7*	*18.6*	*25.3*	*26.4*
Heat	-	*6.1*	*6.9*	*6.4*	*5.8*	*11.1*	*13.4*
TRANSPORT[4]							
TOTAL OTHER SECTORS[7]							
Coal	7.70	6.42	1.34	0.55	0.55	0.90	0.70
Peat	-	-	-	-	-	-	-
Oil	0.59	1.26	0.56	0.39	0.40	0.60	0.60
Gas	1.35	2.15	3.28	3.35	3.53	4.10	4.80
Comb. Renewables & Waste[1]	-	-	0.03	1.21	1.13	0.70	1.00
Geothermal	-	-	-	-	-	-	-
Solar/Other	-	-	-	0.00	0.01	0.01	0.02
Electricity	0.76	1.56	2.42	2.65	2.76	3.20	3.10
Heat	-	1.88	1.84	1.39	1.41	2.00	2.00
Shares (%)							
Coal	*74.0*	*48.4*	*14.1*	*5.7*	*5.6*	*7.8*	*5.7*
Peat	-	-	-	-	-	-	-
Oil	*5.7*	*9.5*	*6.0*	*4.1*	*4.1*	*5.2*	*4.9*
Gas	*13.0*	*16.2*	*34.7*	*35.1*	*36.1*	*35.6*	*39.3*
Comb. Renewables & Waste	-	-	*0.3*	*12.7*	*11.5*	*6.1*	*8.2*
Geothermal	-	-	-	-	-	-	-
Solar/Other	-	-	-	-	*0.1*	*0.1*	*0.1*
Electricity	*7.3*	*11.7*	*25.5*	*27.8*	*28.2*	*27.8*	*25.4*
Heat	-	*14.2*	*19.5*	*14.6*	*14.4*	*17.4*	*16.4*

Unit: Mtoe

DEMAND							
ENERGY TRANSFORMATION AND LOSSES	**1973**	**1990**	**2000**	**2007**	**2008**	**2020**	**2030**
ELECTRICITY GENERATION[8]							
INPUT (Mtoe)	**9.69**	**18.91**	**20.53**	**24.14**	**23.29**	**28.65**	**25.56**
OUTPUT (Mtoe)	**3.54**	**5.36**	**6.27**	**7.55**	**7.15**	**8.24**	**7.75**
(TWh gross)	41.17	62.27	72.91	87.76	83.17	95.85	90.10
Output Shares (%)							
Coal	*85.1*	*76.4*	*73.1*	*62.5*	*59.9*	*46.9*	*33.3*
Peat	-	-	-	-	-	-	-
Oil	*11.3*	*0.9*	*0.5*	*0.1*	*0.2*	*1.4*	*2.0*
Gas	*0.9*	*0.6*	*4.3*	*3.6*	*3.5*	*11.5*	*14.1*
Comb. Renewables & Waste	-	-	*1.0*	*1.4*	*1.8*	*1.9*	*2.4*
Nuclear	-	*20.2*	*18.6*	*29.8*	*31.9*	*34.4*	*43.8*
Hydro	*2.6*	*1.9*	*2.4*	*2.4*	*2.4*	*2.0*	*2.1*
Wind	-	-	-	*0.1*	*0.3*	*1.6*	*1.9*
Geothermal	-	-	-	-	-	-	-
Solar/Other	-	-	-	-	-	*0.3*	*0.3*
TOTAL LOSSES	**15.13**	**14.39**	**14.98**	**17.97**	**17.34**	**19.26**	**16.31**
of which:							
Electricity and Heat Generation[9]	6.15	9.85	10.93	13.71	13.24	16.26	13.81
Other Transformation	7.41	1.71	1.23	1.18	1.12	1.30	1.30
Own Use and Losses[10]	1.57	2.83	2.82	3.08	2.98	1.70	1.20
Statistical Differences	**-1.31**	**0.88**	**0.31**	**0.83**	**0.29**	**-0.10**	**-0.10**
INDICATORS	**1973**	**1990**	**2000**	**2007**	**2008**	**2020**	**2030**
GDP (billion 2000 USD)	41.03	55.30	56.72	77.25	79.15	112.85	144.45
Population (millions)	9.92	10.36	10.27	10.32	10.43	10.30	10.20
TPES/GDP[11]	1.10	0.88	0.71	0.59	0.56	0.45	0.33
Energy Production/TPES	0.85	0.82	0.74	0.74	0.74	0.60	0.52
Per Capita TPES[12]	4.55	4.71	3.92	4.44	4.28	4.90	4.68
Oil Supply/GDP[11]	0.21	0.16	0.14	0.12	0.12	0.08	0.06
TFC/GDP[11]	0.76	0.61	0.44	0.35	0.34	0.28	0.22
Per Capita TFC[12]	3.16	3.23	2.43	2.61	2.59	3.04	3.10
Energy-related CO_2 Emissions (Mt CO_2)[13]	147.1	155.1	121.9	122.0	116.8	113.2	91.3
CO_2 Emissions from Bunkers (Mt CO_2)	0.7	0.7	0.5	1.0	1.0	2.4	2.7
GROWTH RATES (% per year)	**73-79**	**79-90**	**90-00**	**00-07**	**07-08**	**08-20**	**20-30**
TPES	1.2	0.1	-1.9	1.9	-2.5	1.0	-0.5
Coal	-0.2	-0.9	-3.7	-0.2	-7.6	-1.1	-4.1
Peat	-8.8	-100.0	-	-	-	-	-
Oil	4.3	-2.2	-1.2	3.1	-0.8	-0.8	0.1
Gas	14.3	8.0	3.6	-0.6	-0.9	5.3	0.7
Comb. Renewables & Waste	-	-	-	18.6	4.1	-0.4	1.8
Nuclear	-	-	0.8	9.9	1.4	1.8	1.8
Hydro	13.3	-6.0	4.2	2.5	-3.3	-0.4	-
Wind	-	-	-	-	90.9	17.1	0.7
Geothermal	-	-	-	-	-	-	-
Solar/Other	-	-	..	..	58.8	5.3	1.8
TFC	2.7	-0.9	-2.9	1.1	0.1	1.2	0.1
Electricity Consumption	3.4	2.6	0.2	2.1	1.4	3.5	-0.7
Energy Production	2.0	-0.7	-2.9	1.7	-2.8	-0.7	-1.9
Net Oil Imports	4.0	-2.4	-1.3	3.3	0.6	-1.0	0.1
GDP	2.5	1.4	0.3	4.5	2.5	3.0	2.5
Growth in the TPES/GDP Ratio	-1.3	-1.3	-2.1	-2.5	-4.9	-1.9	-3.0
Growth in the TFC/GDP Ratio	0.3	-2.2	-3.2	-3.3	-2.3	-1.7	-2.3

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

Footnotes to Energy Balances and Key Statistical Data

1. Combustible renewables and waste comprises solid biomass, liquid biomass, biogas 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, gas and electricity, total net imports also include combustible renewables and waste, and trade of heat.

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 Sectors includes residential, commercial, public services, agriculture, forestry, fishing and other non-specified sectors.

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, wind and photovoltaic.

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 2007 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:

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.

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.

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.

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.

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.

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.

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.

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.

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 their 4 June 1993 meeting in Paris.)

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

AAU	assigned amount units
ASCR	Academy of Sciences of the Czech Republic
ASMR	Administration of State Material Reserves
bcm	billion cubic metres
CCGT	combined cycle gas turbine
CCS	carbon dioxide capture and storage
CHP	combined heat and power
CNG	compressed natural gas
CO_2	carbon dioxide
CO_2-eq	carbon dioxide equivalent
CPP	Climate Protection Policy
CZK	Czech crown
DGR	deep geologic repository
DSO	distribution system operator
EC	European Commission
EEAP	Energy Efficiency Action Plan
EPBD	(EU) Energy Performance of Buildings Directive
ERO	Energy Regulatory Office
ESCO	Energy Services Company
ETS	emissions trading scheme
EU	European Union
FAME	fatty acid methyl ester
GDP	gross domestic product
GHG	greenhouse gas

GWh	gigawatt-hour
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IKL	Ingolstadt-Kralupy-Litvínov pipeline
IPCC	Intergovernmental Panel of Climate Change
LCPD	(EU) Large Combustion Plant Directive
mb	million barrels
mcm	million cubic metres
ME	Ministry of the Environment
MEYS	Ministry of Education, Youth and Sports
MIT	Ministry of Industry and Trade
Mt	million tonnes
Mtoe	million tonnes of oil equivalent
MW	megawatt
NAP	National Allocation Plan
NESO	National Emergency Sharing Organisation
NGO	non-governmental organisation
NIMBY	not in my backyard
OECD	Organisation for Economic Co-operation and Development
OP	Operational Programme
PM	particulate matter
ppm	parts per million
PPP	purchasing power parity
PV	photovoltaic
RDI	research, development and innovation
R&D	research and development
RES	renewable energy sources
SEC	State Energy Concept
SEI	State Energy Inspection
SME	small and medium-sized enterprises
SSO	storage system operator
TAL	Trans-Alpine pipeline
TFC	total final consumption of energy
TJ	terajoule

TPES	total primary energy supply
TSO	transmission system operator
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollar
VAT	value added tax

CZECH ABBREVIATIONS

ČAPPO: Česká asociace petrolejářského průmyslu a obchodu (Czech Oil Industry Association)

ČSA (or Důl ČSA): Československé armády mine (a coal company)

ČÚZK: Český úřad zeměměřický a katastrální (Czech geodesic and land register office)

JMP: Jihomoravská plynárenská, a.s. (a gas company)

LUAS: Litvínovská uhelná, a. s. (a coal company)

MND: Moravské naftové doly, a.s. (a gas company)

MPSV: Ministerstvo práce a sociálních věcí (Ministry of Labour and Social Affairs)

MUS: Mostecká uhelná, a.s. (a coal company)

MŽP: Ministerstvo životního prostředí (Ministry of the Environment)

MZV: Ministerstvo zahraničních věcí (Ministry of Foreign Affairs)

OKD: Ostravsko-Karvinské doly a.s (a coal company)

OTE: Market Operator

SÚJB: Státní úřad pro jadernou bezpečnost (State Office for Nuclear Safety)

SMP: Severomoravská plynárenská, a.s. (a gas company)

SD: Severočeské uhelné doly, a.s. (a coal company)

SU: Sokolovská uhelná, a.s. (a coal company)

VČP: Východočeská plynárenská, a.s. (a gas company)

VUAS: Vršanská uhelná, a. s. (a coal company)

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