INTERNATIONAL ENERGY AGENCY

Energy Policies of IEA Countries

HUNGARY

2006 Review

OECD

INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA) is an autonomous body which was established in November 1974 within the framework of the Organisation for Economic Co-operation and Development (OECD) to implement an international energy programme.

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

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

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

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

EXECUTIVE SUMMARY AND KEY RECOMMENDATIONS

EXECUTIVE SUMMARY

Hungary's energy policy has developed positively since the last review in 2003. New legislation, such as the 2005 Electricity Act, is increasing the potential for competition in both the electricity and gas markets, and regulatory independence in the nuclear sector grew. On 1 January 2004 all non-residential electricity customers became eligible to participate in the liberalised market. On 1 January 2006 Hungarian electricity grid company MAVIR was established as a true transmission system operator, giving it enhanced powers and responsibilities. The Hungarian Parliament voted in 2004 to extend the lifetime and expand the capacity of the Paks nuclear power plant, which generates 33% of Hungary's electricity supply. The first National Allocation Plan was submitted to and accepted by the European Commission (EC), and all of the institutions required for emissions trading under the European Union's Emissions Trading Scheme (EU-ETS) now exist in Hungary. Hungary contributed significantly to the success of the International Energy Agency's (IEA) first collective action following the hurricane Katrina. These are notable achievements, and the government as well as the regulator and other institutions involved in bringing them forward should be commended.

Nevertheless, there are still questions surrounding the development of the Hungarian energy policy and markets. Key concerns include the future of the government institutions involved in energy policy-making and regulation; the lack of real market opening, despite the favourable legal improvements; and the high level of subsidies given out by the government to encourage renewable electricity and combined heat and power (CHP) production and also to reduce the cost of gas for home heating. Other potential shortfalls relate to the failure to vigorously pursue cost-effective energy efficiency investments and to enhance security of gas supply.

Hungary is facing a challenging situation, with a high budget deficit. This situation led to the introduction of an austerity programme in summer 2006, which affects all of the energy policy-making institutions by threatening them with personnel cuts, in order to reduce government expenditure. The Energy Centre, which performed critical tasks in collecting and processing energy statistics and improving energy efficiency in Hungary, will be restructured and lose a significant amount of its personnel capacity. The Energy Directorate within the Hungarian Ministry of Economy and Transport faces further staff cuts. Institutions not financed by the government budget, such as the Hungarian Energy Office (HEO) and the Hungarian Atomic Energy Authority (HAEA), which are fully financed by licence fees from the industries they regulate, also face some staff cuts. The review suggests that the government re-evaluate the need for the budget cuts in these institutions.

At the same time, the government is spending considerable funds on a household gas subsidy that encourages gas use, and is not tied to real social needs. While residential gas consumption is subsidised directly by the government, Hungarian electricity consumers are also paying for substantial subsidies to the renewables and CHP sectors through levies on their tariffs. The review team suggests that the government reduce subsidies in the renewables and CHP sectors to avoid oversubsidisation and increase economic and energy efficiency. It also suggests replacing the gas subsidy for households who suffer real hardship with an income-related benefits programme, while abolishing the subsidy for all other households.

While Hungary has seen a decrease in its energy intensity since the political changes of 1990, which were followed by industrial restructuring, there is still a significant potential for energy efficiency. For example, many Hungarian households could benefit from increased insulation, and in the electricity generation sector significant amounts of gas are burned in power stations with relatively low efficiency. The changes at the Energy Centre, at a moment when EU funding is becoming available to support investment in energy efficiency, create a risk that the government will find itself without the means to efficiently and effectively allocate these funds through the economy, thereby missing a great opportunity to increase Hungary's energy efficiency and the competitiveness of its economy, while reducing the environmental impact from energy use.

Hungary has successfully introduced the legislation laying the foundation for market reform in line with the most recent EU Gas and Electricity Market Directives. From 1 July 2007, all electricity and gas customers will become fully eligible to freely select their supplier. Despite this positive development, there are serious concerns about the real effect that the legal market opening will have in the electricity and gas markets. In both markets, the power of the incumbents, Hungarian Electricity Companies (MVM) in electricity and E.On-Ruhrgas in gas, dominates. The power purchase agreements (PPAs) in electricity and the Panruszgás import arrangements in gas prevent the emergence of strong competitors to the incumbents. The situation is slightly better in the electricity market, where imports have enabled a measure of competition. In both markets, capacity auctions have proved ineffective in enabling competitors to the incumbents to emerge. The review suggests that the government, the HEO and the Hungarian Competition Commission should co-operate closely in the development of new market models that take the EU legislation into account to create competitive electricity and gas markets in Hungary in time for the full market opening, and to extend this, if possible on a regional basis.

Hungary has one of the highest gas dependencies of IEA member countries. Since the supply interruptions of January 2006, security of gas supply has been a prime concern for the government. A law passed by the government in March 2006 sets the framework for the creation of a strategic gas storage installation to help in the case of possible future disruptions. The review team is of the view that the government should consider the introduction of this measure carefully, owing to its high cost, and that it should be implemented as part of a suite of measures, such as increasing energy efficiency and supply source diversification. The review team suggests that these measures should be evaluated closely to ensure that they deliver the increase in security at a low cost to the gas consumer.

Despite these concerns, the review team finds that Hungary has made good progress over the past four years, and a solid understanding of these energy challenges exists throughout the government and policy-making institutions. The review team is confident that the government and energy policy makers are capable and willing to continue to work towards real market opening and increased efficiency in Hungary.

KEY RECOMMENDATIONS

The government of Hungary should:

- *Reconsider subsidies in the energy sector, particularly for renewables, combined heat and power (CHP) and gas, and restructure or replace them with different means of support that lead to increased economic efficiency.*
- *Consider improved energy efficiency, particularly in gas use, as a key means to increase the security of energy supply in Hungary at low cost.*
- *For the 2007 full market opening, consider restructuring the electricity and gas markets with a view to reducing the incumbents' power in these markets, allowing real competition to emerge, while pursuing further regional integration, and ensuring the full, also financial, independence of the regulatory authorities.*

GENERAL ENERGY POLICY

COUNTRY OVERVIEW

Hungary is a landlocked country with a temperate climate, situated in the centre of Europe. It has a population of approximately 10 million people and borders on Austria, Croatia, Romania, Serbia, the Slovak Republic, Slovenia and Ukraine. Its geographical location makes Hungary an important transit country. Since 1 May 2004 Hungary has been a member state of the European Union (EU). In the energy field, Hungary did not request any derogation for the implementation of EU directives.

Hungary transitioned from a communist state to a democracy relatively smoothly and held its first free, multi-party parliamentary election in March 1990. Prior to this change, Hungary had already implemented significant market reforms that provided a competitive edge to its economy compared to other Council of Mutual Economic Assistance (COMECON) nations. Hungary's infrastructure, particularly that of the energy sector, has features that date back to the time it was a communist state within COMECON, when the focus was on developing large collective energy delivery systems to facilitate energy access rather than maximise efficiency or cost savings, and much of Hungary's energy infrastructure is comparatively old.

The first post-communist government encountered problems in the transition to a market-based economy. Real gross domestic product (GDP) fell by about 18% from 1990 to 1993 and industrial output also shrank, while foreign debt, the current account deficit and the budget deficit rose to high levels. Inflation increased and consequently price controls became a major focus of the government's macroeconomic policy. In 1995, the government instituted an austerity and privatisation programme and a new export-promoting foreign exchange regime to reduce the debt and deficit levels. By 1997, the country's finances were solid; Hungary had repaid all of its debts to the International Monetary Fund (IMF) and no longer required its assistance. Hungary had also developed close political and economic ties to the rest of Europe. It joined the Organisation for Economic Co-operation and Development (OECD) in 1996, the IEA in 1997, and the North Atlantic Treaty Organization (NATO) in 1999. Breaking away from the COMECON signified a redirection of Hungary's external trade flows, clearly noticeable in the shift in its export shares, declining towards Russia and growing towards Western European countries. Hungary has continued to enjoy strong economic growth in recent years (at roughly 4% per year.) and has attracted an impressive amount of foreign direct investment, including in the energy sector.

The economic situation deteriorated sharply in 2006, and the government is currently struggling with a very high annual GDP budget deficit of around 10%. The forecast budget deficit for the whole of 2006 was HUF 1 769 billion.[1] By the end of June, it had reached HUF 1 285 billion; 73% of the expected total for the whole year. As a consequence, the government has announced drastic spending cuts, leading to a downsizing of the civil service which threatens to have a negative impact on the energy sector.

Hungary is part of the Visegrád Group formed in 1991 to facilitate co-operation among then Czechoslovakia, Hungary and Poland, on issues pertaining to European integration. Hungary was a frontrunner in the 2004 expansion of the EU. The talks preceding EU accession progressed in line with the "road map" marked out by the EC for 2004 accession, and Hungary complied with the *acquis communautaire* including the section on energy.

Table 1

Key Economic Indicators for Hungary in %, 1996 to 2005

Indicator	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
GDP at market prices (HUF trillion)[1]		8.5	10.1	11.45	13.28	14.9	n/a	n/a	n/a	n/a
Gross domestic product growth	1.3	4.6	4.9	4.2	5.2	3.8	n/a	n/a	5.2	4.1
Household consumption change	–3.4	1.7	4.9	4.6	4.1	4.0	n/a	n/a	3.6	1.7
Public consumption change	–4.2	5.7	-0.3	1.8	1.2	0.4	n/a	n/a	2.1	–0.4
Consumer inflation	23.6	18.3	14.3	10.0	9.8	9.2	n/a	n/a	3.7	6.2
Unemployment rate	9.9	8.7	7.8	7.0	6.4	5.7	n/a	n/a	6.1	7.2
General government deficit [2]	3.0	4.8	4.8	3.7	3.7	4.1	n/a	n/a	6.6	7.5
Population		10.2	10.2	10.2	10.1	10.0	n/a	n/a	n/a	10.1

1. From June 2006, one euro equalled 285 Hungarian forint (HUF).
2. According to EAS95, the European Accounts System 95.
Source: Hungarian government.

1. Following a currency devaluation in summer 2006, in Aug 2006 HUF 1 000 = USD 4.7.

SUPPLY AND DEMAND BALANCE

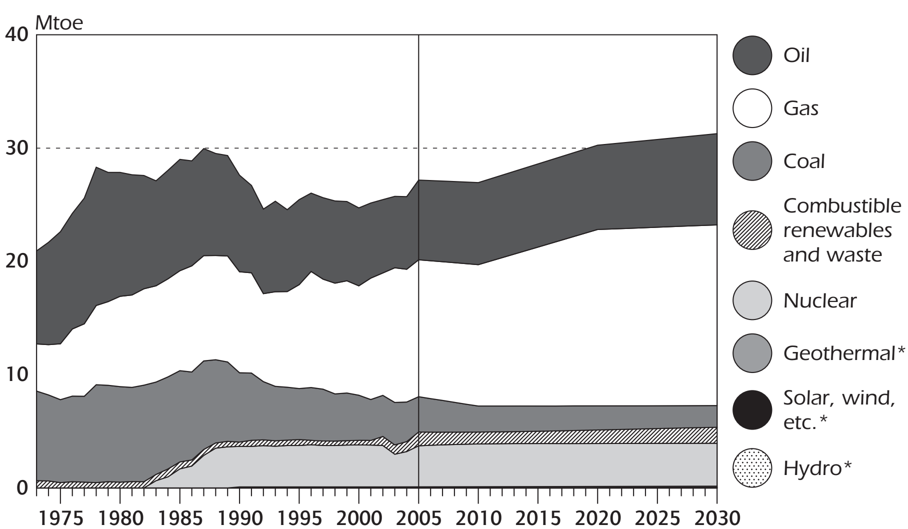
DOMESTIC RESOURCES

Hungary has some indigenous resources of oil, gas and coal. However, domestic oil and gas production has peaked and is expected to gradually decline. At present Hungary imports around 80% of its oil requirements. Its import dependence for gas is equally important, with Russia (Gazprom) providing 80% of Hungarian gas supply. All of Hungary's oil and gas imports come exclusively from Russia.[2] Given that domestic oil and gas production is expected to decline in the future, this import dependence is bound to increase.

The most important contribution to the electricity sector is provided by nuclear energy, which generates almost 33% of Hungary's electricity needs, including imports. This is generated by Hungary's sole nuclear power plant (NPP), Paks NPP, which is owned by the state company MVM. MVM is also the sole buyer and seller of electricity generated in Hungary under long-term power purchase agreements (PPAs), and the unique supplier to the regulated market. Besides MVM, there are several foreign private companies operating in the electricity generation and distribution sector. The Electricity Act 2005 stipulates that MVM shall remain owned by the State.

Figure 2

Total Primary Energy Supply, 1973 to 2030



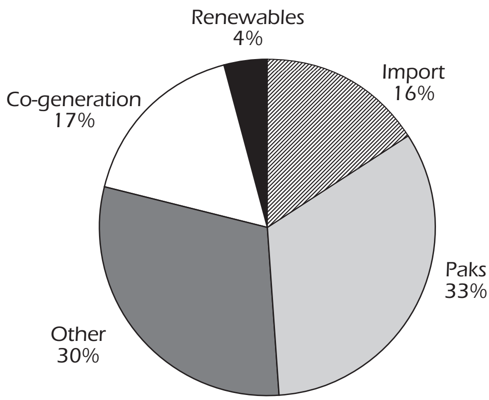
* negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2006 and country submission.

2. While this is not correct in terms of gas import contracts, it is correct in terms of gas molecules.

Figure 3

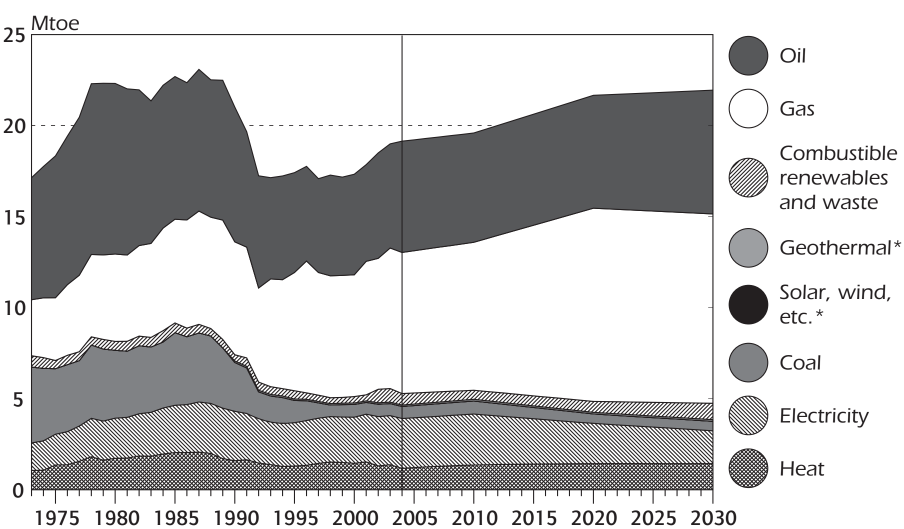
Electricity Generation and Import Shares by Source, 2005



Source: MAVIR.

Figure 4

Total Final Consumption by Source, 1973 to 2030

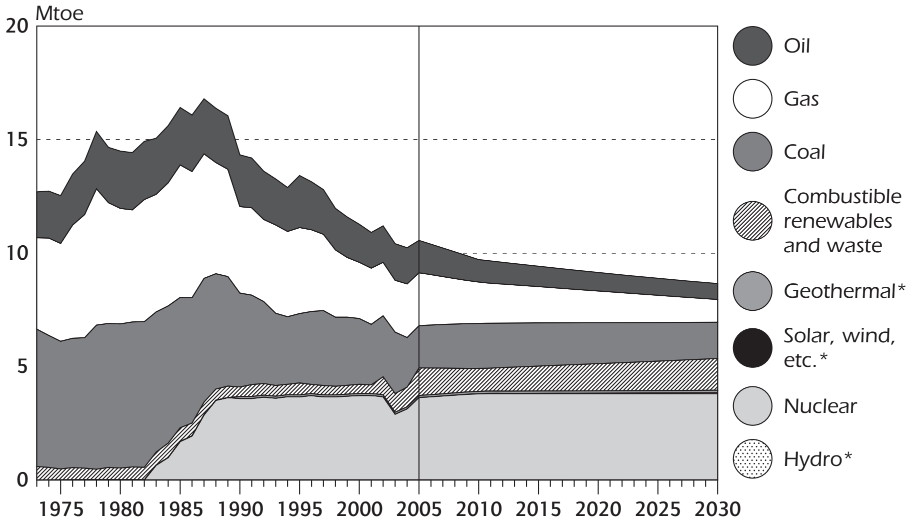


* negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2006 and country submission.

Figure 5

Energy Production by Source, 1973 to 2030



* negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2006 and country submission.

ENERGY POLICY

OBJECTIVES

Hungary's energy policy is aimed at balancing the three "Es", namely energy security, economic growth, and environmental protection. Although the last official "Energy Policy of Hungary" document dates from 1993, the government is currently preparing a new document. The government sees energy security as the highest priority of the three Es, especially in the area of natural gas. This priority is driven by the fact that Hungary is among the IEA member countries with the highest share of natural gas in its energy mix (45%), and imports 80% of its gas consumption from one single supplier. At the same time, its domestic production of gas is continuing to decrease. The political dimension of gas security is highlighted by the fact that a majority of Hungarian households use gas for heating. The fall-out of the Russia/Ukraine gas dispute, with Hungary being one of the most affected EU countries in terms of temporary supply shortfall, has further increased the need to improve the security of gas supply (see also Chapter 7)

ENERGY SECURITY

The government has done very well in enhancing energy security through supply-side measures, such as oil storage and increased electricity interconnections, and centrally directed emergency actions, such as demand response in the case of the January 2006 gas crisis. Energy security is not playing a major role in the formulation of other demand-side policies, such as energy efficiency, however. Some government policies, such as the compensation system for household gas consumption (see below) and the lack of effective market opening in electricity and gas, negatively affect security of supply by encouraging demand and reducing the incentive to make more efficient use of resources, such as in electricity generation.

To further improve security of supply, the government is supporting the development of new gas pipelines to Hungary, such as the Nabucco pipeline, or the construction of a liquefied natural gas (LNG) terminal on the Croatian island of Krk. These projects could contribute to diversify the routes and sources of gas imports in the future.

ENERGY MARKET REFORM

The government has transposed all relevant EU market directives, but has done little to restrict the power of the incumbents in electricity and gas. Because of this, while the degree of legal market opening is up to 70% in electricity and gas, the degree of real market opening[3] is much lower, reaching 7% in gas, and 30% in electricity. While some elements of market regulation are very well developed, such as the electricity network regulation, other aspects, such as the creation of fully functioning wholesale markets, are lagging behind.

In the electricity sector, the government has not yet undertaken action to restructure the PPAs, which are significant barriers to the development of a competitive electricity market. In the gas sector, the government and the regulator have not taken significant action to enable competition against the incumbent to import gas. As a consequence, the development of competition in both sectors is far below the legal market opening. Currently the government has not announced plans for the functioning of the markets after the full opening scheduled for 1 July 2007, even though the regulator has proposed a market design.

3. Legal market opening is relating to the market that is potentially open for competition, while real market opening denotes the share of customers who have already taken advantage of the legal opening of the market.

The Hungarian Energy Office (HEO)

The HEO is the Hungarian energy regulator, and is covering electricity, gas and also heat that is sold by power stations with a capacity above 50 megawatts (MW) to district heating facilities. The HEO is a budgetary corporate body with separate and independent financial management. It is self-financing through licensing fees on the industries it regulates. At the proposal of the Minister of Economy and Transport, the Prime Minister appoints and dismisses the President and the Vice-President of the HEO. Their appointment is for a term of six years. The HEO prepares annual reports directly to the Parliament, not to the government. Regulatory decisions taken by the HEO can only be overturned by a court decision.

The HEO has the following principal responsibilities:

- Issue and amend the licences for the generation, distribution, trade and public utility supply of electric energy, for the production of district heat in the authorised power plants, as well as for the distribution, supply, trade, and public utility supply of gas; issue operation licences to power plants.
- Approve the general terms of electric energy supply (terms of operation, trade and distribution), as well as the business codes of the licence holders, taking into consideration the opinion of the organisations representing consumers' interest.
- Determine the amount of information to be disclosed by licensed operators.
- Prepare administrative prices of natural gas, electric energy and heat energy produced in the authorised power plants, and the conditions of price application for decision-making.
- Investigate customers' complaints, and protect the consumers.
- Manage the Council of Energy Interest Representation.
- Co-operate in some specific tasks of the government connected with energy saving.
- Collect, evaluate and store information about the production and use of electricity and gas.

Since its establishment the HEO issues the licences required for the production of electric energy, gas supply and heat distribution, and for the transport and supply of electricity. It supervises the activities of licence holders and manages the level of supply. It also performs the tasks related to the protection of consumers' interests. It prepares the setting of regulated prices, and proposes new rules for the adjustment of the network development fees. Changes in the ownership structure of licence holders can only take place with the HEO's consent. In such cases the HEO co-operates with the Competition Office.

The operation and further development of the energy price regulation systems, as well as the decision about the annual price revision applications are also the responsibility of the HEO. It is an important task of the HEO to evaluate and process the energy-related information relevant to the supervised sector, and to publish it in various publications and yearbooks. The HEO has authorised staff of about 90.

ENERGY AND THE ENVIRONMENT

The government is pursuing a policy to reduce the environmental impact of energy use by reducing consumption and increasing efficiency, by replacing fossil fuels with renewable fuels, and by reducing emissions at the source. Two National Development Plans have been devised to achieve this aim.

National Development Plan-I (2004-2006)

To enable the utilisation of EU Structural Funds, Hungary prepared the National Development Plan (NDP-I). On the basis of an analysis of economic and social conditions, NDP-I identified the policy priorities that were to be supported by Structural Funds. Renewable energy and energy efficiency were key elements of NDP-I.

National Development Plan-II (2007-2013)

Hungary has prepared the draft National Development Plan (NDP-II) for the period 2007-2013. In the NDP-II the environment-related subject areas are addressed through separate operative programmes, because these give more opportunity for targeted developments.

The draft version of the Environmental Operative Programme (EOP) is ready and its final version was submitted to the EC in the autumn of 2006. According to the high-level policy-related agreement, the EOP will be extended to also cover energy issues, with particular emphasis on the improvement of energy efficiency and on a higher share of renewable energies. The EOP is to be renamed EEOP (Environmental and Energy Operative Programme).

The treatment of these energy issues will depend on close co-operation among the relevant ministries that are responsible for environment, energy, biomass and biofuel projects. The integration of environmental issues into the energy policy requires good stakeholder co-ordination, because a range of organisations are taking part in the formulation of energy and environmental policy, usually working in close co-operation with each other. As a consequence, the formulation of the EOP is a matter for the Interministerial Committees.

Support for renewables and CHP

The government has chosen to establish very generous feed-in tariffs for renewables and CHP (see Chapter 3 on Energy Efficiency and Chapter 6 on Renewables). The cost of these tariffs to the Hungarian electricity consumer is high, and Hungary is rapidly achieving its target for electricity production from renewable sources, ahead of time.

Energy-related environmental legislation introduced since the last in-depth review[4]

- Ministerial Decree 10/2003 (VII.11) KvVM on the limitation of emissions of certain pollutants into the air from large combustion plants, with a rated input equal to or greater than 50 MW.
- Joint Ministerial Decree 17/2003 (IV.4) GKM-KvVM-PM on the limitation of the sulphur content of certain fuels.
- Government Decree 143/2005 (VII.27) on specific rules of the trading system of greenhouse gas (GHG) emission units.
- Governmental Decree 314/2005 (XII.25.) on the licensing procedure concerning environmental impact assessment (EIA) and integrated pollution prevention and control.
- Act XV of 2005 on the trading system of GHG emission units.

ENERGY POLICY INSTITUTIONS

MINISTRIES

The **Ministry of Economy and Transport** is the central institution in Hungarian energy policy-making. It oversees the energy industry, the

4. Relevant international agreements and EU regulations were taken into account by the Hungarian government when developing this legislation.

regulator, and is responsible for security of supply and for the implementation of the EU's market directives. The Department of Energy within the ministry has a small permanent staff of 18. There are three divisions of the department controlling the overall implementation and formulation of the energy policies:

- **Energy Economy Division:** Energy markets, economic issues, pricing and energy legislation.
- **Energy Co-ordination Division:** International affairs and environmental issues including climate change.
- **Energy Saving and Renewable Energy Division:** Energy efficiency, renewables and research and development (R&D).

The **Ministry of Environmental Protection and Water Management** is responsible for environmental policies to reduce pollutants and other adverse environmental impacts from the energy industry. The ministry also has a principal responsibility on climate change policy issues, including the EU Emissions Trading Scheme (EU-ETS). It is dealing with some aspects of sustainable energy management, namely energy efficiency, energy saving and renewables issues. Its activity mainly concerns the energy sector through environmental (air quality, water quality, waste management, etc.) regulation. The Strategic Department of the ministry is responsible for the integration of environmental aspects into other policies.

The **Ministry of Agriculture and Rural Development** deals with biomass issues in energy. It has a leading role in operating an efficient agricultural-energy programme because of the necessary biomass raw materials for green energy production and the development of rural areas.

The **Ministry of Finance** is responsible for taxation and the financing of energy policies. The ministry deals with various supporting measures, such as different subsidies and taxation issues.

INTER-MINISTERIAL COMMITTEES

The following three inter-ministerial committees co-ordinate the energy policy-making process in Hungary:

- **Inter-ministerial Committee on Energy Saving** (co-ordinated by the Ministry of Economy and Transport) – allocates funds to energy saving projects.
- **Inter-ministerial Committee on Renewable Energy** (co-ordinated by the Ministry of Economy and Transport) – prepares and implements the Renewable Energy Strategy.

- **Inter-ministerial Committee on Kyoto Mechanisms** (co-chaired by the Ministry of Environmental Protection and Water Management and the Ministry of Economy and Transport) – primarily in charge of co-ordinating policies relating to joint implementation (JI) projects and emissions trading.

GOVERNMENTAL BODIES

The **Hungarian Energy Office** (HEO) was established in 1994. It is a public administration body with independent powers and competence, acting under the government's control and the supervision of the Minister of Economy and Transport. It is responsible for the regulation of the energy industry in Hungary (see the box in the Energy Market Reform section above).

The **Hungarian Competition Office** (GVH) monitors competition in all sectors of the economy, as well as mergers in the energy sector. The GVH gives expert advice and makes proposals relating to the governmental competition policy and to decisions of the government affecting competition. It also represents public interest and supports the development of competition culture in Hungary. The GVH is headed by a president, assisted by two vice presidents. The president is nominated by the Prime Minister and appointed by the President of the Republic for a period of six years. The GVH is independent of the government, but is controlled by the Parliament. The president of the GVH is obliged to submit an annual report on the activities of the GVH to the Parliament and, upon request, the president will present the report to the competent parliamentary committee or give expert advice in subjects related to competition.

The HAEA is the agency regulating the nuclear sector. It undertakes the regulation of the safety of nuclear materials and facilities under normal and abnormal conditions and is responsible for the management of nuclear emergencies. In addition, the HAEA is handling the nuclear-related public information activities. The HAEA acts independently from the Ministry of Economy, and is supervised by a minister who, in turn, is performing his/her task independently of his/her portfolio and who is directly appointed to this position by the Prime Minister. Since the HAEA is primarily concerned with ensuring nuclear safety in accordance with the law, it is currently under the supervision of the Minister of Justice and Law Enforcement. The HAEA is financed by charges from the industry it regulates.

OTHER INSTITUTIONS AND IMPORTANT COMPANIES

The **Energy Centre** principally acts as an implementing agency of energy efficiency and renewable energy-related national, EU and other multilateral projects, including the National Development Plan and EU Structural Funds.

The Centre is a common background institution of the Ministry of Economy and Transport (40%), Ministry of Environment and Water (25%) and Hungarian Energy Office (15%). It is controlled by a supervisory board, led by the representative of the the Ministry of Economy and Transport. The Centre also produces energy statistics on behalf of the Ministry of Economy and Transport and implements and monitors the Natural Gas Social Compensation Fund (see Chapter 7, Natural Gas). At an international level the Energy Centre represents Hungary in different IEA working groups and is responsible for the international data submission to the IEA and EU. The Executive Director of the Energy Centre is the current chairman of the Energy Committee of the United Nations Economic Commission for Europe (UNECE).

The **Hungarian Hydrocarbon Stockpiling Association** administers oil stocks. The emergency, strategic reserves are held by this agency, which was established on the basis of Act IL of 1993 on the Emergency Stockholding of Imported Crude Oil and Oil Products, and is overseen by the Ministry of Economy. The agency was reorganised in April 2006, on the basis of the new Law on Strategic Natural Gas Reserves, which was approved in February 2006. There are two branches of the Association: the liquid hydrocarbon branch, which is responsible for the stocks of crude oil and oil products; and the natural gas branch, which is responsible for organising the planned strategic gas storage.

MVM. The state-owned company is the central company in the electricity industry, which owns the network operator, and the Paks nuclear power plant, and controls approximately 80% of electricity generated in Hungary (see box in Chapter 5, Electricity).

MOL. The company is the operator of the gas network, and the only refinery in Hungary. It controls approximately 80% of the Hungarian wholesale oil products market. MOL was completely privatised in 2006, when the remaining 10% of shares still in government ownership were transferred to it or sold.

ENERGY MARKET STRUCTURE AND REGULATION

ENERGY PRICES

Hungary's energy prices are partially set by the market, and partially regulated by the government. Energy pricing is predominantly cost-reflective, with regulated tariffs to consumers reflecting the cost of supply. On the wholesale level in electricity, serious distortions are caused by long-term power purchase agreements (see Chapter 5, Electricity).

The regulator or the government sets prices for transportation tariffs in energy networks, regulated electricity and gas; heat prices for households and other consumers; and electricity generation prices paid to generators operating under a PPA or eligible for feed-in tariffs.

Table 2

Energy End-use Prices, 2006

(USD/unit - converted using exchange rates; including taxes)

Fuel	*Hungary*	*OECD Europe*	*Ratio to OECD Europe*
Low sulphur fuel oil for industry per tonne	384.2		
Light fuel oil for industry per tonne	649.8	652.9	99.5%
Automotive diesel for commercial use per litre	1.02	1.124	90.7%
Automotive diesel for non-commercial use per litre	1.224	1.324	92.4%
Premium unleaded gasoline (98 RON) per litre	1.283	1.555	82.5%
Natural gas for industry per toe	452.2		
Natural gas for electricity generation per toe	366.3		
Natural gas for households per toe	406.5		
Electricity for industry per kilowatt-hour (kWh)	0.107		
Electricity for households per kWh	0.134		

Note: Latest available quarter 2006 for each price.
Source: *Energy Prices and Taxes, Second Quarter 2006*, IEA/OECD Paris, 2006.

ENERGY TAXATION AND SUBSIDIES

The energy tax and value-added tax (VAT) affect end-user gas prices in Hungary. According to Act LXXXVIII of 2003 on energy taxation, the amount of tax is HUF 56 per gigajoule (GJ). According to paragraph (1) a)-b) of Section 3 of the act, the energy tax shall not be paid by residential customers. Conditions of exceptions and reclaim are also described in the above-mentioned act. The amount of VAT as set in the Act LXXIV of 1992 is 15%, which was increased from 12% as of 1 January 2004.

Following the government's decision in 2003, residential gas consumption is subsidised as determined in decree 50/2003 (VIII. 14) GKM. The aim of creating the compensation system was that residential customers would only partially be exposed to the import price-based tariff of gas. The subsidy covers

Table 3

Excise Duty Levels in HUF

Fuel	*Excise duty from 2000*	*Excise duty from 2005*
Automotive diesel (all uses)	80.2 / l	88.01 / l
Gasoline (all types)	93 / l	106.54 / l
Natural gas for industry	0	2 345 / toe
Electricity for industry	0	0.19 / kWh

Source: *Energy Prices and Taxes, Second Quarter 2006*, IEA/OECD Paris, 2006.

the difference between the paid and declared prices and thereby compensates the residential customers temporarily, since the amount of compensation decreases continually (see Chapter 7, Natural Gas).

ENERGY STATISTICS AND FORECASTS

The following general assumptions were made during the completion of the Hungarian energy supply forecast to 2030. Energy policy is presumed to follow the key directives of the EU, such as those on CHP, building and services. Energy regulation will conform to EU requirements such as energy standards, labelling and energy audits. Instead of subsidised household energy prices, market tariffs reflecting real conditions shall be introduced for energy use, and consumers can be expected to have an increased interest in the rational use of energy, which will be supported by information campaigns and education. More specific assumptions are set out below:

- The structural changes in the 1990s, which resulted in the reduction of energy-intensive industrial actvities will not continue.
- Technological progress will be present in every sector and improve the efficiency of the energy systems and use.
- Energy policy will include the reform of household energy prices.
- In the area of primary energy production, the substitution of coal by natural gas and renewable energy sources will proceed, including the closure of underground mines.

- The liberalisation of electricity and gas markets will continue, affecting the import-export balance.

- The role of nuclear energy in the fuel structure is almost constant. A capacity increase of 8% is expected by 2020. Given the extension of its life span, the nuclear power plant of Paks will remain in operation, and its capacity will be increased after 2020. Specifically, the life span of all four blocks, which are currently scheduled to retire between 2012 and 2017, will be extended by 20 years. Together with the prolongation of the life span, the nominal capacity will increase up to 2 040 MW (Parliament Decree 85/2005).

- The electricity produced by CHP will continue to be bought at an obligatory feed-in price prescribed by the law. CHP will only be installed in case of real heat demand. The prices are controlled by the regulator. The minimum expected efficiency of CHP is 65%, and 75% in the case of gas engines. (Decree 56/2002 of the Ministry of Economy and Transport, which is an amendment of 78/2005, is currently in force).

- The decline of coal-based electricity production will continue. The building of new and more efficient power plants using imported coal is likely.

- The electricity produced from renewable energy sources is subject to an obligatory feed-in price prescribed by the law, and a must-buy requirement. Hungary made a commitment to the EU that electricity production from green energy sources shall reach 3.6% by 2010. This objective was fulfilled in 2005.

- Energy use in transport is still increasing owing to a rise in the number and mileage of vehicles used in passenger transport and trucking. Government policy has limited influence on this.

- Total primary energy supply (TPES) is expected to rise by 1.2% per year in the forecast period. Oil demand is expected to rise by 0.7% per year owing to the growth of consumption in the transport sector, and gas demand by 1.6% per year. The increasing role of natural gas is explained by its growing importance in electricity production and in the household and tertiary sectors. The reduction in coal supply will be substituted by natural gas and renewables-based capacities.

- Given stagnating heat demand, CHP is not expected to penetrate electricity generation any further. The average efficiency of power generation will show a slight increase owing to the installation of new power plants.

- Electricity demand will rise in all sectors.

Table 4

Hungary's Energy Consumption and Forecast Data in Mtoe, 2000 to 2030

	Actual					*Forecast*		
	2000	*2001*	*2002*	*2003*	*2004*	*2010*	*2020*	*2030*
Total supply (TPES)	**25.01**	**25.42**	**25.81**	**26.34**	**25.87**	**28.47**	**33.21**	**36.51**
Coal	3.97	3.62	3.62	3.75	3.5	2.72	2.52	2.53
Oil	6.87	6.62	6.47	6.3	6.15	6.74	6.94	7.54
Gas	9.65	10.71	10.81	11.88	11.63	12.98	15.93	18.19
Comb. renewables & waste	0.42	0.4	0.8	0.82	0.74	1.5	3.3	3.4
Nuclear	3.71	3.7	3.65	2.89	3.1	3.79	3.79	4.09
Hydro	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Geothermal	0.09	0.09	0.09	0.09	0.09	0.2	0.2	0.2
Solar, wind, etc.	–	0	0	0	0	0.01	0.03	0.05
Electricity (trade)	0.3	0.27	0.37	0.6	0.64	0.52	0.49	0.49
Heat	–	–	–	–	–	–	–	–

Source: Country submission.

CRITIQUE

Since the last review, the Hungarian energy sector has seen significant positive developments. EU accession was completed in 2004, and all EU energy legislation was transposed, without derogations, in line with the schedule for accession. The National Allocation Plan I was accepted, and Hungary completed the first year of emissions trading well below allocation. Given the divestment of parts of MOL's gas business to E.On Hungária (see Chapter 7, Natural Gas), full ownership unbundling took place in the gas sector. A significant nuclear incident demonstrated the independence and competence of the nuclear safety regulator (see box in Chapter 5, Nuclear). The prompt action by the government and regulator in response to the gas supply interruptions of January 2006 ensured that no vulnerable customers were cut off from heating at a critical point in time. All of these are positive developments for which the government and regulator should be commended.

Nevertheless, significant challenges remain for the government and energy policy-makers. Real liberalisation in electricity and gas is delayed owing to the market power of the incumbents. The government's decision to integrate the system operator MAVIR with the electricity company MVM reduced the independence of MAVIR. The budget crisis threatens to affect the capabilities of the energy policy-making institutions. Furthermore, security of supply is not addressed in a coherent framework, taking account of the lack of energy efficiency in the transformation sector and in energy end-use.

The government is facing budgetary problems, which have led to the adoption of an austerity programme. As part of this programme, the number of employees in the civil service is to be drastically reduced. This also affects all government institutions in the energy sector. The government ensures the continued functioning of the Energy Department in the Ministry of Economy and Transport, which was already operating at very low staff levels before the announcement of the austerity programme, and ensures the functioning of other important institutions in the energy sector.

The most immediate and serious challenge facing government in the energy policy arena since the last review has been to ensure the security of gas supply. The government reacted rapidly to the gas supply interruption of January 2006 by speeding up the legislation to create a new underground strategic gas storage capacity of 1.2 billion cubic metres (bcm) by 2010 (law approved in February 2006). While strategic gas storage can make an important contribution, the government should also investigate other measures, and it should ensure that when the storage is built, it is imposing the least possible cost on Hungarian energy consumers.

On the demand side, the current gas subsidy to most households not only puts an increasing burden on the government budget (currently amounting to EUR 500 million per year) but also artificially pushes gas demand to a higher level than it otherwise would be, thus exacerbating the security of supply problem, while removing funds from the budget that could be used for investment in energy efficiency. The gas subsidy is currently under review by the government, and it appears likely that it will be changed significantly to remove its distortionary effects and the burden on the government budget. This is commendable, and goes towards addressing the recommendation from the last review. Ideally, the subsidy scheme would be abolished, and a direct support for poor households would be implemented.

At the same time, the government is trying to accelerate the work on medium- and long-term measures such as speeding up the implementation of two new gas pipelines, the Nabucco pipeline and a new Adriatic pipeline (from the LNG terminal on the Croatian coast to Hungary). An important new development is the Bluestream gas pipeline contract between MOL and Gazprom, which was concluded in June 2006 and which sets the intent for the two companies to co-operate on the development of a second stage of the Bluestream pipeline to bring gas into Europe. It is unlikely that all of these projects will be developed, since they are in direct competition. It also remains to be seen whether it will prove feasible for the government to speed up these complicated projects, as there are many stakeholders and countries involved. Moreover, it is unclear whether these pipelines will bring a significant diversification of supplier countries and not just of supply routes.

Nuclear energy from the Paks nuclear power plant plays a dominant role in the electricity mix in Hungary, and contributes significantly to energy security, climate change mitigation, and to low prices in the Hungarian electricity system. The Paks nuclear power plant enjoys a high level of political and public support in Hungary, and a decision has been taken to extend its capacity and lifetime. The government is to be commended for this achievement and should try to create the framework conditions for this contribution to be continued after the lifetime extension has come to an end.

At the same time, energy security could be further increased by utilising available renewable resources, such as hydro generation, which have been affected by strong resistance for historical reasons. The government could consider initiating a debate on hydropower in Hungary that looks at the issue from a neutral energy policy perspective, by outlining the advantages and drawbacks of hydropower use in the Hungarian energy system, including the impact the construction of a hydro plant would have on the environment.

Economic efficiency in energy supply is important for Hungary, especially because the country is keen to enhance the competitiveness of the economy. In the past 15 years, the Hungarian energy sector has undergone an impressively rapid and fundamental market reform in the electricity and gas sectors. The government is to be commended for introducing extensive privatisation and foreign direct investment, as well as implementation of the European liberalisation directives without any derogation. By now, the market opening of the electricity and gas markets is legally around two-thirds. The real market opening, however, is much lower because of the hybrid market structure (liberalised and regulated sector). Furthermore, there are important factors impeding competition such as long-term contracts (PPAs), congestion of interconnections and the role of dominant market players. Overall, Hungarian energy policy could benefit from a much stronger focus on the development of competition, and from clear statements supporting this focus coming from the highest political level.

While the HEO is seen as a competent and independent regulator, there appear to be questions concerning consultation with the energy industry and energy users in the process of developing new market models, and on the transparency of its decision-making in general. It is for example confusing that the HEO and MVM are presenting to government different and incompatible programmes for further liberalisation of the electricity market , indicating that HEO’s position as the regulator is not as strong as would normally be required for effective regulation, and that insufficient consultation has taken place during the development of the HEO model for liberalisation.

Environmental protection is an integral part of Hungary's energy policy. Its per-capita energy consumption and carbon dioxide (CO_2) emissions are significantly lower than the EU average. The improvement of energy intensity over recent years has been impressive, with an average improvement of 3% per year. However, this is mainly due to significant changes in Hungary's industrial structure. The question is whether this rate of improvement can be continued without stronger energy efficiency policies. Stepping up energy efficiency efforts is now high on the agenda of many IEA members because there is still a large potential for energy savings in sectors like transport, buildings, appliances and industry. It is generally seen as a very important policy to improve energy security (the first "E") as well as a cost-effective way to reduce CO_2 emissions.

Hungary acceded to the Kyoto Protocol in 2002 and appears to be on course to meet its commitment of –6% (relative to average GHG emissions of 1985-87). It also participates in the EU's Emissions Trading Scheme. Hungary has an ambitious renewables policy with high feed-in tariffs. This has led to an impressive and rapid increase in the share of renewables in electricity generation to around 5%, above the 2010 target. However, this improvement has come at a high cost for customers. At the same time, additional wind power capacity has been capped because the system operator MAVIR fears that it would otherwise negatively affect the transmission system.

With high energy prices and increasing concerns on energy security and climate change, energy policy has risen to the highest level on the political agenda in all IEA member states, and many governments are strengthening their capacity for energy policy-making. As already signalled in the previous review of Hungary, the IEA is concerned about the staff capacity of the Department of Energy in the Ministry of Economy. This concern has only increased during the present review. Political decision-makers in Hungary should take into account that there are serious risks in reducing the already very modest staff levels in all its government institutions, which are working in the energy sector in these turbulent times.

RECOMMENDATIONS

The government of Hungary should:

- *Improve energy security by promoting more energy diversification by energy sources, by supplier countries and by supply routes. In particular, avoid over-dependence on natural gas as well as over-dependence on a single gas supplier.*

- *Implement the new system of strategic natural gas stockholding in a cost-effective manner; continue to seek regional co-operation on strategic gas stocks.*

- *Eliminate the gas subsidy to households as soon as possible; target compensatory direct income support to poor households where necessary.*

- *Improve competition in the electricity and gas markets by, among other measures:*

  - *Fully opening the markets and unbundling in line with the EU directive.*

  - *Making tariffs fully cost-reflective.*

  - *Abolishing the single-buyer model.*

  - *Removing the system of PPAs in electricity.*

- *Promote more integrated regional electricity and gas exchange by actively participating in regional initiatives, strengthening interconnections and harmonising regulation and market conditions.*

- *Improve the consultation mechanisms with industry and energy users and in general increase transparency of the regulatory process in electricity and gas.*

- *Strengthen energy efficiency policy in order to improve long-term energy security and the competitiveness of the Hungarian economy, as well as to contribute to environmental protection and climate change mitigation. In particular, encourage energy efficiency in buildings, transport and appliances by utilising cost-reflective prices and standards according to best practice.*

- *Ensure that the renewables strategy, which is currently under development, creates a coherent framework for the more cost-effective and grid-compatible support of renewables in the Hungarian economy.*

- *In view of the importance of these issues and of energy internationally, ensure that the staffing of the Department of Energy, the HEO, the HAEA and the Energy Centre, is appropriate.*

ENERGY EFFICIENCY, CHP AND TRANSPORT

OVERVIEW

Energy intensity in Hungary has improved considerably, from 0.25 tonnes of oil equivalent (toe) per thousand US dollars in 1990 to 0.18 toe in 2004, with a slower reduction from 0.2 toe to 0.18 toe between 2000 and 2004 (see Figure 7). The government predicts a further improvement in energy intensity over the coming years, to 0.15 toe by 2010. In 2004, energy intensity in Hungary was still 17% above the IEA Europe average, but it is expected to continue to fall faster than the IEA average owing to continued structural changes and equipment replacement, and to narrow the gap to 5% by 2010.

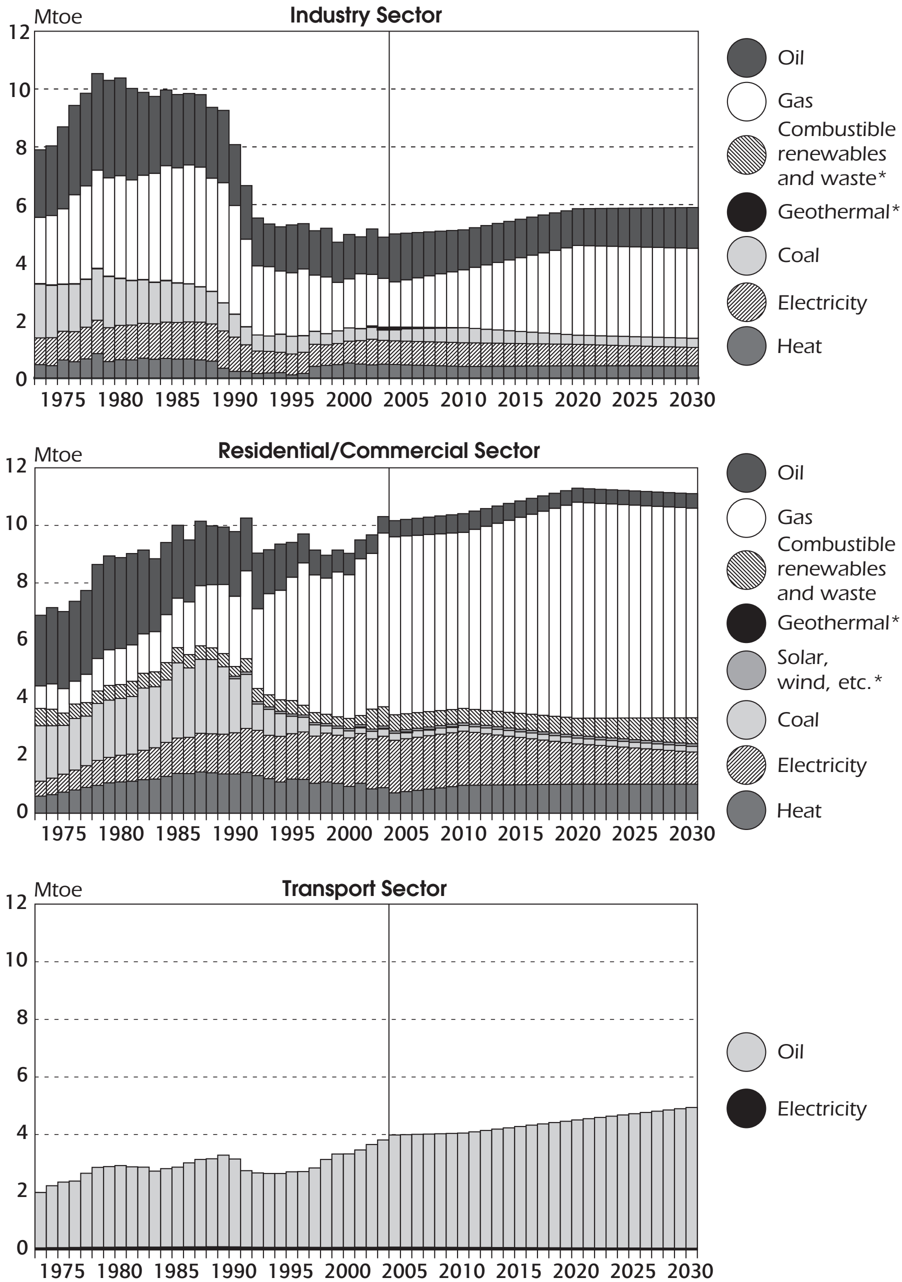
The reduction in total final consumption (TFC) is the result of a 35% decline in industrial energy consumption, from 8.1 Mtoe in 1990 to 5 Mtoe in 2004. During the same period energy demand in transport increased by 27% from 3.15 Mtoe to 4 Mtoe, while in the "Other sectors[5]", demand increased by 5% from 9.8 Mtoe to 10.2 Mtoe. Despite the absolute increase, intensity of energy use declined in transport. The government expects the share of the individual sectors to remain broadly stable in the future. According to the Energy Centre, Hungary's heavy construction activity has given rise to its unit consumption of steel being 5% above that of the EU-15 average, while that of cement is 20% above. Unit consumption of cars is still 20% below the EU-15 average, and expected to increase in the future. The primary fuels consumed in Hungary are gas and oil, which together accounted for 13.9 Mtoe out of 19.1 Mtoe, or 72% of TFC in 2004. Gas is contributing 61% to energy consumption in the other sectors, and 31% in the industrial sector. Oil is contributing 5.5% in the other sectors, and 33% in the industrial sector.

Heat and electricity consumption accounted for another 3.9 Mtoe or 20% of TFC in 2004. There are significant sectoral differences in the development of these two types of energy consumption. Heat consumption has grown by 104% in the industrial sector where it displaced direct gas use, from 0.23 Mtoe in 1990 to 0.47 Mtoe in 2004. In the other sectors, it declined by 48% from 1.36 Mtoe to 0.71 Mtoe. Electricity contributed 18% to

5. Throughout the review, the "Other" sector is defined as covering the commercial, public, residential and agricultural sectors.

Figure 6

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



* negligible.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2006 and country submission.

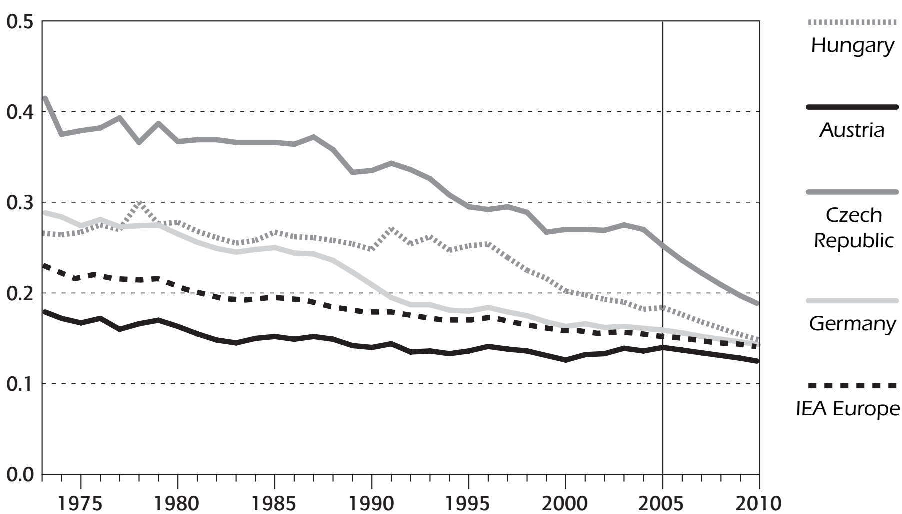
consumption in the other sectors, and 16.4% in the industrial sector. Per-capita electricity use in Hungary is very low compared to other IEA countries, with Hungary consuming just 3 910 kWh per year in 2002, compared to 6 394 kWh in the United Kingdom, or 5 711 kWh in Spain. The government expects that economic growth in the future will lead to a rapid increase in electricity consumption.

Energy consumption in stationary use is the most important contributor to final consumption in Hungary. It accounts for 80% of TFC. Energy is consumed either through direct fuel use, or indirectly in the form of heat and electricity, with district heating (DH) and combined heat and power (CHP) playing a major role. Around 40 % of TFC is used for space heating. The space heating demand is 0.90 GJ per m^2 per year, while in the EU-15 countries it stands a 0.53 GJ per m^2 per year. An EU "efficient" building is defined as a building requiring 0.24 GJ per m^2 for annual space heating purposes.

Figure 7

Energy Intensity in Hungary and in Other Selected IEA Countries, 1973 to 2010

(toe per thousand USD at 2000 prices and purchasing power parities)



* excluding Luxembourg and Norway throughout the series, as forecast data are not available for these countries.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2006; *National Accounts of OECD Countries*, OECD Paris, 2006 and country submissions.

The government pursues energy efficiency primarily for economic reasons, such as a decrease of import dependence, and an increase of international competitiveness of Hungarian companies. The basic elements of the Hungarian energy efficiency and environmental policy in the energy sector are support programmes, including grant and soft loan systems, the preferential feed-in tariff system for renewables and CHP, and taxation of fossil fuels through the energy tax, environmental levy, and emission allowances under the EU-ETS.

Hungary has a long-term Efficiency and Renewable Energy Programme and Action Plan, which was approved by the government in 1999, and covers the period to 2010. No plan has been published relating to the transposition and implementation of the EU Energy Services Directive (2006/32/EC). The 1999 Energy Saving and Energy Efficiency Improvement Action Programme (the National Energy Efficiency Plan) defines the following targets for energy efficiency by 2010:

- Reduction of energy intensity by 3.5% per year, assuming an annual gross domestic product (GDP) growth of 5% and a growth rate of energy consumption of 1.5% per year.
- Saving of 75 petajoule (PJ) per year (1.8 Mtoe per year) of primary energy sources.
- Reduction of 50 kilotonnes (kt) per year of SO_2 and 5 million tonnes (Mt) per year of CO_2 emissions.
- Increase of renewable energy production from the present 28 PJ per year to 50 PJ per year (1.2 Mtoe per year).

A strong institutional background for energy efficiency is present in the form of the Energy Centre (see box). The Energy Centre estimates that with current prices and costs, the cost-effective energy savings potential in Hungary is substantial, at 50-100 PJ, equivalent to 5-10% of TPES. This savings potential is in line with the target of the 1999 Plan of 75 PJ per year. Should energy prices increase, the savings potential will be higher. The Energy Centre expected that the availability of significant EU funds from 2007, together with up to HUF 20 billion from the government, would help to achieve the savings potential, but it is likely that the austerity programme announced in 2006 may have an impact on the programme. The identified savings break down as follows across the different sectors of the economy:

- In the heat and power sector: 5-10% (of sectoral TPES).
- In buildings: 10-20% (of sectoral TPES).
- In the transport sector: 5-10% (of sectoral TPES).

The Energy Centre

The Energy Centre is Hungary's national energy efficiency agency and was established by Government Decree 1031/2000 (IV.7.). It was founded by the Ministry of Economy, the Ministry of Environment and the Hungarian Energy Office. Following the announcement of an austerity programme in 2006, the Energy Centre's functions were drastically reduced on 1 January 2007.

Aim of the Energy Centre

The Energy Centre was established to act as a national energy efficiency agency, with the aim of strengthening and promoting national and international co-operation. The Centre's purpose includes the improvement of energy efficiency and the protection of the environment, the development of related governmental strategies, as well as the implementation of these strategies.

Activities of the Energy Centre

The national and international activities of the Energy Centre include the management of the energy efficiency programmes within the framework of the Energy Saving Programme or "Széchenyi Plan" initiated by the Ministry of Economy; the operation of a national energy statistical system, which includes data collection, management and analysis, including the preparation and submission of data to the IEA; participation in the development of the national energy policy, development of long-term planning for energy policy and support of decision-making at national level to follow up the plans; the fulfilment of international requirements related to energy efficiency; the implementation of international energy efficiency and environmental projects; the fulfilment and strengthening of information, experience and technology transfer between Hungary and foreign (especially EU) countries; and the supply of energy-related information on a not-for-profit basis.

CURRENT STATUS OF ENERGY EFFICIENCY

ENERGY USE IN THE TRANSFORMATION SECTOR

The primary use of energy in the transformation sector is in electricity generation and heat production. An additional large-scale user in this sector is the MOL refinery at Százhlombatta, which operates at a very high level of efficiency, and where MOL estimates that no further improvements are possible, owing to the layout of the refinery.

Gas and coal are burned in power stations with relatively low efficiency, compared to stations in other IEA member countries (see Table 5 below). Upgrading power stations is subject to investment by private owners of these stations, and at least one operator is currently considering an upgrade of a gas-fired power station. The government and system operator, MAVIR, do not have a plan to force upgrading of stations.

Table 5

Average Efficiency by Type of Fuel for Hungarian and Foreign Electricity Generating Plants, in %

Country/region	*All thermal plants*	*Coal*	*Gas*
Hungary	34	32	38
EU	40	n/a	n/a
Germany	n/a	37	45
Austria	n/a	39	47
France	n/a	n/a	53
Difference best/Hungary	*21%*	*22%*	*40%*

Source: Energy Centre.

CHP AND DISTRICT HEATING

The primary use of combined heat and power (CHP) in Hungary is for the generation of heat to supply district heating (DH) systems. Total installed capacity in 2004 reached 1 775 MW_e (net)/ 2 255 MW_e (gross) and 4 694 MW_{th}. Gross electricity generation was 7 767 GWh in 2004, while heat generation reached 42 PJ, giving CHP a market share of 16% of total electricity production and 75% for DH production. The Energy Centre reports that CHP in public heating has an average efficiency of 73%.

CHP is supported by a very high feed-in tariff (see Chapter 6 on Renewables). This tariff has been changed several times and is limited to small- and medium-sized CHP plants up to 50 MW electrical capacity with a minimum efficiency of 65% (yearly and monthly) for boiler CHP units, and 75% (yearly and monthly) for internal combustion CHP units. If a CHP unit fails to reach the minimum efficiency, it does not receive any support. Efficiency is monitored by the local authorities, and it is not certain that controls are stringent. Small CHP units are currently guaranteed a feed-in tariff of HUF 23.8, with provision for a lower tariff during low-demand times (03h00-06h00 and 11h00-15h00), and have the right to sell all their generation to the grid, regardless of the grid situation. This feed-in tariff has encouraged the deployment of a large number of small capacity gas engines for CHP production.

In Hungary, DH has a long tradition, even though the development of DH systems is less extensive than in surrounding countries and only 16% of households receive heating and hot water from DH. The Energy Centre estimated that in 2004 the installed capacity of heat-only boilers was just below 5 GW_{th} with an annual heat production of 13.8 PJ, natural gas consumption of 16.2 PJ, and efficiency of 85%. Charges for DH installations are regulated by the Hungarian Energy Office.

ENERGY EFFICIENCY IN TRANSPORTATION

Transportation demand in Hungary is increasing in both the passenger and freight sectors. The efficiency of transport increased significantly between 1990 and 2000 owing to the switch to western equipment and vehicles in the transport sector, but has grown at a slower rate since then. Between 2000 and 2005, energy consumption from passenger transport fell on an annual basis, while that of freight experienced a slight rise of approximately 1% per year. It is now expected that rapidly increasing efficiency will no longer counteract demand increases in the future, and that active government measures will be required to offset future demand increases. Taxation of transportation fuels has led to relatively modest levels of consumption per head, as Hungarian consumers are highly price-sensitive in the purchase of motor fuels.

The primary area of demand growth is in road transport, both for passengers and for freight. Hungary still has a high share of public passenger transport, and in 2005 33% of passenger-kilometres were delivered by public transport, 60% by private cars, and 7% by aviation. This share is falling slowly because of oil price developments in recent years. The total share of road transport is lower than that of other countries such as Spain, and predicted to stay so at least until 2010.

Mass transport (public road transport, rail, aviation) accounts for 38% of all passenger transport, almost unchanged from 1990, indicating that despite an ageing infrastructure, the mass transport system of Hungary is continuing to fulfil an important role in the economy. In the freight sector, most freight is now travelling by road, but the government expects this share to remain stable until 2010, reflecting higher fuel cost for road transport, and the effects of infrastructure investment in the railroads.

Table 6

Share of Transport Mode in Hungary, 1990 to 2010

Mode	*1990*	*1995*	*2000*	*2005*	*2010*
Public road transport	25%	25%	25%	23%	21%
Private cars	61%	62%	60%	60%	62%
Total road	*86%*	*87%*	*85%*	*83%*	*83%*
Rail	12%	10%	11%	10%	10%
Aviation	2%	3%	4%	7%	7%
Total passenger transport	*100%*	*100%*	*100%*	*100%*	*100%*
Inland navigation	6%	5%	3%	4%	4%
Road	45%	64%	70%	71%	72%
Rail	49%	30%	27%	24%	24%
Freight transport	*100%*	*100%*	*100%*	*100%*	*100%*

Source: Ministry of Economy.

Note: In the tables throughout this book, total percentages may not equal 100 due to rounding of figures.

Table 7

Efficiency Indicators in Transport in Hungary, 1990 to 2010

	1990	*1995*	*2000*	*2005*	*2010*	*Change 1990/2005*	*Change 2000/2005*
Passenger transport. toe/million passenger-kilometres							
Aviation	91.6	66.89	57.07	45	44	–51%	–21%
Inland navigation	37.73	45.2	44.7	–	–		
Public road transport	9.52	9.87	9.12	8.8	8.7	–8%	–4%
Private cars	50	48	44.8	40	38	–20%	–11%
Rail	9.41	11.51	9.74	7	6.8	–26%	–28%
Freight transport toe/million tonne-kilometres							
Inland navigation	14.33	13.04	14.95	15	14.9	5%	0%
Trucks	38.4	24.21	35.49	32	31.8	–17%	–10%
Rail	7.04	6.78	5.23	4.2	4	–40%	–20%

Source: Ministry of Economy.

Hungary has a relatively high share of gasoline vehicles, and expects that this share will fall in the future, owing to the higher attractiveness of diesel vehicles in the current fuel price environment. Such a development would contribute to an increase of efficiency in the Hungarian vehicle park.

Hungary has implemented the EU vehicle label. A monitoring exercise conducted by the Ministry of Economy in 2003 found that the implementation could be improved.

ENERGY EFFICIENCY PROGRAMMES

INDUSTRY AND COMMERCIAL

Support for energy audits is available for industrial energy users, municipalities, and public institutions through the National Energy Efficiency Plan, to help identify savings potential.

Soft loans for the business sector are available through the Energy Efficiency Loan Fund. The fund supplies soft loans for energy efficiency investments up to a maximum of 80% of the project cost. The fund has been operating since 1991, and the maximum loan amount is HUF 100 million. It operates as a revolving fund, which means that the repayments of the former loans make up the resources of the new ones. The preferred target areas are:

- Reduction of the losses in energy transformation.
- Installation of modern, energy-efficient equipment.
- Installation of CHP.
- Introduction of new production technologies.
- Additional heat insulation.
- Renewable energy sources.

RESIDENTIAL

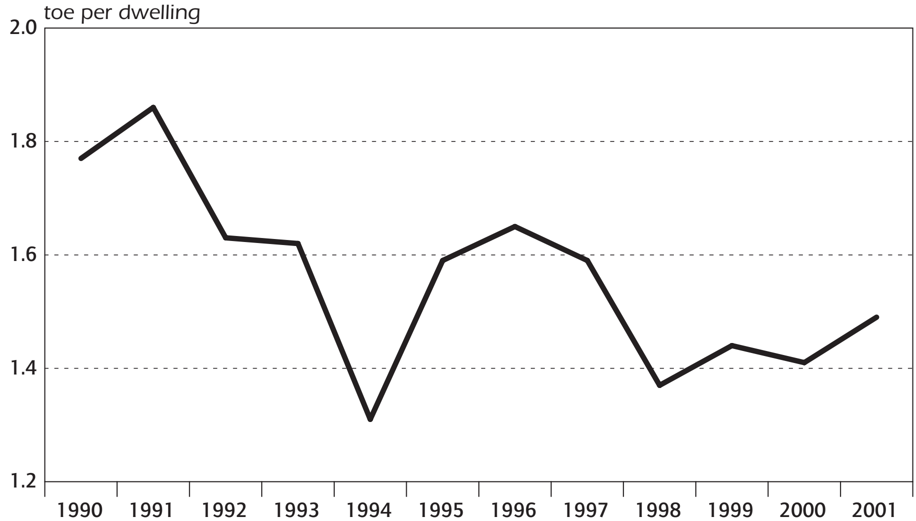
Almost half of Hungarian buildings were built before 1945, and most of these have not been refurbished. Also, prefabricated flats are quite widespread in Hungary, accounting for approximately 22% of all residences. How to renovate these flats in a cost-effective manner was a technical problem that was only solved in 2001.

The programmes in the residential sector aim at this energy saving possibility. Owing to budgetary problems, some residential programmes were halted in 2004, but in 2006 a new programme with a total budget of HUF 1.2 billion was introduced.

Figure 8

Energy Consumption of Hungarian Households, 1990 to 2001

(toe/dwelling)



Source: Ministry of Economy.

Energy-saving renovation of residential buildings built with industrialised technology

The fund managed by the Energy Centre aims at energy-saving renovation and mechanical modernisation. The objectives of the fund are to achieve additional heat insulation of the external walls of prefabricated buildings through the replacement of doors and windows, and to modernise heating and ventilation systems. A maximum funding of one-third of the investment cost up to a maximum of HUF 400 000 is paid by the fund, while the remaining two-thirds are split between the municipality and the flat owners. By the end of 2005, 117 000 flats had been renovated. Additional heat insulation was installed in more than 80% of the winning applications.

Environment-friendly energy management (KIOP-2004-1.7)

KIOP is one of the operational programmes of the National Development Plan (see Chapter 2 on General Energy Policy). Its objective is the facilitation of environment-friendly energy management by increasing the use of renewable energy sources and by improving energy efficiency. The programme provides a direct subsidy of 25-75% for renewable energy projects and 30-75% for energy efficiency programmes. The minimum total project cost is HUF 125 million, and the maximum amount of the subsidy is HUF 300 million.

UNDP-GEF municipal energy efficiency project

The programme aims at the improvement of municipal energy management. It provides financial aid for 40% of the total cost of the energy audit and feasibility study. The financial aid is supplemented by an additional 40% if the feasibility study is followed by an investment.

Phare co-financing loan fund for municipalities and the business sector

The fund has been operating since 1998. The Phare contribution to the loan is a maximum of 25% at a 0% interest rate. The project developer's contribution has to be a minimum of 10%, while the remainder can be financed through a bank loan at the normal interest rate. The preferred target areas are the modernisation of DH systems; the installation of CHP units; the reconstruction of heating systems and the installation of renewable energy sources.

"Apple of our eyes" programme for public educational institutions

The majority of public educational institutions are out of date in terms of both heating and lighting technology. The Ministry of Education established a fund for which these institutions may apply for energy modernisation with the help of Energy Service Companies (ESCOs). The preferred target areas are heating modernisation, additional heat insulation, replacement of boilers, adjustment of boilers, replacement of doors and windows, and the updating of lighting technology.

CRITIQUE

While overall energy use per capita is low, Hungary still has a considerable cost-effective energy efficiency potential in all sectors of the economy, particularly at current levels of energy prices. The report from the Energy Centre analysing this potential at a sectoral level is a commendable exercise, showing the value of an institution with a strong background in energy statistics and a mission in energy efficiency.

In the transformation sector, significant potential exists to increase the efficiency of power generation by modernising power plant equipment, by refitting modern combustion equipment. For example, the efficiency of the privately owned 860-MW Tisza II gas-fired power station is just above half that of a modern combined-cycle gas turbine (CCGT). Refitting the plant with modern technology could significantly reduce gas demand for power generation in Hungary. The existing PPAs may discourage operators from investing in energy-efficient technology. The government and the regulator should work closely with the operators of the power stations to ensure that the most modern equipment is being installed, by ensuring that market arrangements contribute to conducting such work.

In the residential sector, subsidising direct and indirect natural gas consumption for residential space heating is likely to increase consumption and dissuade investment in more efficient heating systems and reduction of space heating demand. These subsidies and the poor energetic performance of many of the residential buildings in Hungary have led to an average space heating energy demand that is 70% above that of the EU-15 average, and 275% above the level of best practice for modern buildings. The government should consider the improvement of residential energy performance a key element of its energy security policy.

One particular problem in Hungary is the age and quality of the building stock, which consists primarily of pre-1939 and Communist-era pre-fabricated buildings with a low energy performance. New buildings and major refurbishment is addressed by modern building regulations published in a decree in 2006. While moving towards more cost-reflective prices will help to resolve this particular problem by encouraging tenants and/or owners to undertake improvement work, significant investment will still be required. In general, Hungary should ensure that all building modernisations use state-of-the-art techniques and materials. A large-scale programme utilising EU funds for the modernisation of Commmunist-era prefabricated housing, which accounts for 22% of all housing in Hungary and where considerable potential exists to reduce space-heating by 75% cost-effectively, should be considered. Not only tenants will benefit from such an improvement, but also the gas supply system as a whole by reducing inflexible peak demand. The programme could benefit from experiences gained through similar refurbishment of this type of buildings in other IEA member states. In particular, the government should introduce programmes to raise awareness on this issue and devote adequate tools (*e.g.* training and access to capital), in accordance with its energy efficiency plan and EU directives.

It is therefore a positive development that under the 2007-13 EU budget, Hungary will receive an annual HUF 20 billion for investment in energy efficiency. Nevertheless, care should be taken to ensure appropriate expertise exists in Hungary to ensure the correct use of these funds. In this context, it is a worrying development that the Energy Centre, where much of this expertise resides, is under threat of budget cuts, and the government's co-funding is uncertain following the introduction of the 2006 austerity programme. The government should consider reassuring the EC by quickly identifying alternative means to co-fund the EU funds, for example through a mechanism similar to the UK's Energy Efficiency Commitment.

The Hungarian Energy Office (HEO) as the regulator should ensure that tariffs for small gas consumers which reflect the actual costs of servicing peak demand and related storage are developed. This would implement the EU Energy Services Directive (2006/32/EC) with its provisions for energy metering and billing, reflecting actual consumption and time of consumption. It would also reduce peak load, and increase both the market for wood pellets and security of supply.

Eligibility for the favourable feed-in tariff for CHP requires a combined annual efficiency of 65% (75% for gas engines). This is a very relaxed criterion and does not exclude that co-generation may be less efficient than relevant separate production based on most modern technologies (individual condensing boilers and CCGT). There are also doubts about whether this condition is being adequately controlled and enforced. Consequently there are very serious concerns about the potentially negative impact of the feed-in tariff for small-scale CHP on Hungarian energy efficiency. Additionally, CHP plants benefit from subsidised gas if they are connected to a DH scheme, which is usually the case. This may distort operating behaviour by CHP operators and create an incentive for heat-dumping, leading to overall lower efficiency of the system. Larger CHP plants serving the industrial sector and DH systems are not benefiting from this subsidy, and the potential for heat-dumping is therefore reduced. The government should consider raising the minimum requirement for the feed-in tariff to above the combined efficiency of the best possible alternatives, and should also reduce the feed-in tariff to a level that avoids oversubsidisation and removes the incentive for heat-dumping.

Nevertheless, given the low average efficiency of electricity production in Hungary, the expansion of DH with heat supply from highly efficient co-generation could lead to an immediate and significant increase in system-wide efficiency and reduce gas use, if a stringent minimum efficiency requirement was adopted and enforced.

In the transport sector, Hungary has benefited from a technology switch towards more efficient means following the political changes of 1990. The momentum of this change is reducing, and the government should consider investigating measures, such as the promotion of highly efficient vehicles and modal shifts to increase efficiency in the transport sector. The government should consider continued investment in the mass transport sector to increase its attractiveness and to prevent shifts towards individual transport.

RECOMMENDATIONS

The government of Hungary should:

General Energy Efficiency

- *Maintain the technical capabilities and expertise of the Energy Centre to ensure that the forthcoming investment of EU funds has the highest possible impact.*

- *Work with power station operators to increase the efficiency of the transformation sector.*

- *Implement a programme for the upgrading of the energy performance of buildings to modern standards through the application and enforcement of stringent building regulations, and ensure easy access to capital.*

CHP and District Heating

- *Consider raising and stringently enforcing the minimum efficiency requirement for CHP to qualify for the feed-in tariff.*

- *End oversubsidising CHP through the feed-in tariff and the gas subsidy.*

- *Remove the mandatory take-off regulation for electricity from small-scale CHP plant.*

Transport

- *Continue to promote modal shifts and increase efficiency in the vehicle fleet.*

- *Persevere in monitoring and enforcing the application of the EU vehicle label.*

CLIMATE CHANGE

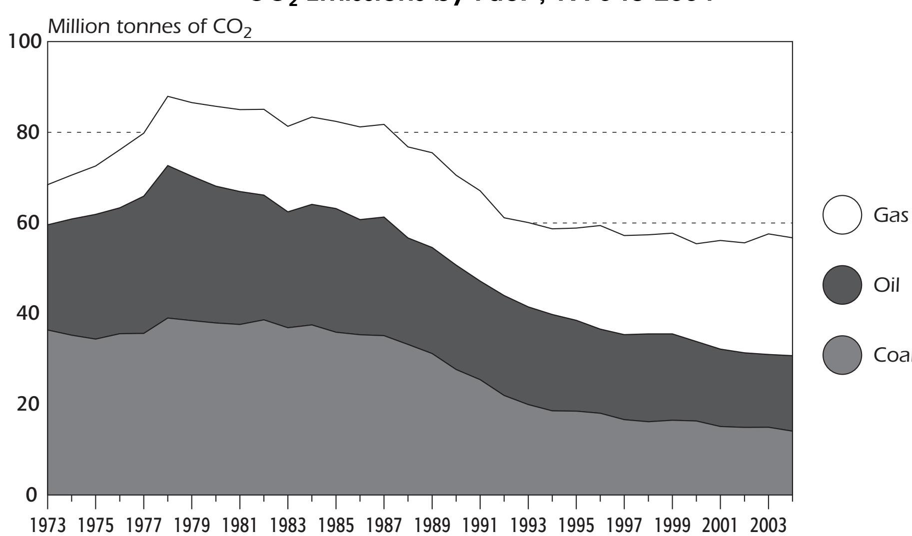
EMISSIONS

Hungary's GHG emissions are significantly below the country's –6% target set by the Kyoto Protocol. In 2003, GHG emissions stood at 83 Mt CO_2-eq., and were 32% below the 1985-87 limit of 122 Mt CO_2–eq., which applies to Hungary under the special provision for economies in transition, which will be instituted during the Kyoto Protocol's first commitment period 2008-2012. The main reasons for this reduction are the collapse of energy-intensive Communist-era heavy industries following the political reforms of 1990, and the continued restructuring of the Hungarian economy.

The most important GHG in Hungary is CO_2, which contributed 56.5 Mt, or 68% to total emissions of GHG in 2003. It is followed by N_2O, which contributed 12.4 Mt CO_2-eq. or 15% to emissions in 2003, and CH_4, which contributed 9.5 Mt CO_2-eq. or 11% to total GHG emissions in 2003. It is likely that recent mitigation projects have significantly reduced N_2O emissions since 2003.

Figure 9

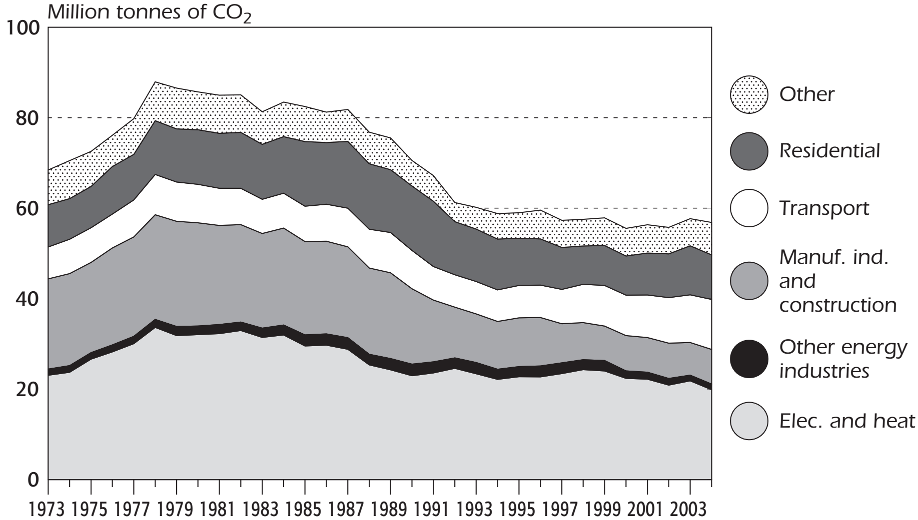
CO_2 Emissions by Fuel*, 1973 to 2004



* estimated using the International Panel on Climate Change (IPCC) Sectoral Approach.
Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2006.

Figure 10

CO_2 Emissions by Sector*, 1973 to 2004



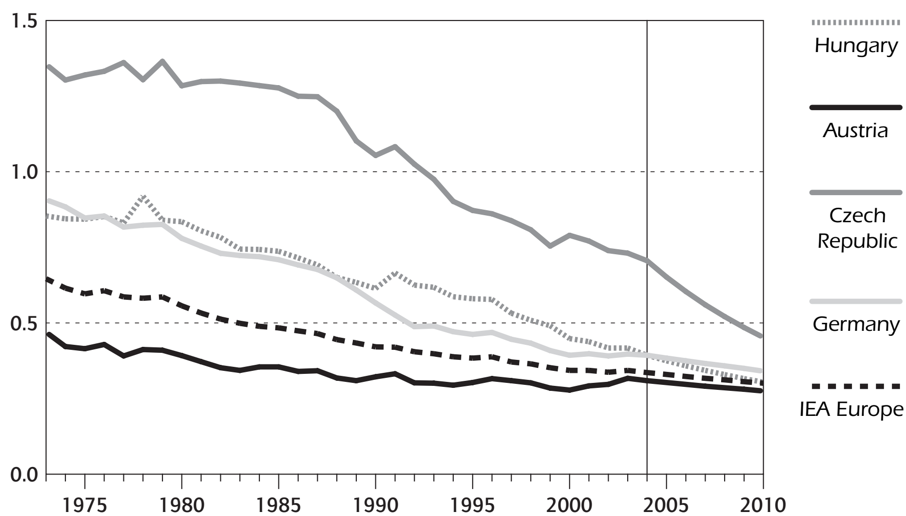
* estimated using the IPCC Sectoral Approach.

Source: *CO_2 Emissions from Fuel Combustion*, IEA/OECD Paris, 2006.

Figure 11

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

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



* excluding Luxembourg and Norway throughout the series, as forecast data are not available for these countries.

Sources: Energy Balances of OECD Countries, IEA/OECD Paris, 2006; *National Accounts of OECD Countries*, OECD Paris, 2006 and country submissions.

Total energy-related GHG emissions were 56 Mt CO_2-eq. in 2004. Of these, 18.7 Mt CO_2-eq. or 33% were related to public electricity and heat production; 17.5 Mt CO_2-eq., or 31% were related to commercial, residential and agricultural fuel use; 10.1 Mt CO_2-eq. or 18% were related to transport activities; and 9.9 Mt CO_2-eq. or 17.5% were related to industrial activities. The single largest emitter of CO_2 in Hungary is the Mátra lignite plant, emitting 6.2 Mt CO_2 per year.

POLICY

Hungary is a signatory to the Kyoto Protocol. As an accession country to the EU in 1998, Hungary is not part to the EU burden-sharing agreement of 1998, and its EU target is identical to its Kyoto target. Hungary has implemented all the climate change legislation required under EU law. Hungary's climate policy devotes less attention to adaptation, but instead focuses on mitigation, and a special project on climate change vulnerability and adaptation was funded by the Ministry of Environment. This project was recently finalised and its conclusions will be taken into account.

Hungarian climate change policy is fully driven by its international commitments. Its general mitigation and other elements are included in the National Environmental Programme's (NEP) thematic action programme on climate change. The Department of Strategy in the Ministry of Environmental Protection and Water Management is responsible for the co-ordination of the NEP and also *inter alia* for the national positions and Hungarian participation regarding the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol, as well as the EU's general, external and internal, climate change policies. Given that emissions are far below the limits, no domestic need for emissions reduction was identified. A comprehensive climate change strategy will be developed and published in 2007.

The Climate Protection and Energy Unit in the Ministry of Environment and Water handles climate change policy and international reporting requirements for Hungary. This unit is drawing up the National Allocation Plan (NAP) for the EU-ETS, and is responsible for reporting to the UNFCCC.

To comply with the UNFCCC and Kyoto Protocol, the Climate Protection and Energy Unit is preparing legislation, reporting, and setting up a national system including the national GHG inventory and data collection, emissions calculation, data management system, sensitivity analysis, quality assurance and control, and peer review. It also handles other issues, such as the development of the national guidelines and procedures for approving Joint Implementation (JI) projects, a national registry for JI projects, and the preparation of decisions regarding JI project endorsement and approval. The latter task is currently performed without a legislative basis.

For the European Union Emissions Trading Scheme (EU-ETS), the Unit is responsible for the preparation of the legal background, including the transposition of the EU-ETS Directive (2003/87/EC) and the Linking Directive (2004/101/EC), the development of legislation on permitting, monitoring, reporting, verification, fines, and the treasury asset management of allowances. It is also responsible for the preparation of and the reporting on the National Allocation Plan. The implementation of the EU-ETS is based on Act XV 2005 and Government Decree 272/2004. A further four government decrees and one ministerial decree cover the specifics of the implementation. Another government decree will be required for the adoption of NAP II.

NATIONAL ALLOCATION PLANS

The initial intent of NAP I was to reduce CO_2 emissions by 4.2% by 2005, compared to 2003. This was one of the strictest plans submitted by a new EU member country, and it raised concerns in Hungarian industry that the cost of purchasing emission allowances would be high owing to a fear of significant under-allocation. Trading sectors were allocated 30.2 Mt CO_2 for 2005, equivalent to 53.5% of total CO_2 emissions in Hungary in 2003. The average annual allocation for 2005-2007 was 29.9 Mt CO_2, with reserves of 0.8 Mt CO_2, or 2.6%.

On 15 May 2006, Hungary reported a surplus of emission rights equal to 4.5 Mt CO_2 emissions from trading sectors, or 17% compared to the allocation for 2005 under NAP I. Of this over-allocation, 35% belongs to the electricity

Table 8

Major Emitter Allocations under NAP I

Operation	*Sector*	*Annual allocation in Mt CO_2*	*Share of 2005 allocation in %*
Mátra lignite plant	Power generation	6.2	21%
Dunaferr	Steel production	2	7%
AES Tisza	Power generation	1.5	5%
Százhalombatta	Refining	1.4	5%
Dunamenti	Power generation	1.4	5%
Vértes	Power generation	1.3	4%
Total		**13.8**	**46%**

Source: Ministry of Economy.

sector, and 13% to the DH sector. Over-allocation varied significantly by sector, with oil refining allocated rights for 105% of actual emissions, and ferrous metals and steel allocated rights for 158% of actual emissions. The ministry sees the low quality of the data on which NAP I was based as the main reason for the over-allocation, and intends to apply a stringent allocation mechanism for NAP II, covering 2008-2012.

In NAP I, 2.5% of the rights are to be auctioned by the government, and no decision has been made on the amount of allowances to be auctioned for NAP II, although it is likely that at least the same level of rights will be auctioned. The draft NAP II has not been submitted to the EU Commission as of 1 January 2007. It became available for public consultation in early November 2006.

The emissions registry for Hungary was only set up in early 2006, and the individual allocations were published relatively late, effectively excluding Hungarian companies from participation in allowances trading immediately after the start of the EU-ETS.

Table 9

Allocation and Verified Emissions in NAP I by Sector, in tCO_2

Sector	*Allocation*	*Verified emissions (2005)*	*Allocation/ verified emissions*
Electricity	16 927 857	15 359 342	110%
District heat	2 267 091	1 687 795	134%
Sugar	436 633	386 700	113%
Other combustion installations	2 095 006	1 846 740	113%
Oil refining	1 383 170	1 317 231	105%
Coking	264 233	184 815	143%
Ferrous metal & steel	2 643 354	1 675 332	158%
Cement	2 390 321	2 054 776	116%
Lime	464 575	381 552	122%
Glass	295 420	274 571	108%
Ceramics	865 447	602 937	144%
Paper and pulp	203 059	171 715	118%
Total	**30 236 166**	**25 943 506**	**117%**

Source: Ministry of Environment.

First National Action Plan

A programme for infrastructure renewal that ran from 2004 to 2006 under the First National Development Plan provided funding to renewables and energy efficiency, with the aim of reducing CO_2 emissions from energy use. Subsidies for projects with a minimum size of HUF 125 million were given, covering 25-75% of the project cost for renewables projects, and 30-75% of the project cost for energy efficiency projects. Total support was limited to HUF 300 million per project. The programme's funds came from EU Structural Funds (75%) and the Hungarian national and municipal budgets (25%). Government and municipal institutions, municipally-owned companies, non-profit companies, and small- and medium-sized enterprises were eligible for support.

Second National Action Plan

Under the Second National Development Plan (see Chapter 2 on General Energy Policy), Hungary has developed a thematic action and general mitigation plan, incorporating the Climate Change Action Programme. The aim is to modernise energy production, conversion and transportation; and to improve energy conservation and energy efficiency of consumers. The funding available for the programme originates from EU Structural Funds.

Joint Implementation

The Ministry of Environment and the Ministry of Economy together have the primary responsibility for the joint implementation (JI) policies and procedures, even though there is no legal act in place defining the criteria for JI projects. Government Decree 2045/2003 established a Kyoto Mechanisms Interministerial Committee, which is a consultative/advisory body whose advice is taken into account in relation to individual projects following their approval by the Ministry of Economy and Transport and the Ministry of Environmental Protection and Water Management. The procedure for approval after the submission of an application takes about one month if no formal requirements are missed and all criteria are met. Guidelines on additionality have been published, but have no legal force. The baseline for reference savings for projects producing electricity for the grid is grid-average efficiency, but this also has no legal force at present.

The total volume of JI projects applied for in Hungary is close to 16 kt CO_2-eq. Of these, about 14 kt CO_2-eq. have been endorsed, and of those about 9 kt CO_2-eq. have been approved, and almost all of the latter have been implemented.

The most important share of projects so far has been in fuel conversion to biomass, N_2O reduction in adipic acid plants, and wind farms. Biomass conversion and wind farm projects are now considered sufficiently well funded through mechanisms such as the feed-in tariff for renewable electricity, that the Ministry of Environment will no longer consider such projects for the generation of Emissions Reduction Units (ERUs) owing to additionality concerns. Table 10 below shows the number and type of energy-related projects that have been implemented, and the amount of emissions reduction units they will generate between 2008 and 2012.

Table 10

Energy-related Joint Implementation Projects in Hungary

Project owner	*Project type*	*ERUs 2008-12 (kt CO_2)*
AES Borsod	fuel switch to biomass	630
Bakonyi Erőmű	fuel switch to biomass	1 800
PANNONPOWER Rt.	fuel switch to biomass	1 140
Vértesi Erőmű	fuel switch to biomass	502
Exim-Invest Biogáz Kft.	landfill gas	138
Pálhalmai Agrospeciál Kft.	biogas	186
Fuűzfő Erőmű Rt.	biomass	354
E.ON Hungária Rt.	wind	205
E.ON Hungária Rt.	wind	205
Pannónia Szél Kft.	wind	408
Liget Bioenergia Mıvek Kft.	biomass	520
TOTAL		**6 088**

Source: Ministry of Environment.

LOCAL AIR POLLUTION

Hungary has been successful in reducing regulated emissions from large-scale combustion plants and currently fulfils the emissions limits set by the Large Combustion Plant Directive (LCPD) (2001/80/EC) and most of those formulated in the Council on National Emission Ceilings (NEC), both of which set targets for 2010 (see Table 11). The achievement of the LCPD was possible given the installation of flue-gas desulphurisation units at the main coal-fired power stations in Hungary. The government has formalised the necessary measures to achieve the required reductions in the 2004 Hungarian Emissions Reduction Plan.

Out of the four pollutants identified, currently only the emissions of volatile organic compounds (VOCs) are above the 2010 limit, and the government is considering further action to achieve the target. The emission of VOCs is primarily from industrial activities, such as solvent production. The

Table 11

Air Pollutant Emissions Reductions in Hungary, 1980 to 2010, in kt/year

Air pollutant	*Emissions in 1980*	*Emissions in the base year 1990*	*Emissions in 2002*	*National emission ceiling for 2010*	*Achieved emissions reduction by 2002 in %*	*Planned emissions reduction by 2010 in %*
SO_2	1 633	1 010	359	500	64	50
NO_x	273	238	186	198	24	17
VOCs	n/a	205	153	137	24	33
Ammonia	n/a	124	66	90	47	27
Particulate matter	577	206	92	n/a	n/a	n/a
Lead (t/year)	575	663	32	n/a	n/a	n/a

Source: Country submission.

Table 12

Origin and Type of Emissions in Hungary, in %

	SO_2	*NO_x*	*VOC*	*Ammonia*
Industry	12	10	45	~1
Transport	1	60	36	0
Energy sector	75	20	3-7	~1
Households	11	5	14	8
Agriculture	<1	5	<1	90
Total	**100**	**100**	**100**	**100**

Source: Country submission.

Table 13

SO_2 Emissions from Oszolány Coal-fired Power Station, 2000 to 2005

	SO_2 (t/year)	*Generated electricity (GWh)*	*SO_2/GWh*
2000	102 974	1 400	73.6
2001	86 808	1 325	65.5
2002	84 545	1 304	64.8
2003	90 951	1 163	78.2
2004	45 715	948	48.2
2005	6 260	1 031	6.1

Source: MVM.

government is considering more stringent inspections and implementation requirements for Best Available Technology emission controls at the 455 industrial installations emitting VOCs.

An environmental load charge is levied on specific pollutants to reduce their emissions. It applies to SO_2, NO_2, and particulate emissions. The charge does not apply to households and transport. Since 1 July 2005, a higher excise tax has been charged on motor fuels with sulphur content higher than ten parts per million (ppm).

Local air quality is a concern in urban areas in Hungary, primarily due to the relatively old car fleet and the country's industrial operations that use older technology. Measuring ambient air quality is a challenge for local authorities, given the cost involved in establishing monitoring stations and evaluating their results. An EU-funded project was carried out from 2000 to 2004 to establish ambient air quality measurements for cities and regions in eastern Hungary.

While the government expects that the gradual renewal of the car fleet will have a positive effect, it is also planning to introduce measures to achieve modal shifts, in particular to increase the share of combined rail and road freight in freight transit through Hungary. At present, the share of this mode of transport is only 8-9% of the total.

Improving motor fuel quality in Hungary has already had a positive impact on local air quality. By 2002, the switch to non-leaded petroleum had reduced lead emissions by 95% (see Table 11). Owing to reductions in the sulphur content of motor fuels, sulphur emissions from fuels sold by MOL in Hungary decreased from 730 tonnes per year to less than 30 tonnes per year since 2005.

Small amounts of solid biomass are widely used as a heating fuel in rural areas not reached by the natural gas network. For biomass plants in general, Hungary goes beyond the EU regulation level and has set emission limits for plants in the size range of 0.14 to 50 MW_{th}, although there is no regulation governing emissions from boilers with a size below 0.14 MW_{th}.

CRITIQUE

In 2003, Hungary was 32% below its emissions target set by the Kyoto Protocol, even though emissions have risen slightly between 2002 and 2003. Hungary has submitted the National Allocation Plan to the EC, where it was accepted in December 2004. A draft NAP has not yet been submitted for the second stage. Building the institutions to handle the EU-ETS required time for Hungary, and achieving the target of NAP I and II is supported by EU Structural Funds. The government should rapidly develop and submit NAP II to the EC for approval, to ensure a secure investment framework for the industries it covers.

Hungary was comparatively stringent in its allocation process, submitting the second-most stringent NAP I of the accession countries, using what it saw as a realistic approach to emission rights allocations on the basis of the available data. This is commendable, since Hungary has thereby attempted to help to give the EU-ETS a good start. Nevertheless, at the time of reporting the results of 2005, it became clear that an over-allocation of 17% had taken place owing to the bad quality of data available at the time of planning the allocations. The allocations for the second phase will wisely be based on real 2005 emissions, and the government should ensure that the next phase of the EU-ETS in Hungary is based on verified data.

In the past, the government accepted JI projects that did not merit support, owing to time pressures and bad data quality. It is commendable that the government is realising this mistake and intends to ensure that it is not repeated. The government should consider the rapid development of a legal basis under which JI projects can be approved.

While recent legislation and implementation have introduced the registry and other mechanisms required to enable Hungarian companies to trade EU-ETS emission credits, it is not clear at this point if all the institutional prerequisites exist for Hungary and Hungarian organisations to participate in the trading of emission credits under the Kyoto Protocol.

Hungary is doing well in reducing non-GHG emissions and is ahead of the schedule set by the Geneva Convention. This is a noteworthy development. The only exception is the volatile organic compounds (VOC) emissions, where Hungary is currently in danger of not being in compliance with the agreements by their deadline. The government should focus additional effort on reducing its VOC emissions.

While it is commendable that Hungary has set stringent emission limits for biomass boilers, local air pollution problems sometimes are related to the great number of very small domestic units, which are not covered by the regulations. Also, the present criteria for the range of 0.14 to 50 MW might not be compliant with the requirement of Best Available Technology Not Entailing Excessive Cost (BATNEEC) across the full range of sizes.

RECOMMENDATIONS

The government of Hungary should:

- *For the next phase of the NAP, continue to use a realistic approach, avoiding over-allocation of rights.*
- *Develop the legal basis for JI projects without delay.*
- *Ensure that the relevant institutions supporting trading of emission credits under the Kyoto Protocol are set up in time for Hungarian companies to benefit from the ability to trade surplus credits.*
- *Continue to reduce non-GHG emissions, paying particular attention to VOCs.*
- *Develop clear environmental criteria for the utilisation of all small-scale biomass appliances and boilers.*

ELECTRICITY

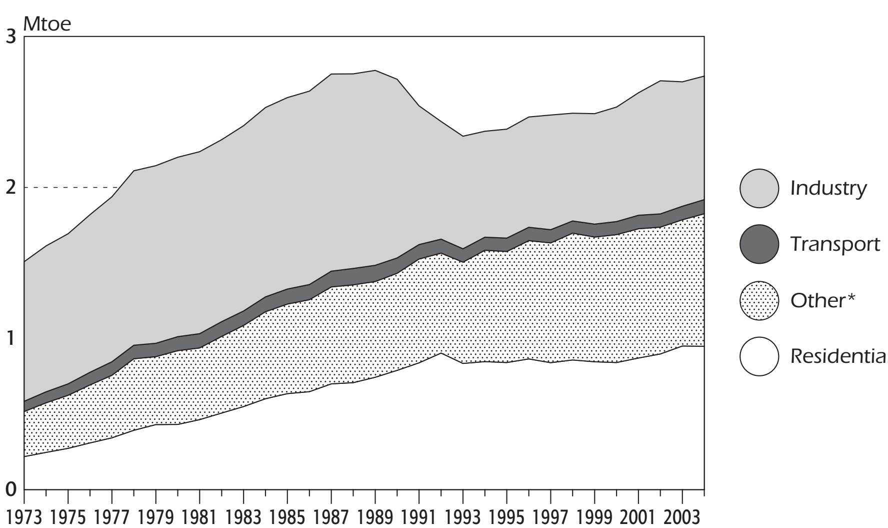
OVERVIEW

Hungary's per-capita electricity consumption is far below the average of IEA member countries. In 2002, it stood at 3 910 kWh per capita, per year, equivalent to 2.74 Mtoe for the whole population. Electricity contributed 14% to total TFC in 2004. The government expects a slight increase in final consumption of electricity of 1.5% between now and 2010, when it is expected to reach 2.78 Mtoe.

Electricity is primarily consumed in the "Other sectors", where it contributed 1.8 Mtoe, or 18% to TFC in 2004. This was an increase of 28% over 1990, when the other sectors consumed 1.4 Mtoe. The industrial sector consumed 0.8 Mtoe in 2004, a considerable reduction of 30% from the 1.2 Mtoe consumed in 1990.

Figure 12

Final Consumption of Electricity by Sector, 1973 to 2004



* includes commercial, public service and agricultural sectors.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2006.

MVM

MVM is the central institution in the Hungarian electricity market. It was originally set up in 1963, based on the model of the French EDF. The company is fully state-owned, and controls approximately 80% of electricity production and sales in Hungary, either directly or indirectly. MVM holds 99.95% of the Paks NPP operating company, 99.7% of the former transmission system operater National Powerline, 100% of the system operator and transmission network owner and operator MAVIR, and 80% of the Vértes power plant, of which local authorities hold the remaining shares. MVM also owns 25% plus one share of all power generating companies privatised in the mid-1990s.

MVM is also the majority owner of several CHP companies and through its subsidiary operates the reserve power plants to ensure reliable power supply in Hungary. An MVM subsidiary is also one of the leading trading companies on the competitive market. A number of companies providing energy services such as engineering are also members in the MVM Group.

MVM is the wholesale market operator and the supplier of the regulated market. MVM purchases electricity under power purchase agreements (PPAs), and arranges auctions for surplus electricity bought under the PPAs. MVM purchases 80% of electricity generation and controls 40% of import capacity. In 2005, MVM sold 28.8 TWh on the Hungarian market, of which 7 TWh was sold to the unregulated market. This accounted for 70% of the total sales of 41.6 TWh.

In 2005, the company reported a turnover of HUF 400 billion and a profit of HUF 900 million.

INDUSTRY STRUCTURE

The Hungarian Energy Office (see box in Chapter 2) is the economic regulator of the Hungarian electricity industry, overseen by the Ministry of Economy. The HEO's tasks include the licensing of activities in the electricity industry, maintaining the quality of supply, consumer protection, the setting of regulated prices and the conducting of inquiries. It has the power to fine licensed entities in proportion to their failure to comply with regulation; in 2005, two distribution companies were fined HUF 20 million and HUF 7 million respectively. HEO applies *ex ante* price regulation for all prices it controls.

MAVIR is the Hungarian transmission operator, responsible for the balance of the system and the scheduling of generating plants. It controls the capacity at international interconnectors through auctions.

The Power Purchase Agreements

About 75% of the electricity generation in Hungary is covered by 15-year power purchase agreements (PPAs), which were signed by MVM at the time of privatisation of the power stations (1995-2001), giving the investors long-term income security, thus ensuring a better price for the assets that were sold off. The PPAs will expire between 2010 and 2020. They include an element covering the operating cost of the station, as well as a generous profit, in some cases reported to be 10-40% per year. In 2005, MVM commenced a renegotiation of these contracts with the desire to bring the guaranteed profit level down to 8%, but has not been able to conclude this process. The PPAs can be competitive, but in some cases they are very clearly above the market rates.

The threat by MVM towards the power station owners is that if the renegotiation fails, it will request that the government reintroduce generation prices determined by the regulator, even though it is unclear if that would be compatible with EU law. According to MVM, a straightforward breaking of the PPA contracts by MVM (*i.e.* the Hungarian government) could lead to compensation payments of up to USD 500 million to be paid to the generators who hold the rights to generate electricity under the PPAs. Losses incurred by MVM as a result of the PPAs are covered through a fund financed partially by grid fees. The EC has challenged the compatibility of the PPAs with the competitive market and is now investigating the legality of the Hungarian PPAs. At this point in time, no solution for the future operation of the PPAs in the fully liberalised market after 1 July 2007 has been found. Regardless of which solution will be found, it is unlikely that any change to the PPAs will have an impact on the physical availability of generating capacity in Hungary, which will continue to be sufficient for Hungarian needs, especially considering planned new investments.

INFRASTRUCTURE

Generation

In terms of capacity, Hungarian electricity generation is well diversified across a range of technologies. However, as regards generation, the Paks NPP contributes approximately 33% of electricity sold on the Hungarian market. The average age of the generation park measured in capacity is 21 years for large stations, and eleven years for small-scale generators. Almost half of the generating capacity is older than 25 years, while over 21% is older than 30 years. The advanced age of generating stations is the main reason for their relatively low efficiency (see Chapter 3). The ability by the Hungarian generation park to switch fuel from gas to oil is helpful in the event of a gas supply crisis, as occurred in January 2006 (see Chapter 7, Natural Gas).

Hungary has been able to cover its peak electricity demand with its domestic generating capacity since 1984, despite a lack of dedicated peak generating capacity. In recent years the gap between installed capacity and peak demand has grown significantly. This is due to the addition of a substantial amount of small-scale generation, and a reduction in peak demand, from 6 550 MW in 1989 to 6 439 MW in 2005, even though this peak has been increasing again more recently. The gap between generating capacity and demand is creating problems for the Hungarian electricity system management owing to the high amount of must-buy electricity. In 2005, must-buy electricity from renewables and co-generation accounted for 21% of all electricity sold in Hungary. An additional 33% was contributed by the Paks NPP, and 16% from imports, which are the main source for electricity sold on the competitive market. The remaining 30% was generated from other power stations in Hungary (see Figure 13 below). This structure of generation and imports creates problems for the system operator because it leads to lower flexibility in the system. Consequently, MAVIR is using the Paks NPP to regulate the system a number of times each year, with the number of these balance cycles increasing. Paks NPP regulated output down 500 times in 2005, which is technically problematic, since load cycling of nuclear plant shortens the lifetime of components. (see section below on Nuclear).

Paks NPP produces the lowest-cost power on the system, at below HUF 9 per kWh, but the nature of its PPAs is different from that of other plants, owing to the full ownership of Paks NPP by MVM. It is also not known whether this price includes the guaranteed return on capital that some other generators receive under their PPAs (see box above). The generation cost of Paks NPP does include a significant element of approximately 20% as contribution to the decommissioning and waste management fund. This element is high because the segregated fund was not started until the plant had been in operation for some time. Should the lifetime extension and capacity expansion be successful, it is expected that this percentage will be reduced.

During recent years, Hungary experienced summer peaks, with the highest one occurring in 2005, when electricity demand in July reached 5 834 MW, close to the level of the 2003 overall peak demand of 6 104 MW. Servicing peak and trough demand can be challenging for the system operator owing to the absence of sufficient peak generating capacity and an over-abundance of must-buy generating capacity. There is no pumped storage plant in Hungary and little geological potential for one to be constructed in the country. Also, while system management tools, such as sound-switched devices, do exist, these are not under the control of the system operator, but are controlled by the distribution operators.

Table 14

Large-scale Generating Capacity (>50 MW) by Fuel in Hungary, 2005

Type	*Capacity*	*Number of units*	*Share of capacity*
Nuclear	1 866	1	24%
Gas/oil	2 743	2	36%
Coal/biomass	1 275	4	17%
Gas	1 103	7	14%
Coal	240	1	3%
Oil	410	3	5%
Total	**7 637**	**18**	**100%**

Source: MAVIR.

Table 15

Small-scale Generating Capacity (<50 MW) by Fuel in Hungary, 2005

Type	*Capacity MW*	*Share*
Gas engine	*380*	*42%*
Steam turbine	*224*	*25%*
Gas turbine or CCGT	*127*	*14%*
Total gas	731	81%
Wood	80	9%
Hydro	50	6%
Waste	25	3%
Wind	17	2%
Biogas	5	1%
Total	**908**	**100%**

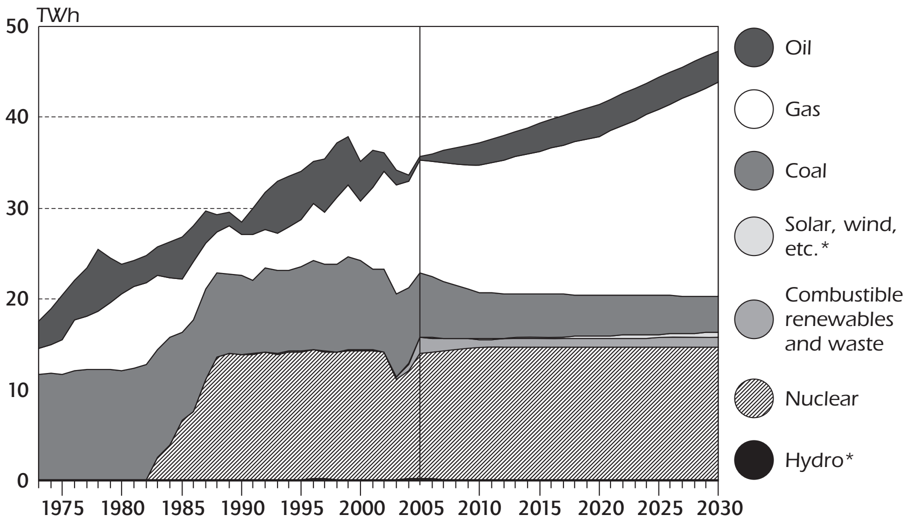
Source: MAVIR.

Transmission and distribution

The Hungarian transmission system is well developed but unusual because from COMECON times it has a 268-km of 750 kilovolt (kV) transmission line which connects it to the western Ukrainian system. This line was used for bulk electricity transfers from Ukraine to Hungary and Czechoslovakia before the political changes of 1990. The total length of the high- and medium-voltage lines and cables is 75 240 km.

Figure 13

Electricity Generation by Source, 1973 to 2030



* negligible.

Sources: Energy Balances of OECD Countries, IEA/OECD Paris, 2006 and country submission.

The transmission system has been owned and operated by MAVIR since 1 January 2006. Prior to this, the system was operated by the MVM subsidiary National Powerline. MAVIR is the transmission system operator in terms of its regulations and operations, and it is 100% owned by MVM.

A further 83 613 low-voltage lines and cables are operated by six distribution companies. Network investments by these companies have increased significantly since 1997, when they stood at HUF 20.3 billion, to HUF 53.8 billion in 2005.

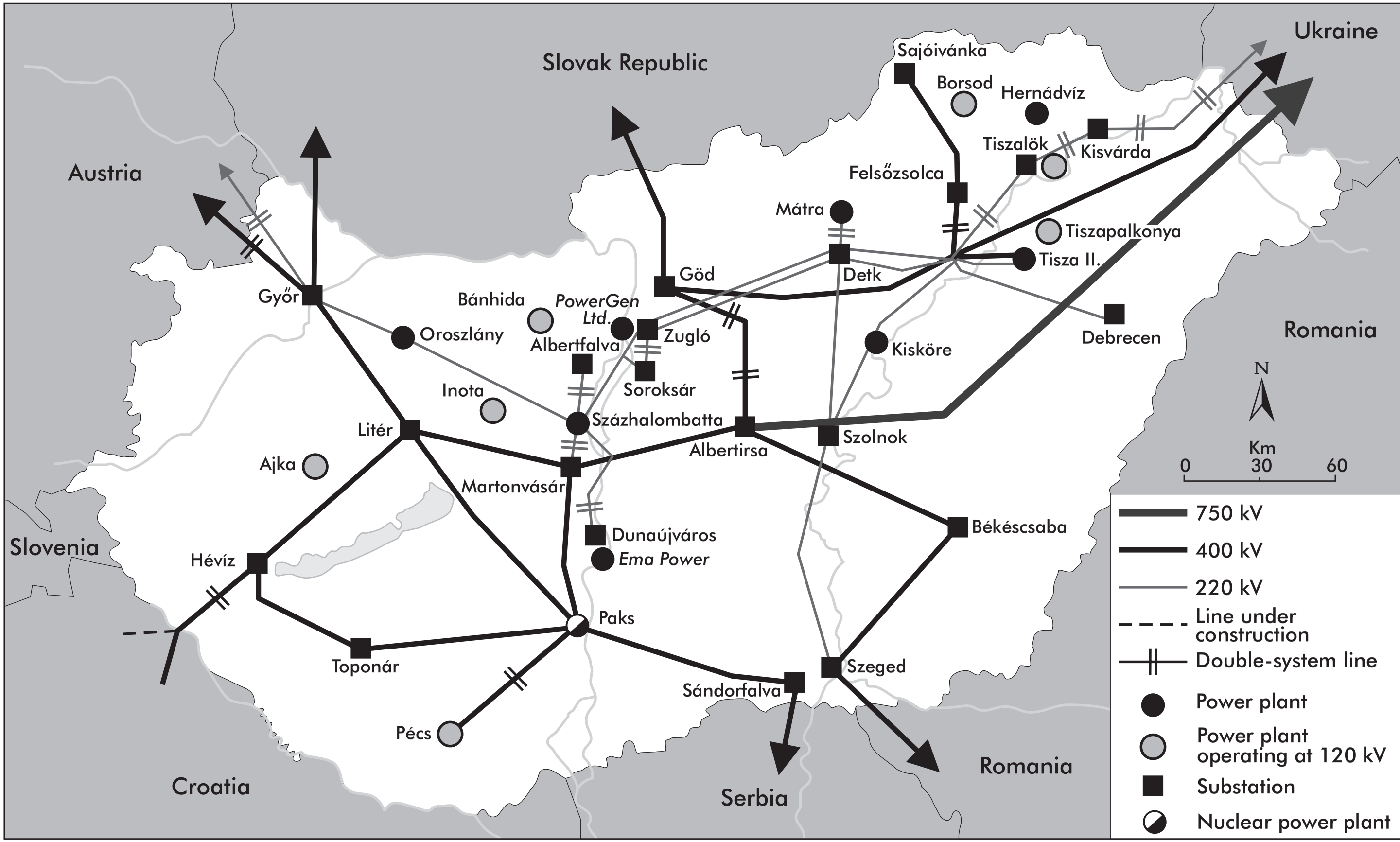
International interconnections and imports

Hungary's electricity system is well connected to its neighbours. Connections exist to Austria, Croatia, Romania, Serbia, Slovakia and Ukraine. By 2008, a new 400-kV line will be commissioned to Romania. After 2010, additional 400-kV lines are expected to be in operation to Slovenia and Slovakia. MAVIR is responsible for the allocation of surplus interconnector capacity under a competitive auction process.

Hungary is a major transit country for electricity, with the main flows crossing the country in a north-south direction (see Table 16). Most of the flows are going from Slovakia and Ukraine through Croatia to Italy and to Serbia. These flows present a major system management challenge to MAVIR.

Figure 14

Map of the Hungarian Electricity System



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

Source: MAVIR.

Apart from electricity for transit purposes, Hungary is also a significant importer of electricity for its own use. In 2005, imported electricity accounted for 16% in Hungary's consumption. Electricity imports increased significantly

Table 16

Electricity Imports and Exports by Country in GWh, 2005

Country	*Import*	*Export*	*Net*
Austria	809	856	-47
Croatia	0	6 689	–6 689
Romania	1 190	146	1 044
Serbia	16	1 693	–1 677
Slovakia	8 806	0	8 806
Ukraine	4 814	26	4 788
Total	**15 635**	**9 410**	**6 225**

Source: MAVIR.

Table 17

Electricity Import Balance in TWh, 1994 to 2005

Year	*Import balance, TWh/year*	*Share, %*
1994	2	5.6
1995	2.4	5.9
1996	2.2	5.9
1997	2.1	5.7
1998	0.74	1.95
1999	1.063	2.8
2000	3.44	8.9
2001	3.17	8
2002	4.256	10.5
2003	6.92	16.8
2004	7.47	18.4
2005	6.23	15.1

Source: MAVIR.

after 2000, reaching very high levels after the Paks NPP incident in 2003 (see box below), and did not decline in 2005, even after the affected unit in the Paks NPP came on line again.

POLICY AND OWNERSHIP

Hungary's policy for the electricity sector is primarily driven by the requirements of the EU's Electricity Market Directive (2003/54/EC). On accession to the EU, Hungary did not request a derogation for delayed introduction of the directive, and instead opted for immediate compliance in terms of market opening.

The major development since the last review was the passage of the Electricity Act 2005, which is a modification to the Electricity Act 2001 (Act CX/2001). The 2005 act implements the Electricity Market Directive (2003/54/EC) in Hungary. The main changes are the introduction of liberalisation to all customers from 2007, and the creation of a transmission system operator by giving additional responsibilities to MAVIR, while at the same time affirming continued full state ownership of MVM.

Despite the privatisation of most power generating capacity and all distribution networks in the mid-1990s, significant assets of the power sector still remain in the hands of the government, which has declared a policy of keeping these assets public. The government owns 99.8% of the MVM power company, which is the most important company in the Hungarian electricity sector (see box above). The government also owned 41.3% of Vértes power plant, most of which was transferred to MVM in 2006 and 100% of Tiszavíz Hydro. It also owns golden shares in MAVIR, the transmission system asset company, in the Paks NPP operating company, in all power generation companies, and in the distribution network operating companies.

The major change in the ownership arrangements since the last review in 2003 was the sale of MAVIR to MVM. Privatisation of MAVIR had been considered, but was ruled out by the government in 2005, and the shares were transferred to MVM instead, further strengthening MVM's position in the electricity industry. Since 1 January 2006, MAVIR is the licence-holder for the operation of the Hungarian transmission network. MAVIR also owns the network, which it operates itself.

Partial privatisation in the 1990s brought significant international investment into Hungary. Large European power companies such as E.On, EDF, Electrabel, EnBW, and RWE, together with smaller international companies such as AES and Atel, are now active in the Hungarian market, in retail, distribution and generation.

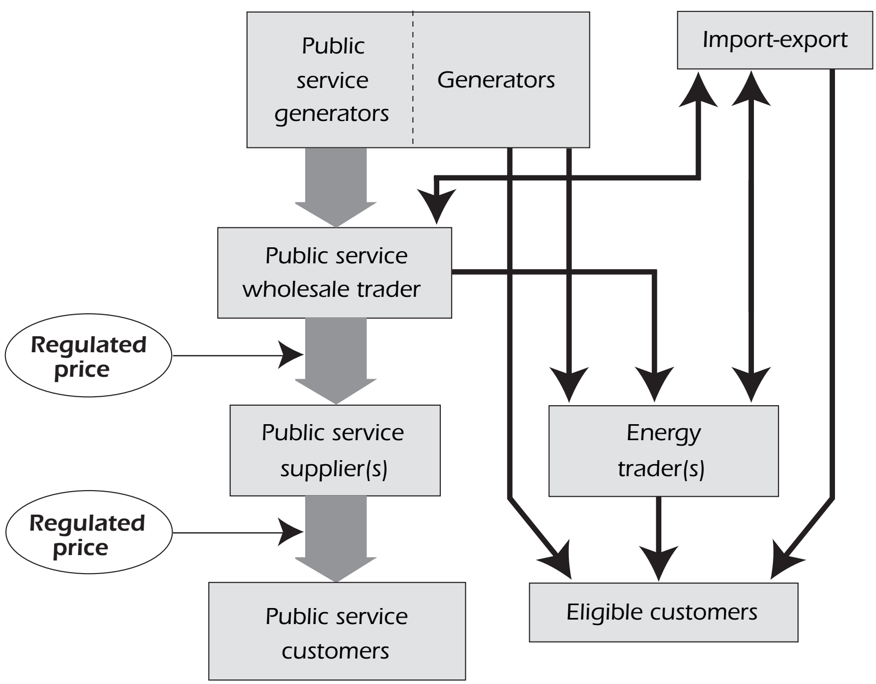
Wholesale market

MVM is operating the public-service wholesale market for electricity in Hungary, and is also active as a market player in the non-regulated market. There is no electricity exchange, but electricity can be traded bilaterally. Generators not classed as public-service generators have the right to sell directly to energy traders and eligible customers. Eligible customers can import electricity directly for their use, provided they have access to import capacity. Access to import capacity was the driving force behind the development of competition in the Hungarian electricity market following its liberalisation.

MVM purchases all electricity from public-service generators, which it then sells on to the public electricity wholesaler or through auctions to independent energy traders. Given the favourable nature of the long-term PPAs, which were entered into at the time of privatisation of the generation assets, generating for the public-service provider is usually preferable, and there are instances when the amount of electricity available for the bilateral market is insufficient

Figure 15

Market Organisation in the Hungarian Electricity Market, 2005



Source: HEO.

to serve it. In 2005 three auctions for surplus generation volume were held by MVM under the supervision of the HEO, and each offering contained base-load and peak-load capacity for a specified time period. MVM is responsible for the allocation of capacity and energy to auctions. Additionally, the HEO can force MVM to sell capacity and energy. In two of the 2005 auctions, energy and capacity remained unsold, owing to an uncompetitive price/offer structure.

Retail market

The Hungarian retail market for electricity is legally open to the degree required by the 2003 EU Electricity Market Directive. The plan of the government and the HEO is to fully open the market by July 2007, in line with the requirements of the directive. No final decision on the new market model has been made, although MVM and HEO have both presented their preferred proposals.

Hungary commenced with the opening of the market before the deadline set by the EU directive, by making customers with a consumption of >6.5 GWh per year eligible on 1 January 2003. On 1 May 2004, all customers with the exception of residential customers became eligible.

As indicated in Tables 18 and 19 and in Figure 16 below, market opening is progressing in Hungary, even though the real market opening is below the legal potential. This is partly due to a lack of electricity available on the free market, with power stations preferring to sell to MVM under the PPAs.

Table 18

Regulated and Competitive Electricity Retail Market Shares in TWh in Hungary, 2003 to 2005

Years	*Public-service market consumption TWh*	*Competitive market consumption TWh*	*Competitive market consumption/total consumption %*
2003[1]	29.7	3.6	11%
2004[2]	28.3	6.9	20%
2005	22.9	11.2	33%

1. January - customers above >6.5 GWh/year eligible.
2. May – all but households eligible.
Source: MVM.

Customers are allowed to move back and forth between the regulated and the open market, and this accounts for the reduction in customers purchasing in the free market that can be observed over the course of a year (see Figure 16). A certain amount of switching back into the regulated market occurs when private suppliers increase their prices ahead of the winter period, while regulated prices are only adjusted on 1 January of each year, and customers are taking advantage of this time lag.

Table 19

Supplier Retail Market Shares in MWh in Hungary, 2005

	Electricity sales (MWh)			
Group	*Public utility segment[1]*	*Competitive segment*	*Total*	*Market share %*
E.On	9 633 720	4 076 403	13 710 123	40%
RWE	10 299 054	1 470 923	11 769 977	34%
EDF	2 978 536	773 343	3 751 879	11%
MVM		2 953 750	2 953 750	9%
Atel		1 216 821	1 216 821	4%
Donbass		526 104	526 104	2%
Other		368 067	368 067	1%
Total	**22 911 310**	**11 385 411**	**34 296 721**	**100%**

1. Electricity in this segment is purchased from MVM by E.On, RWE and EDF who operate the distribution network systems in Hungary.

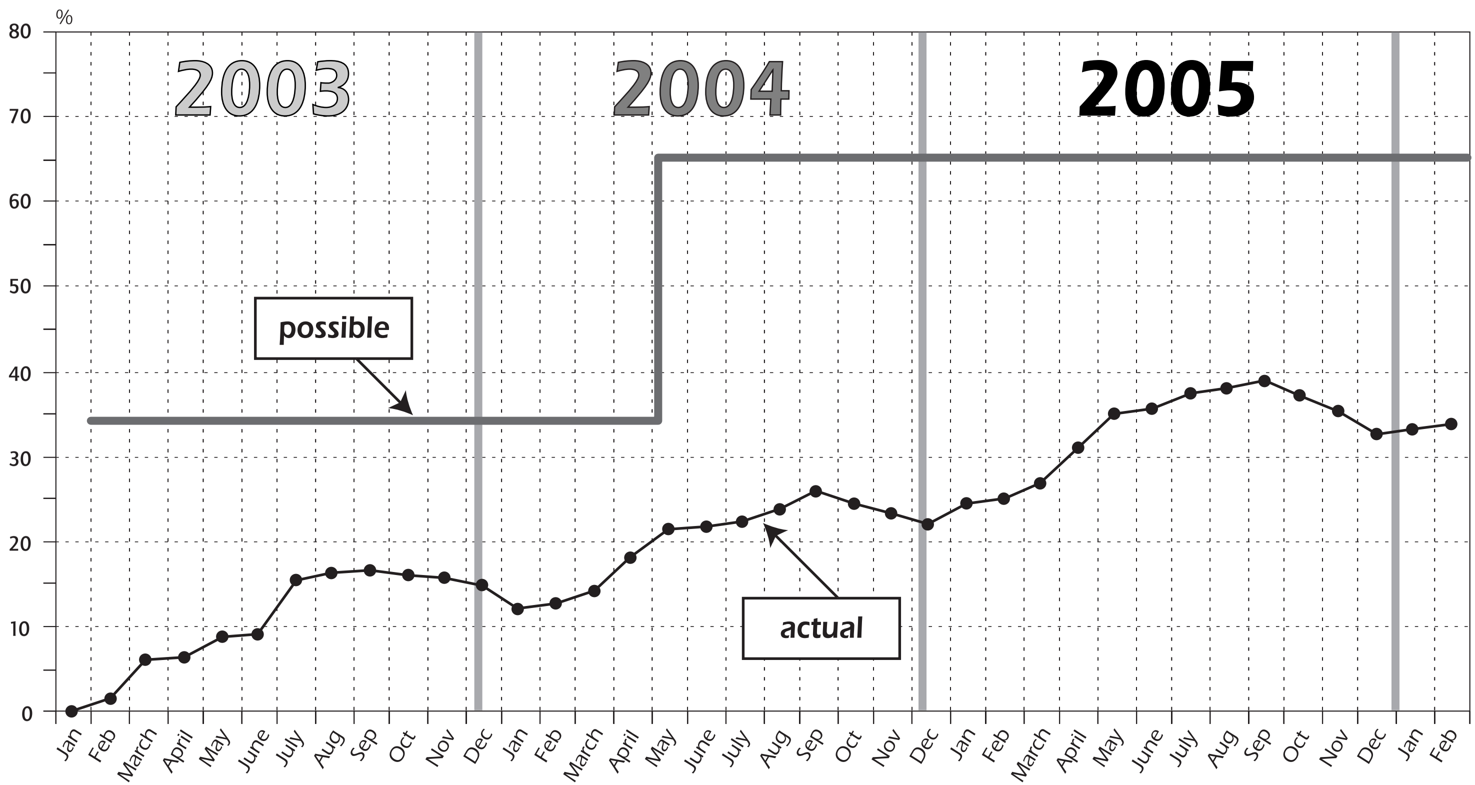
Source: HEO.

Electricity prices

Electricity prices in Hungary are fully cost-reflective, with no public budget subsidy being paid to electricity consumers, network operators or generators. The tariffs also include subsidy payments for stranded costs, and the subsidies for the coal, renewables and co-generation industries. The support costs for these three elements account for 53% of the distribution and transmission charge, equivalent to 21% of the average pre-tax residential tariff of HUF 24.38 per kWh in 2006. This share is expected to increase with the rapid rise in the deployment of renewables and CHP capacity benefiting from the support. Where the funds raised through the tariff are insufficient to finance the subsidy, the system operator obtains a bank loan to finance the charges, which are then recovered with the next price adjustment.

Figure 16

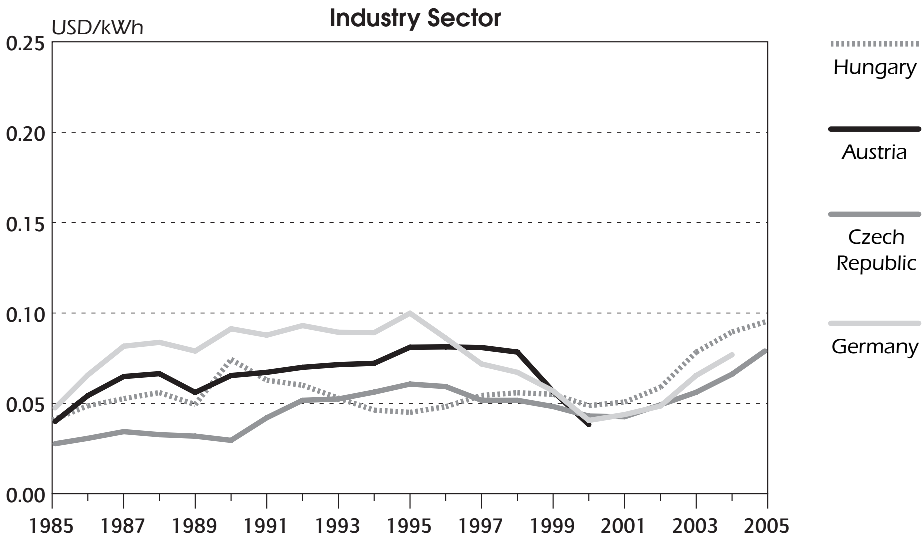
Real and Potential Market Opening in Hungary in % of Total Market Volume, 2003 to 2005

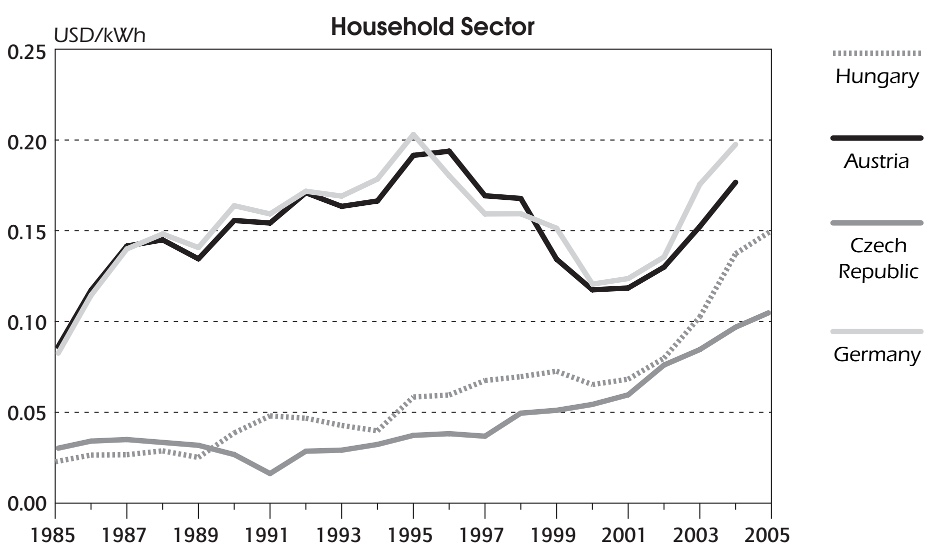


Source: MAVIR.

Figure 17

Electricity Prices in Hungary and in Other Selected IEA Countries, 1985 to 2005





Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2006.

Prices in the residential sector in Hungary, compared to other IEA member countries (see Figure 17) are lower in the regulated public part of the market, especially for households. Prices outside the residential segment are higher than those of other countries. The significant contribution by low-cost generation facilities, primarily the Paks NPP and the Mátra lignite plant, contributes to low average cost for Hungarian electricity.

Table 20

Price Elements of the Regulated Electricity Price in Hungary, 1 January 2006

Element	*HUF/kWh*	*Share of total charge*	*Share of charge element*	*Share of total charge*
Distribution system operation charge	5.79	61%	100%	
Stranded costs	*1.238*		*21%*	*13%*
Coal industry support	*0.291*		*5%*	*3%*
Renewables & co-generation support	*1.129*		*19%*	*12%*
System operation costs	*0.149*		*3%*	
Charge for ancillary services	0.631	7%		
Transmission system operation charge	2.553	27%	100%	
Stranded costs	*1.126*		*44%*	*12%*
Coal industry support	*0.265*		*10%*	*3%*
Renewables & co-generation support	*1.027*		*40%*	*11%*
System operation costs	*0.135*		*5%*	
Charge for ancillary services	0.574	6%		
Total charges	**9.548**	**100%**		**53%**

Source: MAVIR.

NUCLEAR

OVERVIEW

Hungary has one nuclear power plant (NPP), comprising four reactor units of an upgraded pressurised water VVER-440/V-213 Soviet design. The four units were brought into service in 1982, 1984, 1986 and 1987 respectively. Their expected lifetime at the time of construction was 30 years and the design rated output was 440 MW_e per unit. The Paks NPP is currently relying on Russia for its fuel supplies.

The Paks NPP has, for the most part, a very successful operating history. Its lifetime availability statistics are among the best in the world (see Table 21). It provided 39.5% of Hungary's electricity supply in 2005, and is therefore a significant component of energy security in a country highly dependent on energy imports. Paks also makes an important contribution to the environment by not emitting CO_2 and other air pollutants. It produces the cheapest electricity on the Hungarian grid.

Ownership of the plant is in the form of a joint stock company established in 1992. The state-owned Hungarian Power Company (MVM) controls virtually all of the stock, with very minor shares held by its parent, State Asset Management Ltd., and the local authorities. The government retains a "golden share" in the company.

2003 Service Fuel Pond Incident

One safety event of significance has occurred in recent years, outside the reactors themselves, in the reactor 2 service pond, resulting from a special cleaning operation on partially used fuel assemblies. A deposit had been building up on the fuel cans during operation, reducing the heat transfer capability of the fuel and hence power output. Trial cleaning operations proved effective. A specially designed cleaning facility was installed in the service pond of reactor 2 and operated successfully on a number of fuel batches. On 10 April 2003 the system malfunctioned, however; the fuel batch undergoing treatment overheated and suffered significant damage from partial melting.

As would be expected in such a situation, the site management and the regulatory authority mounted investigations into the event. It was a commendable initiative that the regulator also asked the International Atomic Energy Agency (IAEA) to review its own procedures and role in approving the cleaning process which had failed.

The malfunctioning equipment, together with the failed fuel assemblies, is still in the reactor 2 service pond. Consequently, space constraints have inhibited reactor 2 refuelling operations and extended the outages, resulting in a significant loss of availability. Recovery processes and equipment have been designed, the appropriate safety documentation is with the regulatory authority and the recovery operation was planned to commence in October 2006.

Table 21

International Comparison of Nuclear Power Plant Lifetime Unit Capability Factor[1]

Country	*No. of reactors*	*UCF (%)*
Argentina	2	81
Armenia	1	66.9
Belgium	7	88.1
Brazil	2	66.9
Bulgaria	4	72.1
Canada	18	78.4
China[2]	9	83.5
Czech Republic	6	81.4
Finland	4	91.1
France	59	79.3
Germany	17	85.4
Hungary	4	84.7
India	15	67.4
Japan	53	73.8
Korea, Republic of	20	86.1
Lithuania, Republic of	1	73.2
Mexico	2	82
Netherlands	1	87.8
Pakistan	2	50.9
Romania	1	87.5
Russian Federation	31	71.6
Slovak Republic	6	79.3
Slovenia	1	83.8
South Africa	2	76.1
Spain	8	85.9
Sweden	10	81.4
Switzerland	5	87.3
Ukraine	13	70.9
United Kingdom	22	77.3
United States of America	103	77.8
Worldwide	**435**	**78.4**

1. Includes all operational and shut down reactors from beginning of commercial operation up to 2005.
2. Data for Chinese Taipei are included: No. of reactors 6, UCF 82.6%.
Source: IAEA PRIS database.

PLANT HISTORY AND FUTURE PLANS

Plant operating history

Operating statistics show the plant to be well managed. The operational availability of the reactors has been high, even during the early years, reaching 84.6% on average in 2005, with individual units reaching 90.2%, 75.3% (as a consequence of the 2003 safety incident; see box above), 80.9%[6] and 90.1%. Automatic reactor scrams (reactor shut-downs by the safety systems) have reduced since the early operating days and no scrams occurred in 2004 and 2005.

Plant improvement history

At the time of construction, Hungary made a number of modifications to the original plant design to improve safety features. During Hungary's accession process to the EU, further safety upgrades were implemented, with an investment of HUF 60 billion, and these brought the plant up to the equivalent of Western European reactor safety standards.

Utilisation of fuel has also been improved over the plant's operating period. Increased fuel enrichment and core arrangement changes during refuelling have increased fuel assembly lives from three to four years, and raised discharge burn-up from 28 to 40 MW-days per kg uranium. These improvements have subsequently decreased the number of new assemblies required on refuelling from 115-120 originally to 90-96 at the present moment.

The Paks NPP also includes an excellent training centre, with real reactor components taken from cancelled VVER reactor projects in Poland and Germany. These are used for practice training before difficult operations in the real reactors. The training facility thus contributes to both the safety and the efficiency of the operations.

The original power output of the units was 440 MW_e. Improvements made to the conventional plant (turbines and condensers) have enabled this to be increased; they now range from 456 to 471 MW_e, totalling 1 870 MW_e.

Future plans

Following approval in Parliament, the Paks NPP is now in the process of implementing changes that will allow a further increase in power output and a lifetime extension. For both projects, the Paks NPP maintains a close working relationship with the Loviisa plant in Finland, which operates two similar VVER 440's of Russian design.

6. Unit 3 had a long outage owing to uprating modifications being installed in 2005.

Modifications to the fuel, improvements in core monitoring and an increase in primary coolant flow are expected to bring each unit to a gross power output of 510 MW_e, totalling 2 040 MW_e for all four units, an 8% power uprate. The intention is to phase the improvements across the units so that implementation lessons can be learned. The plant management assesses the cost of the implementation at less than half the investment cost of a gas-fired plant, and estimates that the return period on the investment is three-and-a-half years.

At the same time, plans are also in progress to extend the current 30-year unit lives to 50 years, moving the first reactor closure from 2012 to 2032. A range of technical analyses are in progress to prepare the necessary regulatory submission, which must be with the nuclear safety regulatory authorities by 2008, five years before current life expiry. Environmental and operational licences also require extension. Analyses conducted to date have not revealed any technical issues that will prevent life extension.

ISSUES OF NOTE

Public and political support

Public and political support for the operation of the Paks NPP is high, reflecting the importance of the plant to Hungary's energy supply. The Paks NPP has an active community relations policy, and the regulatory authority, HAEA, provides in-depth non-promotional, factual information to the public. Public support for nuclear power is strong. Opinion polls show that some 75% of the population supports the continued operation of the Paks reactors. In the parliamentary vote of support for the life extension project, 96.6% of parliamentarians voted in favour of the proposals. The search for sites for waste repositories has also been more recently conducted with public support. Nuclear power and radioactive waste issues in Hungary have avoided the difficulties created by party political differences seen in many other countries.

Water charges

The plant pays a very significant levy for abstracting cooling water from the Danube, which is returned to the river downstream. The cost of the water for cooling purposes from the Danube is so high that the plant optimises its use, and at times it may be cheaper to pump less cooling water and generate less electricity.

Mining

Mining of uranium previously took place in the Mecsek Mountains of Hungary. Mining operations began in 1956 and were shut down in 1997, as the mine was not commercially viable with the then depressed world price for uranium. During its lifetime the mine produced 21 000 tonnes of uranium. Hungary now reports no identified uranium resources to the biennial OECD-NEA/IAEA survey of world resources. Remedial operations at the redundant mine were due to be completed by the end of 2006.

Strategic fuel reserve

The station keeps a strategic reserve of two years of fuel. In co-operation with Loviisa in Finland, it has tested and gained regulatory approval for fuel produced by British Nuclear Fuels Ltd (BNFL).

Nuclear fuel services

There are no conversion, enrichment or reprocessing capabilities in Hungary, and no plans to develop any. Until early 1995, spent fuel from the Paks reactors was sent to the USSR and subsequently to the Russian Federation. There was no requirement for Hungary to take back the recovered reusable material (uranium and plutonium) or the waste products. In spring 1992 it became apparent that the spent fuel arrangement with Russia would not continue, so the station management had dry storage vaults constructed to a modular design, with extendable capacity as needed. Spent fuel is transferred to these vaults after an appropriate cooling period in the fuel ponds. The assumption for liability provisioning purposes is that the spent fuel will eventually be sent for direct disposal in a deep, high-level waste repository. Despite this, the possibility of reprocessing still remains.

Spent fuel storage, radioactive waste and decommissioning

The national waste management organisation (Public Agency for Radioactive Waste Management (PURAM)) is now responsible for the management of the spent fuel dry store. The agency is also responsible for developing and managing Hungary's waste disposal facilities.

An engineered near-surface disposal facility for low-level and short-lived intermediate-level wastes (L/ILW) at Püspökszilágy is now reserved for industrial and medical origin radioactive waste. The Paks NPP waste is now managed and stored on the site pending the availability of a disposal facility.

Recently significant progress has been made in searching for a permanent solution to L/ILW disposal in Hungary. PURAM adopted a policy of seeking a technically acceptable site combined with local public acceptability. A formal site selection process has resulted in identification of a disposal site in granite, at 200 metres depth, at Bátaapáti. A local referendum in July 2005 showed 91% in favour, and a parliamentary vote in November 2005 showed 90% in favour. Licensing and construction will be conducted in parallel and operation is due to commence in 2008.

In 1995, a site selection programme identified an extensive (150 km^2, 700-800 metres thick) claystone formation, which had been revealed by the deep shaft for the uranium mine as a potential site for the disposal of high-level waste (HLW). Access via the mine shaft allowed easy *in situ* exploration and research during the 1994-1998 period. When the uranium mine closed in 1998, the research facility could no longer be operated. Unfortunately, site selection had not included a country-wide screening. In 1999, the government rejected PURAM's plan for an underground research laboratory as the first step to a deep repository. Following this decision, PURAM returned to establishing a step-by-step selection programme, in accordance with international best practice. A nationwide search for appropriate sites confirmed the Mecsek clay layer as the preferred geology. In 2004 surface investigations began, which may last until around 2016. Subject to these results, an underground research laboratory will then be constructed. Again, subject to the results, repository construction will start in 2033 with a view to first operation in 2047. This time scale is comparable with that in a number of other OECD countries. The intention is that directly disposed fuel will be encapsulated in copper canisters, a technology currently being developed by Sweden and Finland.

The back-end liabilities of radioactive waste disposal and decommissioning are now to be funded from income received during the operating lives of the power reactors. Originally, the funding of these longer-term financial commitments was regarded as an obligation of the State, and no separate account was established. These arrangements have now moved in line with similar practices in Western economies. A separate part of the regulatory body (HAEA) manages the payment necessary to the Central Nuclear Financial Fund. The annual fees are paid to a state fund and cannot be used for any purpose other than the discharge of the waste management liabilities. The State may employ the funds for its own purposes, but is required to pay an interest charge to the fund.

NUCLEAR REGULATION

Hungarian Atomic Energy Authority (HAEA)

Following changes in regulatory arrangements, the independence of the nuclear safety regulator, the HAEA, has been improved, as recommended by a review conducted by the International Atomic Energy Authority of the United Nations. The HAEA now reports to the Minister of Justice, who is not involved in other energy matters. The HAEA's decisions are also protected from possible interference by law and its funding is secured by being largely provided by service charges against the nuclear licensees whom it regulates. The main tasks of the HAEA are:

- Licensing.
- Surveillance and inspection, safety assessment.
- Enforcement, safeguards.
- Export-import of nuclear goods.
- Accountancy of radioactive materials.
- Radioactive waste.
- Emergency preparedness.
- International relations, EU-integration.
- Regulations.
- R&D.
- Public information.

The various independent units of the HAEA act as responsible authorities in their areas of work. For example, for matters concerning nuclear facilities and equipment, the Nuclear Safety Directorate (NSD) of the HAEA is the responsible organisation, while for matters concerning nuclear and radioactive materials, the Department of Nuclear and Radioactive Materials is responsible. The HAEA's Director-General is the authority in all administrative matters.

In accordance with the act on atomic energy, and in order to ensure the scientific basis for governmental, regulatory, and emergency response measures concerning the safety of nuclear applications, the work of the HAEA is supported by a Scientific Council. This council consists of 12 members who are nationally known professionals in the field of nuclear energy applications. The chairman and the members of this council are appointed by the minister supervising the HAEA. Within its terms of reference and taking into consideration the most recent state of knowledge, the Scientific Council is required to advise on the most important issues of principle, research and development related to nuclear safety, radiation protection and emergency response issues.

Public Agency for Radioactive Waste Management

Since the last review, the Public Agency for Radioactive Waste Management (PURAM) has been separated from the HAEA. This is in line with the stipulation of the Joint Convention on the Safety of Spent Fuel and the Safety of Radioactive Waste Management of the International Atomic Energy Agency to ensure effective independence of the regulatory functions from other organisations that are involved in spent fuel or radioactive waste management.

CRITIQUE

ELECTRICITY

Since the last review, Hungary has made laudable progress in market opening. The privatisation of the 1990s had already led to a more diversified ownership structure. In parallel with the ongoing opening for regional cross-border exchange for electricity, this initial step is a commendable basis for a further liberalisation of the Hungarian electricity market.

The HEO is the regulator of the electricity industry. It is closely involved in the market and has a wide range of powers. The government should ensure that the HEO has the ability to determine as much as possible the development of a market model for the fully liberalised market, and should ensure that the HEO maintains its powers and independence.

Nevertheless, the electricity market in Hungary is very much influenced by the existence of long-term power purchase agreements (PPAs) between most of the domestic (private) generators and the state-owned public utility MVM, which dominates the market. Around 75% of the national electricity production was covered by these contracts in 2005. PPA power is bought exclusively by MVM and resold to the public electricity suppliers as well as wholesalers in the non-regulated market, including the MVM trading subsidiary. MVM has a right of first refusal, and is free to designate power from PPA power plants to be used for the supply of the regulated market, or to be auctioned off, in a form of its choosing. Supplementary power from the generators operating under a PPA that has not been nominated by MVM may be sold by generators freely on the competitive segment of the market. Auctions are supervised by the HEO, which approves the rules. Two out of three auctions in 2005 failed to sell all power offered, indicating that there was no clearing price for electricity generated in Hungary, despite substantial imports, equivalent to 16% of national electricity demand. Still, there is a shortage of power on the open market for the 400 000 eligible customers, despite substantial overcapacity in the Hungarian electricity system. It is likely that the central role of MVM in the allocation of power is primarily responsible for this situation. The government and the regulator should refine capacity auctions to ensure that a clearing price is established, and should consider introducing a mechanism forcing MVM to designate only the amount of electricity needed for the supply of the regulated market.

The creation of the PPAs led to a positive short-term budgetary effect for the government at the time of privatisation. Over time, however, Hungarian electricity consumers have had to pay higher electricity prices compared to a free market situation, even though this situation may have improved now, owing to rising electricity prices in many markets. MVM has attempted to renegotiate the PPAs, but has so far failed in this attempt, and the PPAs are now subject to an investigation at EU level. Because of the PPAs, the potential efficiencies of introducing liberalisation have not been realised by Hungarian customers in the opened segment of the market.

The competitive segment is limited to domestic production that is not bound by PPAs and imports. Traders use foreign electricity exchanges, such as the EEX in Leipzig, as well as over-the-counter trade. MVM´s resale to wholesale traders and captive customers is legally governed by state price regulation for customers who are not yet eligible, such as household customers (who will have a free choice of supplier as from 1 July 2007). For eligible customers and wholesale traders in this public segment of the market, price conditions rely on the decision of MVM. As a consequence of MVM´s exclusive marketing rights based on PPAs for most of the domestic power production, even eligible customers do not have a choice between different generators in this market segment. They only have the option to enter or leave the competitive/free segment of the market, depending on where they can access better prices, and supply volumes. According to the Hungarian Competition Office, MVM has the ability to discriminate against customers who are purchasing electricity from non-MVM sources, given its position as sole buyer of 80% of the electricity generated in Hungary. To ensure that MVM cannot discriminate, the HEO and the government should consider introducing strict separation between MVM's trading subsidiary and its wholesale activities.

Eligible customers who switched from the regulated segment to the competitive segment have the right to move back to the regulated segment with MVM after a six-month period. Many are exercising this right if the regulated price is not adapted quickly enough. An extension of the six-month period to one year could prevent this switching back and forth, and ensure that traders in the liberalised market can offer different products.

Taking all these elements into account and on the basis of the commendable technical and competitive achievements reached in the competitive segment of the market, it is important for the HEO and the government to develop a new market framework aimed at creating undistorted competition at the generation, wholesale and final customer level. This would also have the likely effect of considerably increasing the transformation efficiency in the electricity generation sector, leading to reduced costs and environmental impacts. The diversified ownership structure of generating capacities achieved by the privatisation in the 1990s should form a solid basis for a future diversified market structure and sufficient potential for competition. In order to be able to recognise and eventually react to adverse developments, regulatory and competition authorities should continue to be legally obliged to hold investigations into the functioning of the market, when they deem them necessary.

Hungary is an important transit country for electricity, and imported electricity plays a major role in keeping its electricity prices low. Despite good technical connections with individual neighbours, there is no regional co-ordination on the issue of interconnections. The development of cross-border regional market relations could increase security of supply and competition. The government and the HEO should consider establishing such a regional approach. Hungary is in a good position to lead the development of such an initiative within the region, given its role as the major transit country.

The management of peak- and low-load demand periods is a problematic issue in Hungary, owing to the high amount of must-buy electricity, and a lack of management tools controlled by the system operator. Such tools as exist (*e.g.* sound-switched devices designed to create more even demand load), are operated by distribution network operators. The HEO should consider changing regulations, to allow these to be operated by the system operator.

NUCLEAR

Overall, the Paks NPP is a very important element of the Hungarian electricity system. It has sound operating and safety statistics. The plant has some excellent practices, such as the training facility installed during the 1990s. It is clear that the Paks NPP plays an important role in securing Hungary's energy supply and reducing the environmental impact from electricity production. As a consequence, there are exceptionally high levels of public and political support for the continued operation of the plant in Hungarian society.

The plans for uprating and life extension show the nuclear power plant management's response to the forthcoming fully liberalised market for electricity. Both power uprates and life extensions are becoming common across the world's fleet of operating NPPs and, if conducted appropriately, are to be encouraged. However, in the projections of TPES made by the government authorities, the assumption has been made that both will be successfully implemented. While the Paks operators and the regulatory authorities indicate that they believe success is highly probable, they should consider also how to cope with the consequences if the life extension case does not deliver all that is intended. This is an important issue, given the prime role Paks plays in the Hungarian electricity supply, and the government should consider a contingency plan for such an eventuality.

There is also the question of what the future role of nuclear power will be in Hungary. Assuming that the life extension work will be fully successful, the first of the units at the Paks NPP will reach the end of its extended 50-year operating life in 2032, just after the limit of the current TPES forecast to 2030; and the others will follow in the next few years but all will be gone by

2038. The length of the political, commercial, financial and regulatory processes to approve replacement units/plants before construction can even begin should not be underestimated. A strategic look at nuclear power's future role and the time scale for any associated decision-making process should be put in place. In this respect the additional space at the Paks site that had previously been intended for two additional reactors should be reserved until such a decision has been made. Similarly, potential sites on the Tisza in the north-east of Hungary or elsewhere should be preserved to avoid a future limitation.

The Hungarian electricity market is due for full liberalisation by 2007, and this will affect the commercial operation of the Paks NPP. The in-depth review team has been unable to discover the current nature of the PPAs between MVM and the Paks NPP, or how they will change in the future. Looking forward, it is important that there is a transparent and level playing field and that no generators are unfairly privileged or disadvantaged.

At the moment, the Paks NPP is being used to regulate the electricity system when demand is low, and generation from must-run sources, such as renewables and CHP, is high. From an environmental and economic perspective this use of a NPP is difficult to understand. It appears uneconomic, technically inefficient since it will consume some of the reactors' operating lives, and environmentally damaging to reduce generation from a cheap CO_2-free electricity source with a low generating price in order to allow more expensive fossil fuel or renewables generation plant to run.

A semi-segregated fund has been established for the long-term liabilities, such as radioactive waste disposal, spent fuel management, decommissioning, etc. Money is transferred from the operators and is held by the government, which is required to pay interest for its use. In the event that the Paks NPP was to be privatised at some future point, which is regarded as politically and publicly unacceptable at present, a fully segregated fund might be necessary. Given Hungary's budget situation, it might be difficult for the government to release money to set up the fund in these circumstances.

The plant upgrades to be undertaken will change some features of the fuel design and it is possible that the previous tests and licence for BNFL-produced fuel will no longer be valid. Furthermore, there are changes to the ownership and services provided by BNFL and it is not obvious what the necessary time scale for alternative fuel production would be. A review of the strategic position on fuel supply should be undertaken to ensure that the fuel supply risk is appropriately managed.

It is commendable that PURAM has made significant progress in advancing the development of national radioactive waste disposal facilities since the last review and has achieved this with public and political support.

The changes to the reporting lines of the HAEA and PURAM are commendable, as they have reinforced their independence and improved the clarity of their roles. It is important that the HAEA's independence, competence and authority are not undermined in this process. Hungary has a good nuclear safety record and exceptionally high levels of public and political support for nuclear power, both of which rely, in part, on the visible independence and effectiveness of the nuclear regulatory body.

RECOMMENDATIONS

The government of Hungary should:

Electricity

- *Pursue a fully transparent process of market re-design, in which all steps are discussed in a systematic way between government, regulator and all market participants.*

- *Amend the market framework in order to allow suppliers and customers to freely contract electricity services without limitation of market access.*

- *Abolish the role of MVM as single buyer of most of the domestic electricity production in order to open free access of customers to competing suppliers.*
  - *Accordingly abolish or amend the existing long-term contracts (PPAs) between domestic generators and MVM as the exclusive buyer and reseller to wholesale traders in a way that distributes remaining financial burdens without discriminating or distorting competition.*
  - *Ensure that regulated prices do not interfere with competition.*
  - *Continue to maintain the independence of the transmission system operator to ensure investor confidence of new entrants.*

- *Continuously involve the Hungarian Competition Office and the HEO in the monitoring of the further development of the market and have them report regularly to Parliament and to the public on their findings, and take the necessary steps based on their recommendations.*

- *Continue co-operation between governments, regulators and market participants to increase cross-border exchange of electricity and support the EU-based regional initiative for co-ordinated congestion management with neighbouring countries in the Central and Eastern Europe region.*

- *Initiate the necessary steps to investigate the possible necessity and eventual opportunities for an additional balancing power unit and move the operation of existing system management tools to the system operator.*

Nuclear

- *Consider the alternative options in case of failure of the Paks NPP lifetime extension project to ensure future security of energy supply.*
- *Review the intended future role of nuclear power in the Hungarian energy mix to identify key decision points, preserve the unused Paks NPP sites for two more reactors; consider the protection of other potential sites if appropriate locations for NPPs are in short supply.*
- *Keep under review the appropriateness of the semi-segregated fund and its management arrangements.*
- *Ensure that the independence, competence and authority of the HAEA are not compromised by reorganisations and that adequate staffing levels are maintained.*
- *Preserve the independence of PURAM and maintain the excellent progress in establishing repositories.*

RENEWABLES

OVERVIEW

The share of renewables in Hungary's energy supply has increased significantly, by 140% from 0.41 Mtoe in 2000 to 0.98 Mtoe in 2004. Between 1990 and 2004, the supply of renewables increased by an average of 6.2% per year, with most of this increase occurring in 2002, due to policy changes. Renewables contributed 3.7% to TPES in 2004, and it is estimated that the share will have increased to almost 5% in 2005. The government expects that this growth will slow over the coming years, to 2.3% between 2004 and 2010, based on the estimated growth between 2004 and 2006. However, this appears to be an underestimation.

Table 22

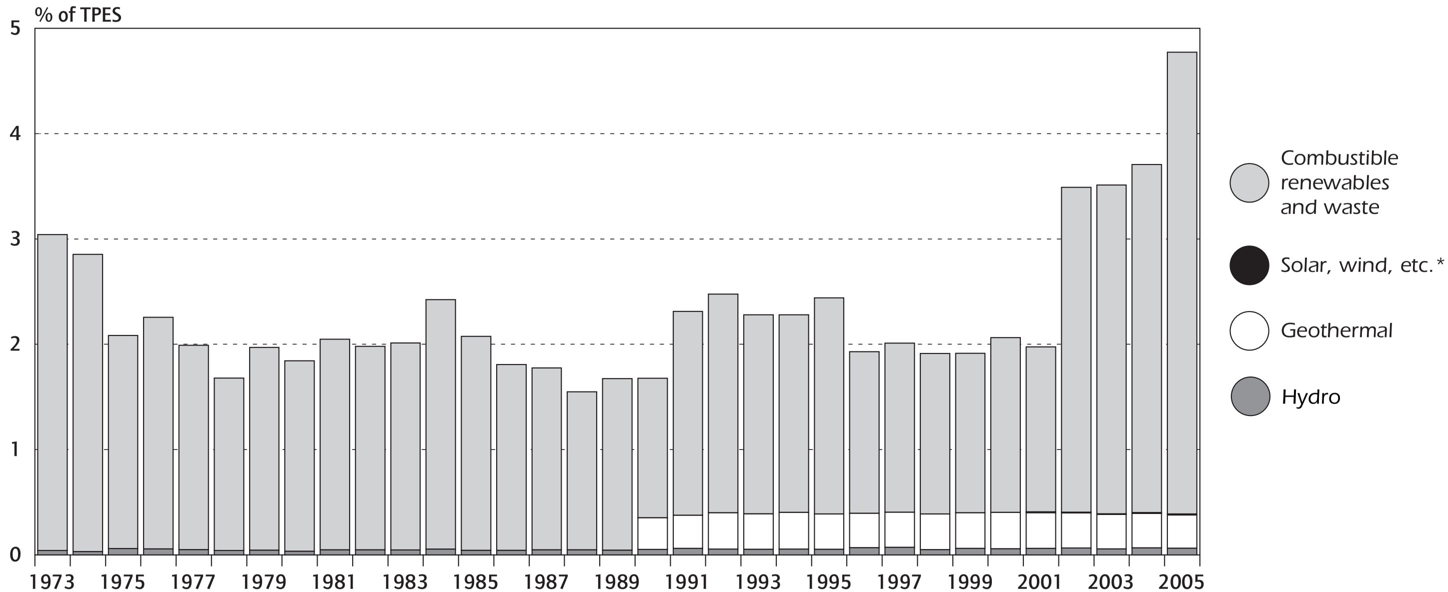
Renewables Supply in TJ by Fuel, 2001 to 2005

Fuel	2001	2002	2003	*Preliminary* 2004	*Estimated* 2005	*Increase* 2001/2005	*Share* 2005
Geothermal	3 600	3 600	3 600	3 600	3 600	**0%**	**7%**
Solar collector	60	70	76	76	80	**33%**	**0%**
Fuel wood (from trade)	13 539	14 592	14 850	14 659	19 000	**40%**	**39%**
Fuel wood (from forest, estimated)	4 600	4 550	3 326	2 805	4 936	**7%**	**10%**
Fuel wood from other sources	12 461	11 602	14 425	16 892	20 285	**63%**	**41%**
Biogas	126	133	191	274	290	**130%**	**1%**
Hydropower (3.6 MJ/kWh)	670	698	616	740	713	**6%**	**1%**
Wind energy	3	4	13	20	32	**878%**	**0%**
Photovoltaic	0.2	0.2	0.3	0.3	0.4	**67%**	**0**
Total	**35 059**	**35 250**	**37 097**	**39 066**	**48 936**	40%	100%

Source: Energy Centre.

Figure 18

Renewable Energy as a Percentage of Total Energy Supply, 1973 to 2005*



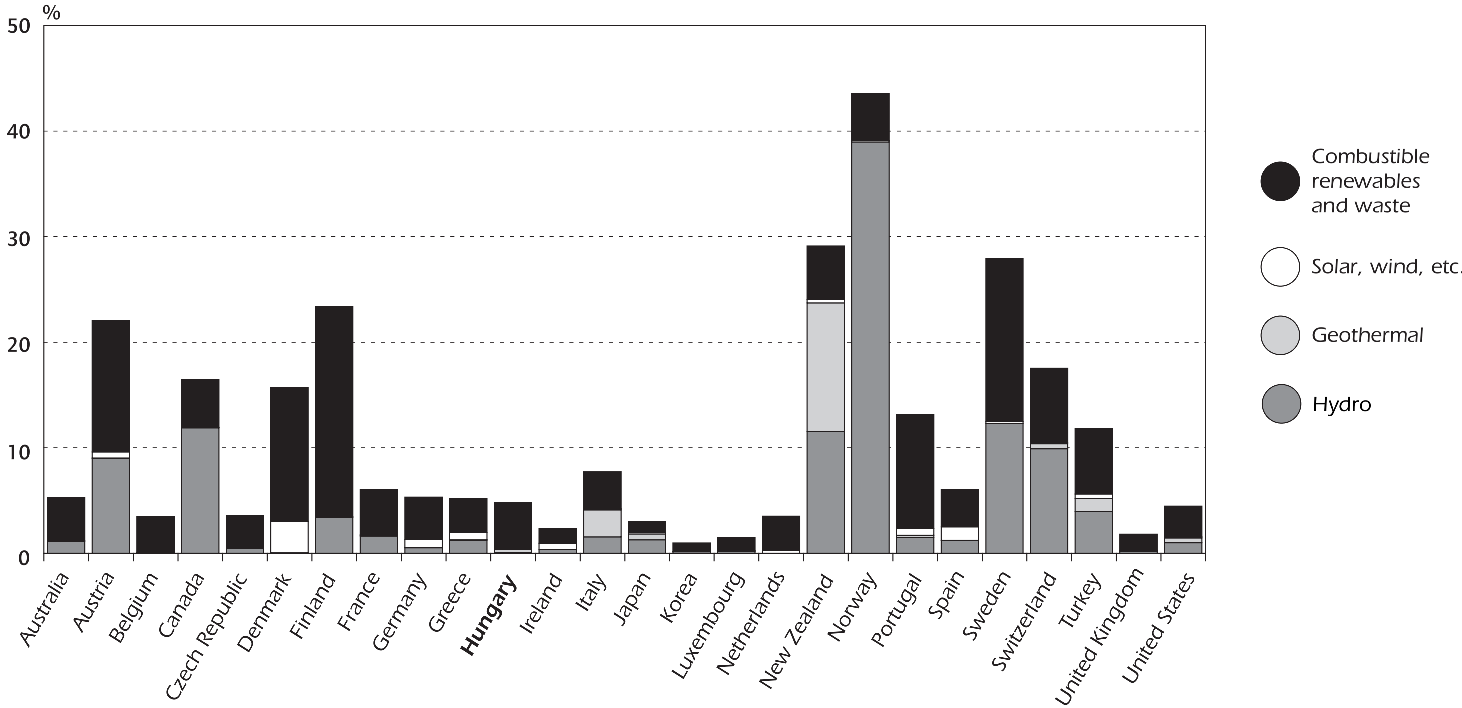
* estimates.

** negligible.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2006.

Figure 19

Renewable Energy as a Percentage of Total Primary Energy Supply in IEA Countries, 2005*



*estimates.

Source: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2006.

Table 23

Renewables Contribution to Electricity Supply by Fuel in GWh, 2001 to 2004

Fuel	2001	2002	2003	2004	*Increase* 2001/2004	*Share* 2001	*Share* 2004
Firewood	7	6	109	678	**9 586%**	**2%**	**70%**
Biogas	8	11	18	22	**189%**	**2%**	**2%**
Hydro	186	194	171	205.5	**10%**	**59%**	**21%**
Wind	0.9	1.2	3.6	5.6	**522%**	**0%**	**1%**
PV	0.06	0.06	0.07	0.1	**67%**	**0%**	**0%**
Waste incineration	112	59	67	54	**48%**	**36%**	**6%**
Total	**314**	**272**	**369**	**965**	**308%**	**100%**	**100%**

Source: Hungarian Government, Status Report on Directive 2001/77/EC.

Renewables are used as a fuel in heat production and electricity generation (see Table 22 above). In 2004, renewables contributed 0.71 Mtoe, or 3.7% to TFC. The primary use of renewables is in heat production, where 72% of renewable fuel was utilised. Most of this is in the form of fuel wood. With the increasing importance of electricity production from biomass, it is expected that the share of renewables for heat will decrease. The dominant renewable fuel is biomass, which accounted for 0.87 Mtoe in 2004 or 89% of total renewable energy contribution. It is followed by geothermal energy, which contributed 0.09 Mtoe and hydro, which contributed 0.02 Mtoe in 2004. It is expected that wind energy will increase in importance in the future when the 330 MW of windfarms licensed in March 2006 are commissioned.

SOURCES OF SUPPLY AND DEMAND

Table 23 above breaks down Hungary's renewable fuel supply by fuel type and origin. Biomass is the most important renewable source in Hungary, and is primarily used in the form of fuel wood. Biomass is generally used in stationary applications for the production of heat and electricity. Hungary has significant potential for the sustainable production of biomass drawing on its 5 million hectares of productive farmland and 3 million hectares of forest land.

BIOMASS FOR STATIONARY USE

Solid biofuel (fuel wood) is a traditional fuel widely used for heating in rural areas without natural gas supply. Increasing gas and oil prices are expected to lead to a continuing growth of this form of biomass utilisation. The supply of solid biomass in Hungary currently reaches 2 million cubic metres per year, and is now fully utilised, leading to sharp increases in prices. To increase usage, it would be necessary to increase supply by either reforestation, increased use of wood waste, or the introduction of purpose-grown short-rotation biomass.

Since 2000, Hungary has rapidly developed the commercial utilisation of solid biofuels in electricity generation. Biomass accounted for 3.5% of total electricity generation in 2003. Biomass used for electricity generation is mostly round-wood co-fired in old coal-fired power stations that have been adapted for the purpose. The wood is procured on the open market by the power stations, and is also imported.

BIOMASS FOR TRANSPORT

Hungary is making a significant effort to introduce biofuels for transport with a focus on bioethanol from cereal plant, reflecting the structure of Hungarian agriculture. Hungary has an annual surplus production of 2.8 to 3 million tonnes of cereals, which cannot be exported owing to World Trade Organizaton (WTO) restrictions. This surplus is expected to increase to 3.5 to 4 million tonnes by 2013. The Hungarian Ministry of Agriculture estimates that between 630 000 and 1.55 million tonnes of cereals could be utilised in bioethanol production, while another 110 000 to 240 000 tonnes of sunflower seeds and rapeseed could be utilised in biodiesel production. It is expected that a large part of the biofuel produced this way would be exported.

Ethyl tertiary butyl ether (ETBE) production to replace methyl tertiary butyl ether (MTBE) has begun at the MOL Danube refinery in Hungary in 2005, with an annual production of 50 000 tonnes of ETBE from 24 000 tonnes of bioethanol. This production is expected to increase over the coming years. The MOL refinery is investigating the possibility of direct blending of bioethanol to achieve this target, and is considering the establishment of an additional ETBE unit. There are also a considerable number of other developments of bioethanol production under way, such as a combined Danube port, grain storage and drying, power production and a bioethanol production complex in Fadd-Dombori. This sector has strong appeal to foreign investors.

WIND

Wind has so far been a minor contributor to renewable energy production in Hungary. The 2006 licensing round for new wind capacity showed however that the support regime has generated a strong interest in wind installations. The round ended with restrictions on most of the proposed projects, either reducing their permitted capacity by 50%, or not giving them a permit at all. This restrictive result of the licensing round was on the advice of the grid operator MAVIR, whose concerns about the secure operation of the grid led the HEO to limit capacity and access for new wind installations to a total of 330 MW in all of Hungary. It is currently not clear if and when this limit will be reduced.

HYDRO

While Hungary is crossed by many rivers, it is a relatively flat country, with low available hydro resources. Additionally, large-scale exploitation of water resources for energy production would compete with other established uses, in particular shipping. It is therefore seen as unlikely that hydro power is a realistic option for the country. However, mini- and micro-hydropower are supported by the government.

GEOTHERMAL ENERGY

Hungary has abundant resources of geothermal low-temperature energy in the form of warm/hot water, and the country was pioneering in the application of geothermal energy 30 to 40 years ago. The geothermal water has a very high content of mixed salts and thus the brine must be reinjected in suitable geological formations, because of the potential environmental damage from a discharge into water courses. This limits the potential for the geothermal resource to contribute significantly to renewables production in Hungary.

DEMAND

Currently, direct demand for renewables is primarily for use as a heating fuel. In the transformation sectors, biomass and renewable electricity generation technologies are rapidly growing in importance, while in the transport fuel sector, renewable biofuels will be blended in at refinery level.

GENERAL

A feed-in tariff has been in place since the Electricity Act 2001 (Act 2001/CX). A Hungarian Parliament resolution in 2005 asked for the introduction of further measures to support renewables, such as simplified environmental authorisation, a proper framework for geothermal energy use, and the use of biogas in natural gas pipelines. Governmental Decree 2058/2006 (III.27) states that it is necessary to develop commodities for export (bioethanol, biodiesel, etc.) in the long term, to 2030.

TARGETS

Following EU accession and implementation of the Renewables Directive (2001/77/EC), Hungary was set an indicative target of 3.6% for the contribution of renewables to electricity generation by 2010, compared to a contribution of 0.5% in 2000. The government implemented this target by Government Decree on the implementation of the Electricity Act 2005 (Act LXXIX/2005), and it estimates that this target was reached and exceeded in 2005.

SUPPORT

Feed-in tariff

A licence from the HEO is required to receive the feed-in tariff. The volume of electricity for which it is paid, as well as the duration of the feed-in tariff in the licence is limited by the HEO, based on the project payback period. The feed-in tariff was set by Parliament at HUF 23.8 per kWh, more than double the average price of Hungary's electricity at wholesale level, and close to three times the price of the lowest cost plant on the grid. The cost of the feed-in tariff has risen rapidly since 2003, and is expected to continue to rise in the future (see Table 24).

The cost of the feed-in tariff for renewables and CHP is recovered through the transmission charge of the electricity system. The Central Price Support Mechanism (KAP) is the fund covering both CHP and renewables feed-in tariffs. In the case of under-recovery, extra charges are added to the system charge in the following year, while the difference is financed through bank loans by the system operator. There is no link between the government budget and the feed-in tariff, and the financing of the feed-in tariff through the electricity charges is fully cost-reflective. Funding the feed-in tariff for renewables accounts for approximately 40% of the KAP volume.

Table 24

KAP Feed-In Tariff Payments and System Charges in Hungary in HUF, 2003 to 2006

	2003	*2004*	*2005*	*2006 (est.)*
KAP feed-In tariff payments	9.3 billion	14.5 billion	31.6 billion	50 billion
KAP system charge per kWh	0.2	0.46	0.7	1.13 (January) 2.07 (August)

Source: HEO.

To reduce the impact on system stability of increasing volumes of renewable energy being fed into the grid under must-take obligations, the HEO as the energy sector regulator has set up maximum limits beyond which the feed-in tariff is not applied. For wind energy, this is in the form of a system-wide limit of 350 MW capacity. The HEO issued licences in line with this limit at a licensing round in March 2006. The limits imposed are not based on a detailed analysis of individual proposals, and do not take account of locational or capacity factors. For biomass co-firing, the limit is expressed as a volume limit on a plant level, such as a small coal-fired plant operated by AES with a maximum volume of 200 GWh of renewables production per year, which are eligible for the feed-in tariff.

Taxation

From 1 July 2007 a tax reduction to 0% excise tax will apply for biofuels blended up to 4.4% of the volume of gasoline and from 1 January 2008 this tax exemption will also apply to 4.4% of biodiesel blended into diesel. Fuel distribution companies not complying with the 4.4% requirement will have an extra tax burden of HUF 8 per litre of fuel at the wholesale level.

Grid access and dispatch priority

Renewable electricity receives guaranteed grid access under a shallow-charging regime. Renewables developments do not have to pay for grid reinforcement at the higher level and are given priority dispatch on the grid.

Investment support

Investments in renewables in Hungary are eligible for direct support. In the past, some biomass projects benefited from support under Ministry of Environment tenders for CO_2 reductions, but because of the favourable funding situation for renewables in Hungary, the ministry no longer considers this an appropriate method of generating CO_2 reductions. Direct investment support for renewables is made available by the EU through its Structural Funds, and has been allocated for the period through 2013 by the National Development Plan II. In 2006, HUF 77 billion was allocated, and from 2007 to 2013, HUF 600 million will be available for biofuels for transport alone.

CRITIQUE

Hungary has rapidly increased the contribution to its TPES from renewable energy during the past two years, surpassing its 2010 target for renewable electricity production four years ahead of time. This achievement is due to oversubsidisation through the introduction of a generous preferential feed-in tariff with priority access to the grid, both at times of installation and for dispatch. The feed-in tariff is limited in time and volume or capacity, to prevent renewable operators from receiving privileged feeding-in-tariffs even after their investment has been fully recovered.

In order to reduce the potentially negative impact of large-scale grid integration of renewable energy installations on system operation and electricity tariffs, the HEO has limited the total amount of renewable electricity developments either by capacity or volume. To combine a generous feed-in tariff with a limit of capacity or volume has the potential to create distortionary effects by oversubsidising first movers, while potentially more efficient projects that come later may find that they are excluded from the support. These limits are also detrimental to the long-term sustainable development of the industry. Overall, it is questionable whether the high subsidies and the rapid achievement of the targets are economically sensible, and the government should consider giving full support to the HEO in its attempt to create a more efficient support system. It is generally preferable to create renewables support that harnesses market forces, as may be possible in biomass co-firing given the low barriers to fuel switching in established power stations, as demonstrated by the UK Renewables Obligation.

In particular, when considering further measures to promote electricity production from renewable primary energy sources, the efficient use of the existing grid in the interest of operational security and availability for potential competition should be considered as a priority condition, until the overall framework for support has become more market-based. In the context of grid efficiency, the rapid development of generation from biomass and the limiting of wind capacity seem to be reasonable under the current circumstances of oversubsidisation of renewables.

The primary fuel for renewables in Hungary is biomass. When considering the potential introduction and implementation of any additional support measures for biomass, their financial and economic side effects should be carefully taken into account. The government is currently expecting that up to 75% of biofuels production will be exported. It is not clear at this time whether an export market for such an amount of biofuels will exist. It may be useful to consider the development of an inter-ministerial biomass strategy for Hungary, taking into account fuel availability, system limitations, environmental commitments, and other aspects. Such a strategy could form the basis for developing an efficient and competitive use of biomass in Hungary.

A market for solid biofuels of almost 1 million tonnes of dry matter has been created from almost zero in just two to three years, and all available biomass resources in the country are now being utilised, albeit in some cases in applications with very low efficiencies. In the longer term, the government should consider a support policy that leads to a more efficient and sustainable production of solid biofuels, such as pellets, or wood chips, for large-scale use.

In the area of biofuels for transport, the government is offering a tax exemption for 4.4% blended biofuel as a component in gasoline and diesel. While this decision has been successful in triggering investment into biofuels production, it is also creating an arbitrary cut-off level that may be difficult to achieve when considering optimal refinery configurations. There is also a lack of a clear statement on future requirements, which would enable refinery operators to efficiently plan investment. The government should consider clarifying its medium-term plans for the biofuels requirement in order to create investment security for refinery operators.

The increase in the use of biomass facilitates the adaptation process to world trade agreements in the agriculture sector. The government's policy intent in the area of biomass is that decreasing contributions of agriculture to food supply and exports (WTO prohibits export of an essential part of cereal production) are compensated for by the contribution of agriculture to energy production. This should lead to the conservation of social and economic structures in rural areas and help to prevent job losses. These are essentially not energy policy-related aims, and there is a risk that Hungary is pursuing the development of biofuels for the wrong reasons and at high cost, which may make it more difficult to adjust support schemes at a later stage, in reaction to potential technological advances.

RECOMMENDATIONS

The government of Hungary should:

- *Reduce the oversubsidisation of renewables, and investigate the potential to introduce market-based support measures, while ensuring investor confidence.*
- *Examine the scope for reform of the feed-in tariff, considering the introduction of elements such as a reduction of the tariff, degression over time, and differentiation by technology, always taking into account the effect of renewables on the electricity grid, and the optimal use of all renewable energy sources.*
- *Develop a National Bioenergy Action Plan elaborating strategic options for sustainable and cost-effective utilisation of nationally available bioenergy from agriculture, forestry and waste management, including integrated sewage water-energy, crop plantation schemes, based on energy policy goals. This strategy should:*
  - *Use the present market for solid biofuels as a trigger for the development of a competitive industry for sustainable supply of solid biofuels.*
  - *Re-examine the decision to introduce tax exemptions for 4.4% of biofuels as a blended component in gasoline and diesel with the intent of making the system more market-oriented and tying the support to the actual share of liquid biofuels.*

NATURAL GAS

OVERVIEW

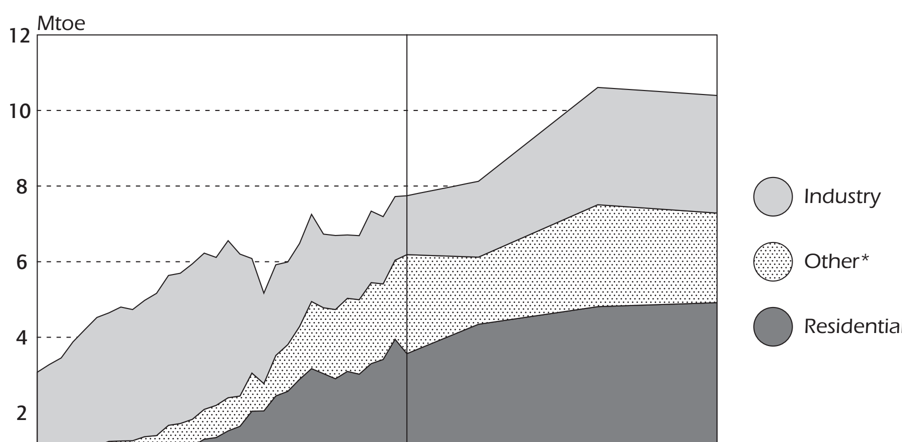
Natural gas is the most important fuel in Hungary, contributing 12.1 Mtoe, or 43.6% to TPES in 2005. The supply of natural gas has changed by an average of 2.1% per year since 1990, when it stood at 8.9 Mtoe.

The government predicts that natural gas supply will increase slightly by 3.2% to 12.5 Mtoe in 2010, and more rapidly thereafter, by 24.5% to 15.6 Mtoe in 2020. If this is correct, natural gas would supply over half of Hungary's energy needs in 2020. Given that most of the additional demand is expected to come from gas use in power generation, these figures are subject to considerable uncertainty.

In 2004, natural gas accounted for 35% of Hungarian electricity production. During the same period, heat and electricity production together used 3.3 Mtoe of natural gas, 28% of the year's total gas supply.

Figure 20

Final Consumption of Natural Gas by Sector, 1973 to 2030



* includes commercial, public service and agricultural sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2006 and country submission.

Natural gas is an important fuel in stationary energy use in all sectors in Hungary. It contributed 7.75 Mtoe or 40.5% to Hungary's TFC in 2004. Of this, 6.2 Mtoe were consumed in "Other sectors", contributing 61% to these sectors' consumption of energy. Residential gas use accounted for 3.6 Mtoe, or 29.8% of all gas supplied in Hungary, and 46.1% of all gas consumed. The industrial sector accounts for 1.6 Mtoe, or 20.2% of all gas consumed in Hungary.

SUPPLY AND DEMAND

Supply

Exploration and production

Hungary produced 2.4 Mtoe or 2.61 bcm of natural gas in 2004, a significant decline of 38% from the 4.9 bcm produced in 1990. Production peaked around 1985, and has declined by an annual average of 3.2% since 1990. It is expected that production will decline further in the future, to 1.8 Mtoe or 2.0 bcm in 2010, by 15%. Conventional exploration activity for new gas resources is focused on eastern and southern Hungary, and some new unconventional potential deposits were discovered in south-eastern Hungary, where TXM is undertaking exploration in very great depths of 5 000 to 6 000 metres. Domestic production accounted for 19.3% of total supply in Hungary in 2005. The main producer of natural gas in Hungary is the integrated oil company MOL (see next section on Oil), producing 2.6 bcm in 2005. The only other producer is Winstar, with a production of 0.3 to 0.35 bcm in 2005. Proven reserves of MOL fell from 29.25 bcm in 2004 to 27.5 bcm in 2005, sufficient for nine years at the current rate of production. A potential new producer, Toreador, plans to open production from a gas condensate field at Örményes. With the predicted increase in demand, and reduction in production over the coming years, the government expects that domestic production will cover 14.4% of consumption by 2010, and 9% by 2020.

Special royalties are paid on gas production from wells that started before 1998. These proceeds are used to fund the household gas subsidy (see below). In 2006, the government and MOL renegotiated the royalty agreement, to encourage MOL to consider increased investment in continued production from these wells.

Imports

Hungary has not been fully self-sufficient in gas production since 1973. The country currently relies on imports from Russia to satisfy demand. Total imports in 2005 reached 9.8 Mtoe, or 12.7 bcm. Of this, 2.2 bcm were contracted from new suppliers such as Gaz de France, Ruhrgas and EMFESZ, with physical supply coming entirely from Russia. The share of Russia in

Hungary's gas supply is reaching 80% of contracted volume, and this could increase to 85% in 2020 according to the government's scenario, if no measures for import source diversification are taken.

Imports are under five long-term supply contracts held by Panrusgáz, originally a joint venture of Gazprom and MOL with each owning 50% of the shares. With the sale of the gas supply and storage business from MOL to E.On in 2006, E.On took over MOL's share of the joint venture.

Demand

Hungary's peak gas demand is comparatively inflexible. Residential use accounts for the majority of demand, either directly or indirectly when gas is used for the production of heat in residential CHP units. Hungary has good geographical coverage of the gas network; 3.5 million Hungarian households are connected to the gas network for heating purposes, a share of over 80%, which also contributes to the very high seasonal variation of gas demand. On a typical summer day between June and August, consumption is 15 million cubic metres (mcm) per day, with another 20 mcm per day going into storage. On a typical winter day between December and February, consumption is 65-75 mcm per day, and the maximum winter consumption observed reached 89 mcm per day.

Unlike in many IEA countries, relatively little gas is used in large-scale industrial application. Since 1990, the industrial demand for gas has decreased by 58.5%, from 3.8 Mtoe to 1.6 Mtoe in 2004. In 2002, chemical and other large industries accounted for only 9.3% of gas consumption, and power plants 14.6%. Only this demand can be considered to be completely flexible in the case of a supply interruption.

INFRASTRUCTURE

International connections and entry capacity

Hungary's main international connections by pipeline are to Ukraine, Austria and Serbia. The Ukraine pipeline is the prime import route for gas into Hungary, while the Austrian pipeline is primarily used to balance the system and at times of high demand. The Serbian pipeline serves as a transit pipeline, through which gas is sent under a 20-year contract concluded in 1998.

At the moment, only the Ukraine pipeline has spare capacity. Capacity on this pipeline is contracted to the customers. Eligible customers hold or bring the exit and import entry capacity and storage capacity according to the Hungarian network code. Free and overbooked capacity at the entry points is allocated by auction. Table 25 gives capacities by entry point.

Table 25

Entry Capacity of the Hungarian Gas System

Entry point	*Annual capacity bcm*	*Daily maximum capacity mcm*
Beregdaróc (from Ukraine)	10.0	30.0
Mosonmagyaróvár (from Austria)	4.4	12.1
Domestic production (7 entry points)	3.5	10.2
Storage		47.5
Total	***17.9***	***99.8***
Daily peak demand 2005		89.0
Transit (not included above)	n/a	12.0

Source: MOL.

Further international connections are currently under discussion, including the Nabucco pipeline, an extension of the Bluestream pipeline, and the construction of an LNG terminal on the Croatian island of Krk, with a pipeline connection into Hungary. The aim of establishing a major gas transit line from the Caspian region through the Balkans would be to secure the increasing natural gas demand of EU and south-east European countries, and a number of regional gas companies are studying the possibility to build major transit lines with a yearly capacity of approximately 30 bcm.

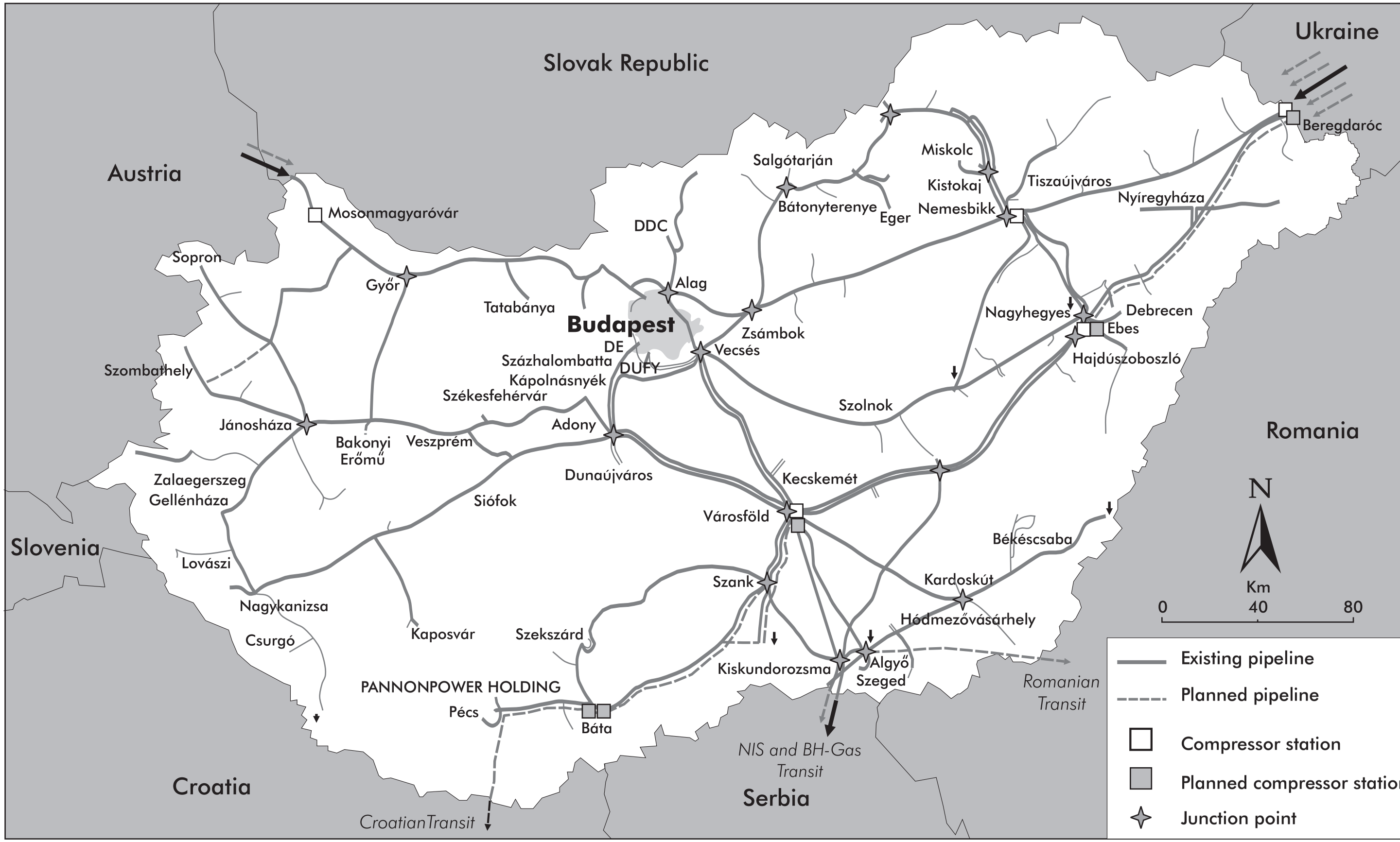
A number of projects on increasing regional networks are being evaluated. MOL is interested in establishing a transit pipeline serving Romania, and negotiations are in progress with Romgaz and Transgas about a pipeline with a 1.0 bcm to 1.5 bcm yearly capacity, which would need two years to be built at an estimated cost of HUF 6-7 billion. MOL and INA (the Croatian oil company) also decided on the evaluation of a Croatian transit connection point with a delivery amount of 1.5 bcm per year, and an estimated capital demand of over HUF 20-25 billion. All of these projects are at a very early stage of development.

Transmission network

Following the discovery of natural gas in Hungary in the 1960s, a gas transmission network was constructed from 1963, which reached 5 194 km in length in 2005, and includes five gas-turbine compressor stations. The average age of the system is 25 years, and approximately 50% of the system was built between 1963 and 1980. Inspections using advanced methods have

Figure 21

Map of the Hungarian Gas Transmission System



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

Source: MOL.

shown that the majority of the system is in need of major reconstruction, and in some areas complete replacement. As a consequence, the transmission tariff has been amended to create an incentive for investment by the system operator.

The transmission system is operated by MOL Transmission Plc., and regulated by the Hungarian Energy Office (HEO). Since 2005, the price for the system use has been based on an entry/exit calculation. Before, it was a flat rate. A temporary network and commercial code was published in 2003, regulating third-party access (TPA) to the transmission and distribution network and the storage system, including prices and co-operation rules. This was followed by a government decree in 2004, and the Gas Act of 2005. Under the network code, the natural gas transmission company has to publish on its website's homepage the available capacity for the following 18 months in a monthly breakdown at the network's feed-in and off-take points. Also, spare capacity of the transmission system and storage must be published 15 months in advance and the annual maintenance plan of the interoperable natural gas system must be published by 15 February of each year. The code also provides detailed rules for contracting capacity, and describes the scope of basic services provided by system operators. It identifies possible and mandatory contractual relationships of the new market structure, including not only commercial agreements, but also those of various forms of co-operation between system users and the operator.

Underground storage

Underground storage (UGS) plays a very important role in Hungary considering that residential consumption represents a large proportion of the total gas consumption. Residential gas consumption is heavily seasonal and relatively inflexible, accounting for almost half the daily peak during winter. In 2006, MOL sold four and rented one of its five UGS facilities with a total capacity of 3.4 bcm, and a daily release capacity of 47.5 mcm to

Table 26

Gas Storage Facilities in Hungary

Name	*Pusztaederics*	*Zsana*	*Algyő-Maros-1*	*Kardoskút-Pusztaszőlős*	*Hajdúszoboszló*	*Total*
Maximum release (mcm/d)	2.7	21.0	2.2	2.4	19.2	**47.5**
Mobile gas (mcm)	330	1 300	150	200	1 400	**3 380**
Cushion gas (mcm)	347	1 647	250	260	2 133	**4 637**

Source: MOL.

E.On (Table 26 gives details on the storage facilities). TPA to UGS has been implemented for the competitive gas market, while the regulated tariffs for supply of the captive markets now contain incentives for new investments into UGS.

Strategic storage

Following the supply interruption of January 2006 (see box below) the Hungarian Parliament approved a new law, the Act XXVI/2006 on Safety Stockpiling of Natural Gas, in February 2006.

According to the act new underground gas storage with a total capacity of 1.2 bcm and a daily release capacity of 20 mcm has to be constructed and become operational by 2010. This new strategic storage will allow Hungary to face exceptional shortages due to technical difficulties or supply disruption. It will give approximately 40 days of autonomy if the main import source from Russia fails. It is possible that if the storage is not built in the north-east of the country, close to the entry point of the Ukrainian pipeline, grid reinforcement may be required to ensure that the stored volumes can actually be used in the event of a cut-off.

The legal framework under which the storage will be managed is similar to that for oil emergency storage. The Hungarian Hydrocarbon Stockpiling Association (MSZKSZ), financed by the gas suppliers, will be responsible, and the government will have the right to initiate a stock draw. The conditions under which this right can be exercised have not yet been clarified.

All gas companies operating in Hungary have to become a member of the MSZKSZ. The level of their contribution fee and how it will be determined is unclear at this time, and will depend on the cost of creating and operating the storage facility. One possible option is for the cost to be covered by an additional charge on the current regulated final tariffs if new storage is installed.

The cost of the project is estimated to be between HUF 165 and 180 billion, equal to 2% of the early 2006 final residential tariff once financing costs are taken into account. The investment in constructing the storage and acquiring the cushion gas will account for around HUF 77 to 88 billion and will be financed by long-term bank loans taken by the MSZKSZ.

The price of the gas with which the unit will be filled will be financed by short- and medium-term loans taken out by the MSZKSZ. The MSZKSZ is expected to launch a tender to select a company for the building and operating of the facility and thereafter, annual tenders to procure gas. It has not yet been clarified what the requirements of such a tender would be. The possibilities are a completely new development or an extension to an existing storage site.

The January 2006 Supply Interruption

Hungary was the IEA member country most seriously affected by the Gazprom-Ukraine conflict about gas pricing in 2006. Gazprom had argued throughout 2005 that Ukraine should start to pay "market" prices for gas rather than what it calls subsidised rates. On Sunday 1 January 2006, the conflict escalated when Gazprom markedly decreased the volume of gas through one of its major pipeline systems. It simultaneously announced to the world press that if Ukraine "did not siphon" the gas transiting its country, European customers including Hungary at the other end of the pipe would receive their contracted quantities of gas. By Monday morning, however, national gas companies in Europe were reporting significantly lower volumes of gas arriving at their borders with Ukraine, with Hungary losing 60% of capacity on the pipeline.

While other IEA member countries were able to cover the lost volumes from storage, in the case of Hungary the reduction was on such a scale that storage could not make up the supply lost. The Hungarian gas market design does not allow for price signals to feed through to the power suppliers who were in a position to respond, while the domestic sector is completely inflexible over such a short period. The immediate measure taken by the Ministry of Economy was to order the gas-fired power plants to switch from natural gas to fuel oil, while further measures to reduce industrial gas use were taken later. The Hungarian Prime Minister and the Minister of Economy monitored the situation very closely and initiated some international consultation. In particular, the Hungarian Administration immediately contacted the EU Energy Commissioner, as well as the Ministers of the Visegrád 4 Group (Czech Republic, Poland, Slovakia and Hungary) to discuss possible joint actions.

The Minister of Economy later announced the speeding-up of the new underground gas storage capacity building, as stipulated in the new proposed Law on Strategic Gas Reserves. In line with this proposal, until 2010 the new capacity will be 1.2 bcm with a daily release capacity of 29 mcm, equal to the Ukrainian pipeline. As a medium- to long-term solution, the acceleration of two gas pipeline projects has also been announced: the Nabucco pipeline from mid-Asia to Europe (Turkey, Bulgaria, Romania, Hungary and Austria) and a new pipeline system (Croatia, Slovenia, Austria and Slovakia) from an Adriatic LNG terminal.

MARKET STRUCTURE

Regulation

Market regulation is undertaken by the HEO under the Natural Gas Supply Act XLII/2003, which came into force on 1 January 2004. An amendment to the act was passed by Parliament in 2005, as Act XLIII/2005, and with this amendment all provisions of the EU Gas Market Directive 2003/55/EC have been implemented by the government.

Gas safety regulation is the responsibility of the Mining Bureau of Hungary (MBH).

Market reform

The natural gas market was partially opened on 1 January 2004, and all non-household customers have been eligible since 1 June 2004. They represent 70% of the market by gas volume. Real market opening, however, has been very slow. According to the HEO, in 2006, 15 traders were registered, but only three were active and, according to the regulator, the volume of gas sold in the free market accounted for only 7.5% of the total gas market share in 2005. Eligible customers also have the possibility to import gas directly, if they have booked capacity on the Ukrainian pipeline. Pipeline bookings are only possible if a gas contract has been entered into.

Supply for captive customers is undertaken by five regional monopolies, all of which are foreign-owned (by E.On, Gaz de France and Italgas). The municipality of Budapest owns half of the Budapest Supply Company, while the other half is owned by RWE.

The regional companies also offer supply to eligible customers. These companies can either buy their gas from Panrusgáz or contract for imports directly, in which case they have to ensure that sufficient import pipeline capacity is available for them. A lack of pipeline capacity is currently preventing this opportunity to supply businesses.

Table 27

Gas Market Opening in Hungary

	2004 Dec.	*2005. Dec.*
Legal market opening	70%	70%
Number of traders	10	14
Number of eligible customers in free market	23	63
Market opening by volume of gas	6%	9.6%
Average wholesale price regulated HUF/m^3	40.71	45.65

Source: HEO.

Prices and subsidies

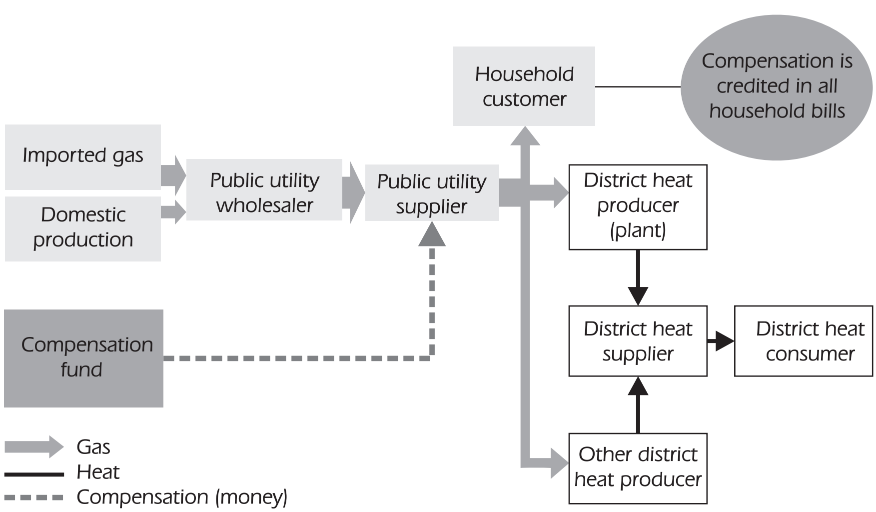
The regulated natural gas end-user price is the same throughout the country, regardless of distance from the main supply points, while the non-regulated price is distance-related. Regulated prices are set by the HEO. The 2004 Gas Act changed the method regulating the gas price. It introduced a formula under which the regulated price must be set at import prices plus 8.5% for the operation of the system and other non-gas supply costs. Prior to this change, the government through the HEO had the ability to leave the regulated price unchanged, even if the import prices rose, forcing the gas business of MOL to absorb the difference and incur losses when procurement cost of gas rose faster than regulated prices. On 18 January 2006, the average regulated gas price was increased to HUF 58.1 per m^3 of gas, below the regulated or unregulated wholesale market price.

The following elements make up the gas tariffs:

- Eligible customers:
  - Gas cost (balance gas included).
  - Transmission fees (fee of system operator included).
  - Storage fees.
  - Distribution fees.
  - Other fees (seller's margin).

Figure 22

Operation of the Household Subsidy System

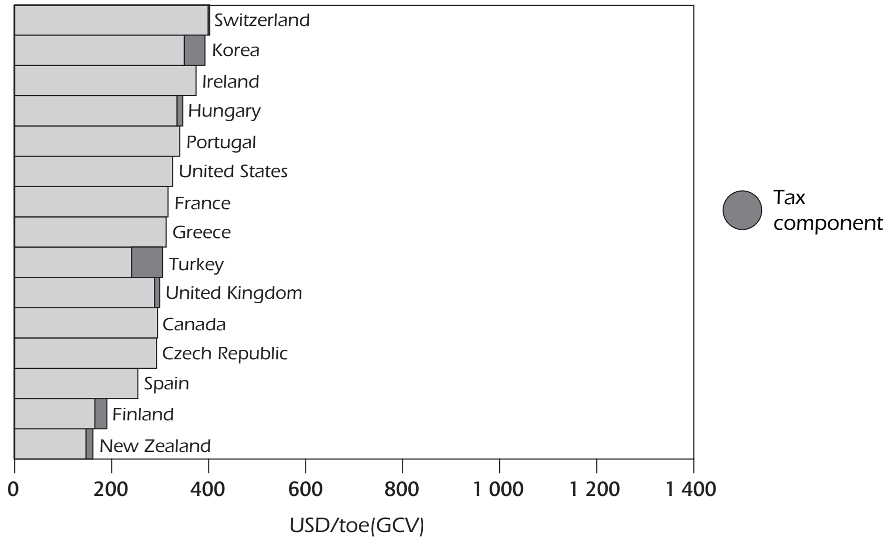


Source: HEO.

Figure 23

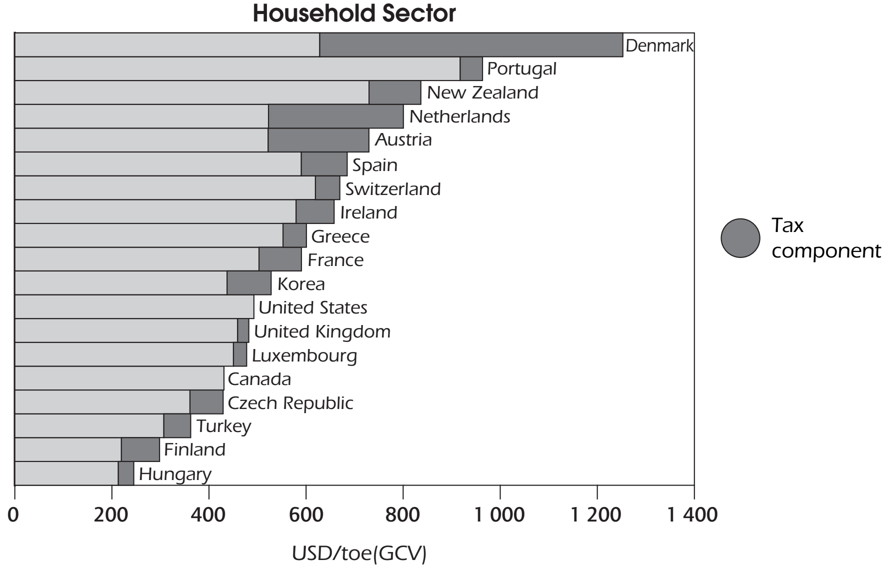
Gas Prices in IEA Countries, 2005

Industry Sector



Note: Tax information not available for the United States. Data not available for Australia, Austria, Belgium, Denmark, Germany, Italy, Japan, Luxembourg, the Netherlands, Norway and Sweden.

Household Sector

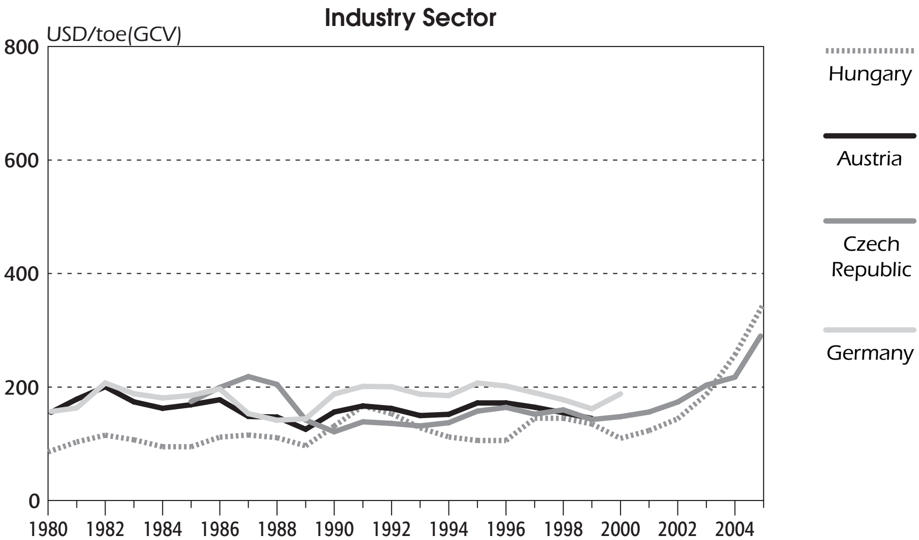


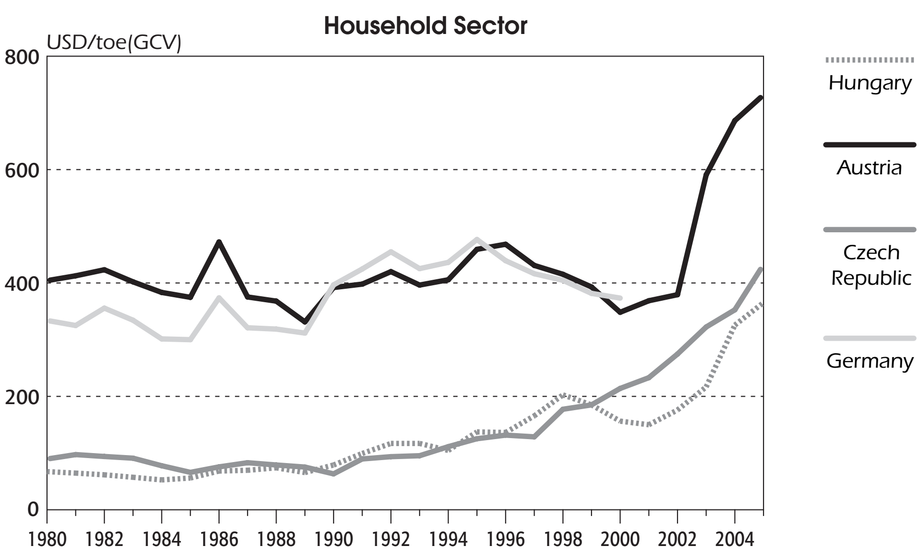
Note: Tax information not available for the United States. Data not available for Australia, Belgium, Germany, Italy, Japan, Norway and Sweden.

Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2006.

Figure 24

Gas Prices in Hungary and in Other Selected IEA Countries, 1980 to 2005





Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2006.

- Public utility customers:
  - Capacity (basic) fee.
  - Commodity (gas) fee.

Household gas consumption is subsidised by the government, with the average subsidy covering approximately 12% of the average household bill. In 2004, this subsidy amounted to approximately HUF 11 000 per household per year. It is expected to be considerably higher in 2005 and 2006. A reform of the system was undertaken in August 2006, with the new system reducing the subsidy, while gas prices were increased to reflect the higher import cost. The government estimates that the cost of running the subsidy will reach HUF 143 billion in 2006.

The subsidy is paid to public gas suppliers who must credit it explicitly on the bills to households they supply directly, or credit it to the account of DH suppliers who supply heat to households, in proportion to the number of households served. The subsidy is paid on a per-household basis, with no consideration for the actual financial situation of the household, or the status of occupancy.

OIL

OVERVIEW

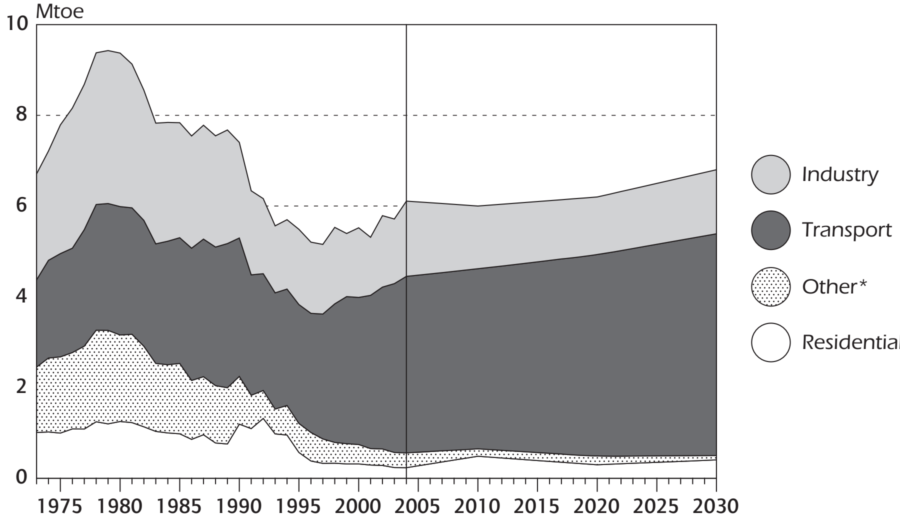
Oil supply in Hungary has decreased since 2000 when it stood at 6.9 Mtoe and fell to 6.4 Mtoe in 2004. This represents a decrease of 25% compared to the 1990 supply of 8.5 Mtoe. However, supply in 2005 will increase back to 2000 levels of 6.9 Mtoe, by almost 9%. This sudden increase was caused partly by the rise in diesel demand of the transport sector driven by economic growth and large infrastructure investments, partly by the increased petrochemical feedstock demand of TVK and partly by reduction in petroleum product smuggling at the Hungarian/Ukrainian border.

Oil contributed 24.3% to TPES in 2004, down from a contribution of 29.8% in 1990. Almost 25% of Hungarian oil demand was supplied by domestic crude oil production in 2004. It is estimated that this share will fall to 14% by 2010, owing to a decline in crude oil production in Hungary and a slight increase in demand for petroleum products.

The share of oil in TFC stood at 31.9% in 2004. The primary use of oil was in the transport sector, where 4 Mtoe were consumed, or 65%. The industry sector consumed 1.7 Mtoe, or 27%, while the other sectors consumed 0.6 Mtoe, or 9.1%. The low use in the other sectors reflects the high level of natural gas coverage for heating in Hungary. Oil was used to generate 2.3% of gross electricity in 2004. It is estimated that oil consumption will grow by 2.1% per year between 2004 and 2010.

Figure 25

Final Consumption of Oil by Sector, 1973 to 2030



* includes commercial, public service and agricultural sectors.
Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2006 and country submission.

EXPLORATION AND PRODUCTION

Exploration

The HEO is responsible for the issuing of exploration licences to petroleum companies. While the Hungarian oil company MOL (see box below) holds the majority of exploration licences, other companies can access licences freely, and a number of companies are active in Hungary.

There is no specific policy encouraging the exploration of a licensed area. The government views Hungary as a depleted oil area, and is not focusing on increasing exploration activity. Both the government and MOL believe that only small incremental finds are possible in Hungary. Most exploration activity is therefore focusing on adding small fields, which can be accessed with existing infrastructure. The most significant find in 2005 was a 500 barrels per day discovery.

Production

Total oil production in Hungary stood at 1.6 million metric tonnes (Mmt) of oil and natural gas liquids in 2004 and is expected to halve by 2030. Oil production peaked in 1985 at approximately 2.5 Mmt, and has been declining since, with a more rapid decline from 1990. It has declined by 27% since

Table 28

Active Exploration Areas in Hungary, 2005

Owner of exploration rights	*Number of areas*	*Area (km²)*
Blue Star (Hercules)	1	2 297
Gas-Feld	1	303
Winstar Magyarország	1	2 300
Geotop	2	2 890
Halmi	1	9
Magyar Horizont	20	20 623
Petro-Hungária	2	2 483
Rotaqua	2	418
Torreador	2	3 432
TXM	2	2 291
Xpronet Inc	1	908
MOL	33	36 451
Total	**68**	**74 405**

Source: MOL.

1990, when it stood at 2.3 Mmt. The majority of known oilfields are situated in the eastern part of the country. The most important of them is the MOL-owned Algyő field in south-east Hungary, which produces almost half of Hungary's output.

MOL is the primary oil producer in Hungary. MOL's proven oil reserves stood at 48 million barrels (6.37 Mt) in 2005, while its domestic production declined to 7.2 million barrels (0.95 Mt). In Hungary, MOL is spending approximately HUF 10 billion per year on exploration and production.

MARKET STRUCTURE

Major players

The main oil company operating in Hungary is the formerly state-owned MOL (see box). Other major players in the downstream market in Hungary are Austrian OMV, and international oil majors. MOL has also entered into a strategic partnership with the Croatian national oil company INA.

MOL

The main oil company operating in Hungary is the formerly state-owned integrated oil company MOL. MOL Group is the largest private company in Hungary with over 12 000 employees in 2005. MOL controls 80% of the petroleum wholesale market, and 35% of the retail market, and operates the only refinery in Hungary. Recently, the government has reduced its stake in MOL; in early 2006 it reduced the State's ownership in MOL from 12% to 1.7%, and in late 2006 the remaining shares except for a golden share were sold.

MOL has transformed itself into a dominant regional player in the petroleum markets of central Europe since the political changes of 1990. It now has retail and wholesale market activities in Croatia, the Czech Republic, Romania, Slovakia and Slovenia. It owns 98.4% of the Slovak national oil company Slovnaft, and 25% plus one share of the Croatian national oil company INA. MOL owns 853 filling stations, the majority of which are in Hungary and Slovakia, and has a significant retail presence in Romania where it bought Shell's retail stations in 2004. Products from MOL's refineries are exported throughout the region.

Following the sale of its gas wholesale and import activities to E.On Hungária in 2006, MOL is still operating the gas transmission pipelines in Hungary, and is involved in the consortia working on the Nabucco pipeline and the feasibility study for an Adriatic regasification terminal. In 2006, MOL signed a Memorandum of Understanding with Gazprom for the construction of an extension to the Bluestream pipeline through the Balkans to Hungary. MOL is the owner and operator of the Friendship II branch of the Friendship oil pipeline, which delivers Russian oil into central Europe.

MOL is also active in upstream exploration and production activities in Hungary, Kazakhstan, Pakistan, Russia and Yemen. Its production portfolio covers a daily production of about 100 000 barrels of oil equivalent (boe) per day, and reserves of approximately 270 mboe.

MOL also owns the majority of the Hungarian company TVK, a petrochemicals business.

Market regulation and competition

MOL Group holds the majority share of each level of the market in Hungary. MOL is the only supplier of certain oil products to customers in some regions of Hungary, owing to their distance from non-MOL refineries offering similar quality levels. The Hungarian Competition Commission is responsible for ensuring competition in the market, and the prevention of possible abuse of MOL's dominant position.

While MOL has traditionally increased its retail and wholesale prices by the same amount, it has recently changed this approach, and increased retail prices by less than wholesale prices, forcing its competitors in the retail market to reduce margins or lose market share. In 2005, the Competition Commission denied MOL the right to decrease its wholesale prices in order to prevent it from further increasing its wholesale market share.

The most significant change in the market in recent years has been the entry of the British retail company Tesco, which is rapidly growing its retail station network. Tesco is not using MOL as a wholesale supplier, and is exerting considerable pressure on retail prices.

Retail market

Diesel sales have been growing substantially in Hungary, because of an increasing number of diesel vehicles and the growth of the national economy leading to higher transport demand. MOL converted its refineries to new EU product norms ahead of schedule, and had phased out the lowest quality of fuel by 2005 (see Table 29). All fuel types sold by MOL in Hungary are above EU quality standards.

Hungary's filling station network is relatively thin, compared to that of Western European countries, and is seen as having a good potential for growth, since the number of cars per inhabitant is lower than in Western Europe and is likely to grow (see Chapter 3). The number of petrol stations operated by oil companies that are members of the Hungarian Petroleum Association has been increasing, while the number of independent stations has been decreasing.

Table 29

Fuel Sales by Type at Hungarian Petroleum Association Stations, 2003 to 2005, in m^3

Fuel	*2003*	*2004*	*2005*
RON 91	92 985	14 409	61
RON 95	1 378 273	1 431 722	1 445 013
RON 98	192 052	170 704	127 688
Gasoline total	*1 663 310*	*1 616 835*	*1 572 762*
Diesel	1 158 134	1 178 464	1 272 926
Fuels total	**2 821 444**	**2 795 299**	**2 845 688**

Source: Hungarian Petroleum Association.

The arrival of Tesco as a retailer in the Hungarian market has exerted significant price pressure since 2004, because consumers are willing to travel significant distances to fill up at a Tesco station to take advantage of lower prices.

Table 30

Filling Stations in Hungary, 2003 to 2005

Company	*2003*	*2004*	*2005*
MOL	348	358	354
Shell	165	182	183
OMV	168	170	164
Agip	115	118	123
Esso	32	35	38
Conoco	29	31	32
Lukoil	–	25	34
Tesco	–	9	24
Avanti	30	–	–
Total	39	–	–
In all	**926**	**928**	**952**

Source: Hungarian Petroleum Association.

International trade

The supply of MOL Group's crude oil requirements (for both MOL and the Slovnaft refineries) comes primarily from Russian fields via the "Friendship II" pipeline, with the remainder delivered via the Croatian pipeline that connects to the Krk oil terminal. Russia was the source for 6.1 Mt of oil imports into Hungary in 2005. Additionally, free pipeline capacity in Hungary is used for the transit of Russian crude oil to supply INA's Sisak refinery in Croatia.

MOL procures crude oil on the basis of term contracts with the main suppliers covering approximately 75% of imports, while the rest is procured on a spot basis. Prices for term contracts are related to dated Brent monthly average quotations.

A significant amount of oil products is exported from Hungary; 2.9 Mtoe in 2004, an increase of 88% compared with 1990. The simplification of export procedures and the removal of custom duties and administrative barriers with many neighbouring countries since accession to the EU have led to stronger competition among the refineries in the central European region, and to increased exports from MOL's Danube Refinery. Gasoline and diesel are actively traded with neighbouring countries, and the main export destinations for Hungarian oil products are Austria, Germany and the Slovak Republic. Outside the EU, major export destinations are the states of former Yugoslavia and Romania.

In 2005, the Hungarian customs authority began a successful anti-smuggling operation on the Ukrainian border in which it succeeded in reducing the amount of petrol smuggled.

INFRASTRUCTURE

Bulk transport

Hungary is served by three international pipelines. The "Friendship II" pipeline with a capacity of 7.9 Mt per year carries the main supply from Russia into Hungary. The Adria pipeline with a capacity of 10 Mt per year connects to the oil terminal on the Croatian island of Krk and is used for transit purposes. The crossing point for the Friendship pipeline is Fényeslitke on the Ukrainian/Hungarian border. A branch line of the Friendship I pipeline connects Hungary and the Slovak Republic. Product exports from MOL's refineries utilise barge transport on the Danube River where possible.

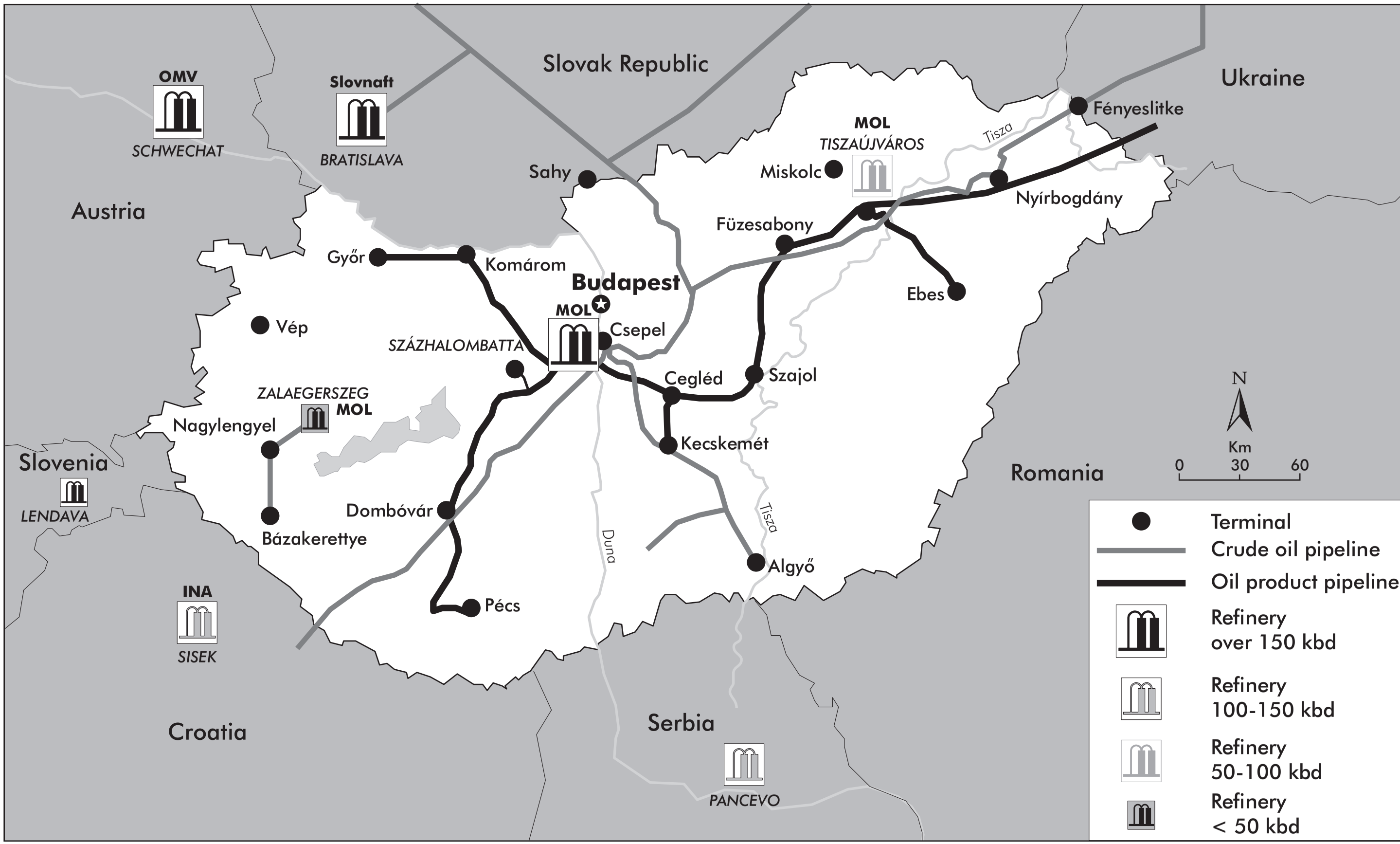
MOL operates 1 200 km of internal product pipelines and 13 connected depots cover the supply of retail stations and wholesale customers in Hungary. MOL owns 1.5 mcm or 75% of depot capacity in Hungary, while other players own 0.5 mcm.

Refining

Hungary has four refineries, all of which are owned and operated by MOL. The main refinery is the Danube Refinery at Százhalombatta in central Hungary. It has a distillation capacity of 8.1 Mt per year (165 000 barrels per day) and is currently the only crude processing refinery in Hungary. MOL also owns the Slovnaft Refinery in Bratislava in the Slovak Republic, with a distillation capacity of 5.7 Mt per year (114 000 bpd). A smaller refinery is the Tisza Refinery in eastern Hungary, with a distillation capacity of 3 Mt per year or 60 000 bdp, which was mothballed in 2001 for cost reasons. The refinery is currently only undertaking diesel

Figure 26

The Oil Pipeline System in Hungary



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

Source: MOL.

desulphurisation, MTBE production, and gasoline blending. Another small refinery is the Zala Refinery in western Hungary, which is only producing bitumen. Its distillation unit with a capacity of 0.5 Mt per year or 10 000 bpd was also mothballed in 2001. The Almásfüzitő Refinery is engaged in lubricant production. MOL is operating its refineries as an integrated business, ignoring state borders.

MOL has implemented refinery upgrading at the crude refineries in Hungary and in the Slovak Republic in order to meet the EU oil product quality requirements, such as keeping the sulphur content of motor fuels below 10 ppm, and enabling the processing of sour crude while keeping a competitive product slate. Besides imported crude, MOL's refineries also process domestically produced crude oil and condensates, and other raw materials.

In Százhalombatta the following upgrades and installations were undertaken to ensure compliance with new EU fuel regulations:

- 750 kt per year capacity gasoline desulphuriser.
- 2.2 Mt per year capacity gasoil desulphuriser.
- 40 000 m^3 per hour capacity hydrogen plant.
- gasoil blending plant.
- auxiliary facilities.

Active government support for the production of ethanol from cereal plant has led to a number of ethanol plants currently being constructed in Hungary (see Chapter 6).

EMERGENCY PREPAREDNESS

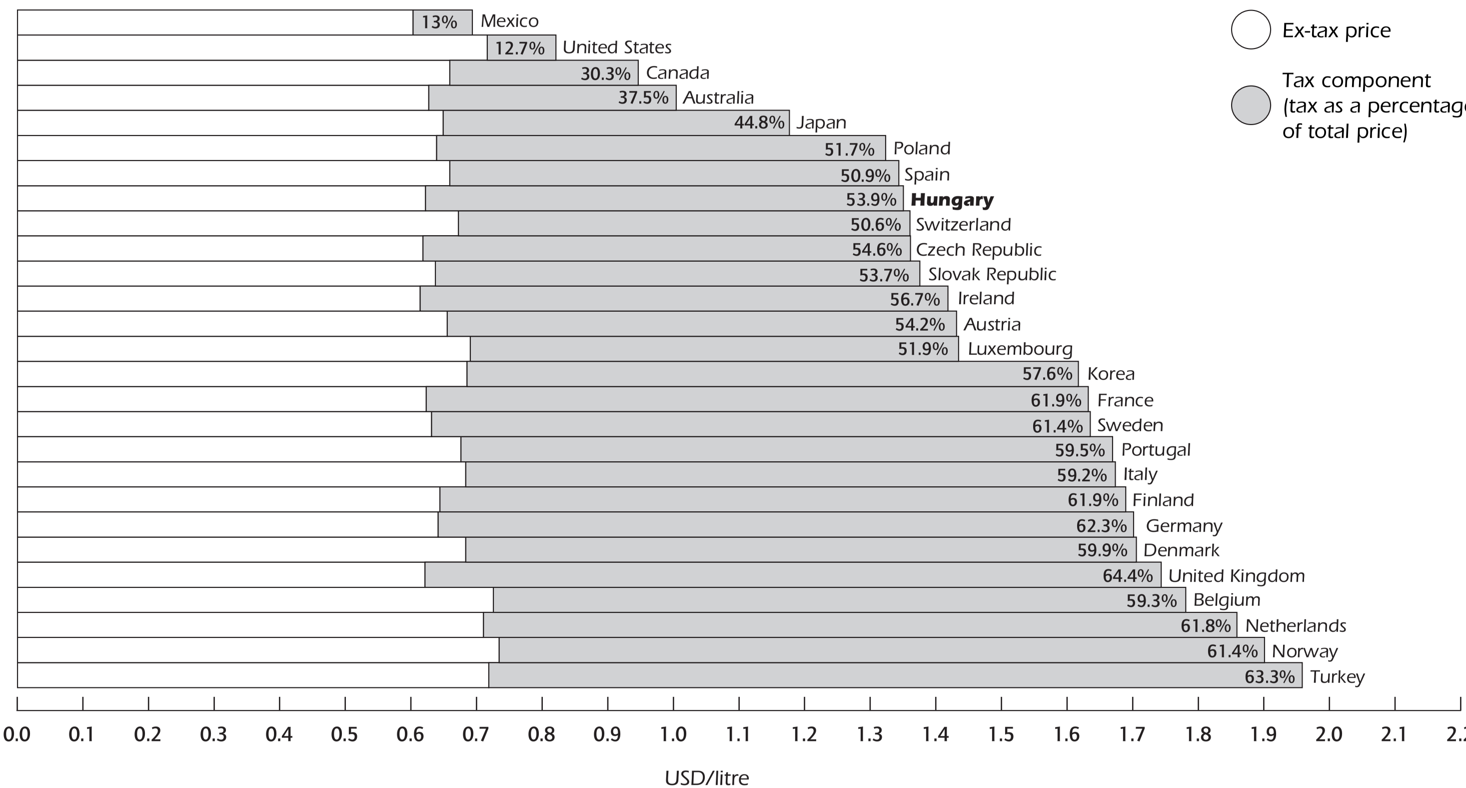
Hungarian oil security policies are consistent with its IEA commitments. The Act XXXIX of 1999 is the basic legal tool of the Hungarian IEA membership.

Given Hungary's high energy import dependence, energy security is a key strategic issue for Hungary. Measures to implement its energy security strategy include the following:

- Diversification of energy sources and routes of procurement.
- Strategic stockholding, mainly crude oil and products, but now also includes natural gas.
- Decreasing dependence through increased energy efficiency and policies to promote renewables.

Figure 27

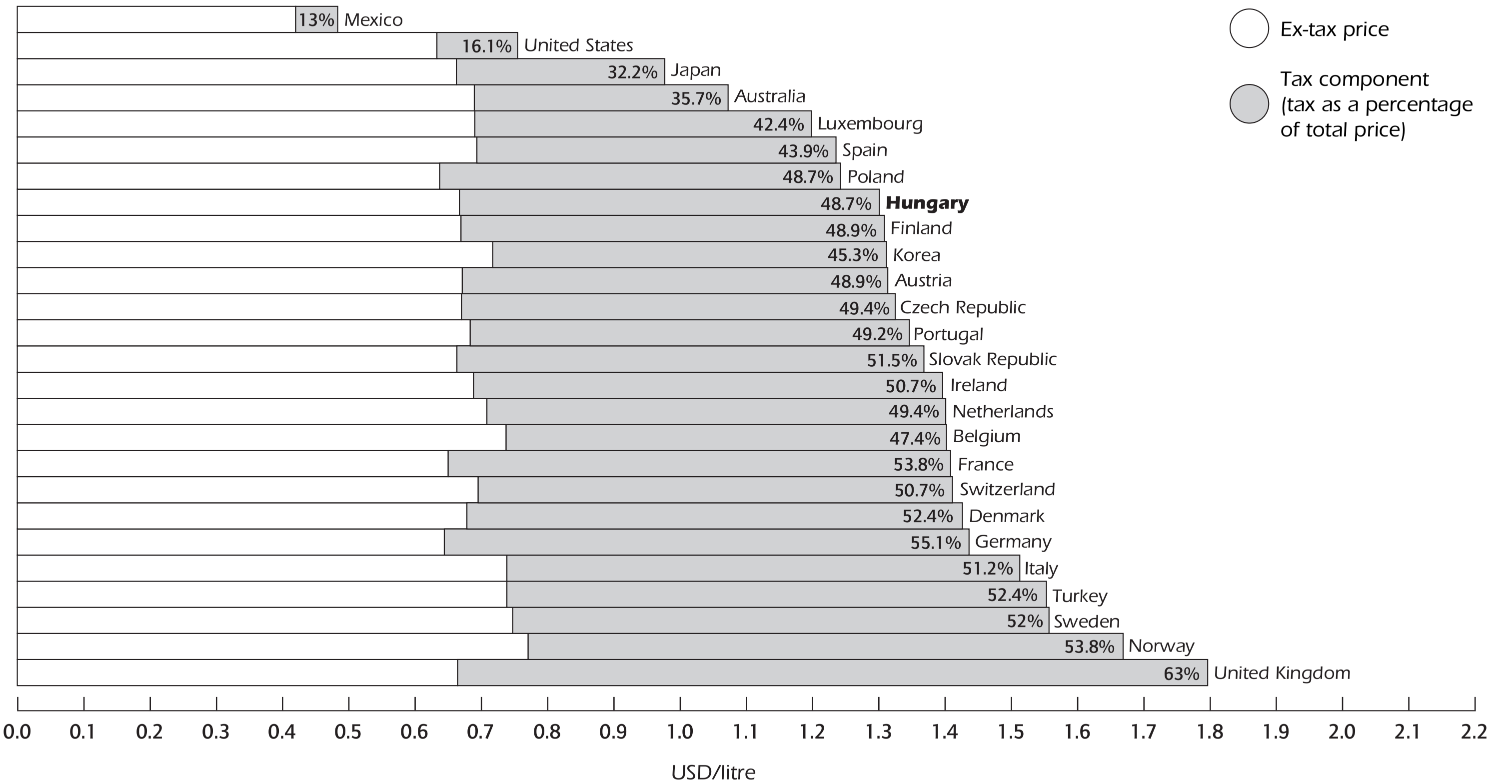
OECD Unleaded Gasoline Prices and Taxes, Second Quarter 2006



Note: data not available for Greece and New Zealand.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2006.

Figure 28

OECD Automotive Diesel Prices and Taxes, Second Quarter 2006



Note: data not available for Canada, Greece and New Zealand.
Source: *Energy Prices and Taxes*, IEA/OECD Paris, 2006.

Hungary's oil stocks are consistently well above the IEA 90-day obligation. It has made provision for Collective Emergency Response Measures, mainly based on stock draw, with some fuel-switching options. The country has well developed demand restraint measures.

Strategic reserves are held by the Hungarian Hydrocarbon Stockpiling Association (MSZKSZ). This association was previously named the Crude Oil and Oil Product Stockpiling Association (KKKSZ), but now includes strategic gas stocks as established by the February 2006 Law on Strategic Natural Gas Reserves. By 2010, in accordance with the new gas law, there will be new gas storage capacity of up to 1.2 bcm. In addition, in the medium to long term, the acceleration of two gas pipeline projects has been announced, namely the Nabucco pipeline from mid-Asia to Europe (Turkey, Bulgaria, Romania, Hungary, Austria) and a new pipeline system (Croatia, Slovenia, Austria, Slovakia) from an Adriatic LNG terminal.

The Hungarian Contribution to the IEA Collective Response Action 2005

The Energy Department prepared the official letter to the Hungarian Hydrocarbon Stockpiling Association on oil stock release with the signature of the Minister (as authorised by law). The amount authorised was 800 tonnes per day for a duration of 30 days with a review after 15 days. The released stock type was crude oil (Russian Export Blended). The stocks were tendered on 6 September 2005, sold to MOL on 7 September 2005 and delivery began on 8 September 2005 at a rate of 800 tonnes per day. This action replaced oil supplies which would normally have been purchased on the international oil market.

COAL

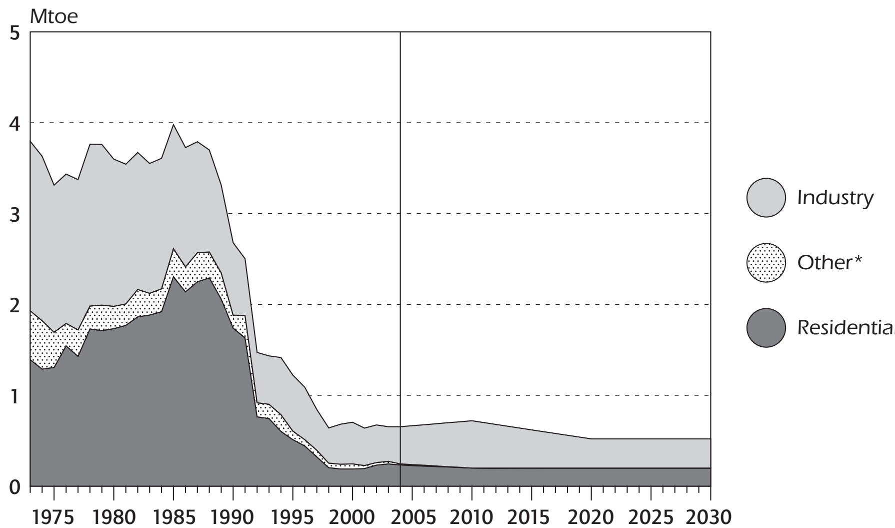
SUPPLY AND DEMAND

Coal's importance in the Hungarian energy mix has continued to decrease since the political changes of 1990. In 1990, 4.1 Mtoe of coal was produced in Hungary which, with imports of 1.6 Mtoe combined with a small stock draw, led to a coal contribution to TPES of 6.1 Mtoe, or 21.4%. Almost no coal was exported in 1990. In 2004, production fell to 2.2 Mtoe, of which 0.1 Mtoe was exported. Net imports stood at 1.1 Mtoe, and coal's contribution to TPES fell to 3.5 Mtoe, or 13.3%.

Coal is primarily used in power generation, where it contributed 24.7% to Hungary's electricity production in 2004, down from 30.5% in 1990. It is also used in the industrial sector, where 0.4 Mtoe were consumed, contributing 8.2% to the sector's TFC. In the residential and all other sectors, 0.25 Mtoe of coal is consumed, primarily for heating purposes, contributing 2% to these sectors' TFC.

Figure 29

Final Consumption of Coal by Sector, 1973 to 2030



* includes commercial, public service and agricultural sectors.

Sources: *Energy Balances of OECD Countries*, IEA/OECD Paris, 2006 and country submission.

RESOURCES

Hungarian coal is primarily lignite, with estimated reserves of 2.9 billion tonnes. Hungary has small amounts of other brown and hard coal reserves of 0.2 billion tonnes each. The significant reduction of coal production from 4.1 Mtoe in 1990 to 2.2 Mtoe in 2004 was primarily in hard and brown coal. Since 2000, a large number of mines have closed and the number of miners has been reduced through early retirement and redundancy programmes. Since the introduction of favourable feed-in tariffs for biomass co-fired in electricity generation, a certain amount of fuel-switching has taken place, with small coal-fired stations now burning wood instead of coal (see Chapter 6).

Opencast lignite mines are profitable, and lignite is seen as the only opportunity to increase future production of coal in Hungary. However, plans for a 1 000-MW lignite-fuelled plant were cancelled in 2000. Should any proposals for new hard coal-fired power stations go ahead, these would have to rely on imported coal transported to Hungary via rail or river. Coal mines in Hungary are owned by private enterprises or the government-owned electricity company MVM.

GOVERNMENT SUPPORT

Since 2000, no direct government aid has been extended to coal production. Indirect aid was given to hard coal production through the very favourable PPA under which the 240-MW Oroszlány power station was operating. Until 2006, these subsidies were implicit in the power prices paid to the station's owner, Vértes Power Plant Plc, which also operates the Márkushegy mine that supplies coal to the station and which was indirectly state-owned through the power company MVM until the privatisation was completed in 2005.

In 2005, the EC agreed to a restructuring package under which the Hungarian government grants total aid of HUF 64.3 billion for the years 2004 to 2010 to Vértes. The yearly aid amounts decline, falling from HUF 12 billion in 2004 to HUF 6.9 billion in 2010, forcing the company to adapt (*e.g.* by increasing its capacity to co-fire biomass). Direct government assistance is also given to support mine closures, and rehabilitation of mining areas.

A direct support system for coal is now in operation, under which the funds are paid by electricity consumers through the electricity tariff and a levy modelled on the German "Coal Cent" was added to the transmission tariff on 6 January 2006.

CRITIQUE

NATURAL GAS

Natural gas plays the most important role in Hungary's energy mix and contributed 44% to TPES in 2005. It is used extensively in all sectors of the economy, with a particularly large share being used in the household heating sector.

This high importance explains why the government sees the security of gas supply as one of the top priorities of its energy policy and seeks ways to diversify both routes of supply and origins of gas. The fall-out of the

Russia/Ukraine gas dispute in January 2006 and the cold spell later in the same month further increased the need to improve the security of gas supply. Hungary was one of the most affected European countries and experienced a significant temporary supply shortfall, leading to interruption of industrial and power generation demand on both occasions.

To finance the household subsidy, a special levy was raised on gas production from pre-1998 wells. This arrangement between "old" and "new" gas produced in Hungary creates distortions, which discouraged domestic producers to invest into increased exploration and production at existing wells. It is commendable that the government has renegotiated this arrangement with a view to removing the disincentive. Reducing the royalty-take from the pre-1998 gas increases the incentive to keep these gas fields in production for longer. Nevertheless, blocking of gas exports from Hungary remains a barrier for increased exploration activity. The government should consider allowing Hungarian gas to be exported, to encourage additional exploration activities and investment in increased production.

The government and the oil company MOL are closely involved in the negotiations for a new international gas infrastructure, such as the Nabucco pipeline, and the Adriatic LNG terminal. MOL has also signed a contract with Gazprom to study the development of an extension to the Bluestream pipeline. This diversification of supply route and/or source would improve gas competition in Hungary by introducing new players and would therefore increase security of supply. Within Hungary, the new regulated tariff for transmission contains an added incentive for new investments, compared to upgrading old infrastructure. The government should be commended for encouraging the development of new infrastructure, such as pipelines and underground storage, in order to ensure increased security of supply, but care should be taken that there is sufficient investment in the upkeep of the existing infrastructure.

Although the regulation of networks has improved significantly since 2003 through, among other measures, the creation of an independent TSO, the introduction of third-party access and the development of an entry–exit system and a network code, some challenges remain. Capacity constraints, which hamper the development of the gas market seem to remain in the Hungarian transmission and distribution system. Of particular concern is the lack of free capacity at the Ukrainian border. The public service wholesaler (E.On since 2006, previously MOL) has booked 95% of the pipeline's capacity. An analysis of the expected future flows of transit (12 bcm per year, estimated to increase by 600 mcm during the next five years) should be undertaken in close co-operation with the other regional TSOs and regulators in order to determine if there is a need to increase cross-border capacities and pipelines. Regional co-operation on this specific issue would be useful because the gas demand of Croatia and Serbia could increase rapidly, leading to much higher demand made on the transit infrastructure. Pipeline capacity should be allocated on a "Use It or Lose It" basis for long-term contracts, or ideally by auctions. The HEO should also consider introducing stronger locational signals to ensure that scarce capacity is used most efficiently.

The Hungarian pipeline network is relatively old. The TSO has put in place a regular inspection programme with intelligent pigging (covering approximately 10% of the network every year), which seems to be satisfactory. However, considering the ageing of the network, the safety level requires continued attention by competent authorities even though incentives exist within the tariff, which in principle should move the TSO to decide in favour of sufficient investment.

The current storage and import daily capacities are sufficient to cope with the variations in seasonal demand. The total daily peak release capacity is currently 96 mcm, and will be increased to 99 mcm. The highest daily peak demand was 89 mcm in winter. The full market opening from 2007 may lead to the creation of different forms of contracts reflecting tightness in the system, and offering lower prices in exchange for interruptability as is usual in other IEA countries. Nevertheless, owing to the high share of inflexible home heating demand, it is unlikely that the market will be able to solve the problem of a potential serious supply interruption through contracts alone. The intent to create a strategic storage is a reaction to the events of January 2006, and may help to reduce the serious risk to Hungary's energy supply. This proposal should be examined carefully in comparison to other cost-effective solutions that could be implemented together, such as an extension of existing underground storages, which could offer the same service; increasing the incentives for interruptible demand and investing in demand reductions by increased energy efficiency. Such an analysis should also take into account the difficulties faced by the government to increase end-user tariffs. Attention should also be paid by the HEO that any tenders to provide gas security of supply services do not distort the gas market and add as little as possible to the cost of gas for the consumers.

The entry into force of the new Gas Act of 2004 was an important step in the liberalisation of the Hungarian gas market. Now government will have to go further in order to fully open the market by 1 July 2007 in application of the EU's 2003/55 Gas Market Directive. In particular, government should consider taking as soon as possible appropriate measures to comply with this goal, ensuring that legislation will be amended and that at least a decree is passed to help fulfil this obligation. Industrial users have expressed great concerns about the government's ability to comply with the July 2007 deadline, and the recent announcements on civil service restructuring may make it impossible for the regulator to conduct the work required to achieve this goal. It is of high importance that the proposals for the introduction of the new structure of the gas market be shared as soon as possible with all interested parties.

Following the sale of the MOL supply and storage business and the gas import contracts to E.On, E.On is now a licensed wholesaler allowed to sell gas to the seven distribution companies in the regulated market. Despite the condition on the transaction to auction 1 bcm of the import contracts every year for eight years, competition based on gas price is limited. The reasons for this are the limited number of suppliers and the restricted import pipeline capacities. As a consequence, the first gas release has not proven to be effective owing to a lack of transmission and import capacity. The HEO should closely observe the effect of the auctions, and consider taking appropriate measures to increase competition in the market, should they prove insufficient.

Setting the regulated Hungarian gas price is a sensitive political issue considering the importance of gas in the energy mix. The government should be commended for having made important progress towards the liberalisation of the gas market since the last review in 2003. Following the changes implemented in the 2005 Gas Act, two markets coexist now, a competitive market and a regulated market. The fundamental problem is that these two markets are not distinct, because consumers are allowed to move back and forth between them, creating a real obstacle to competition and blocking new entrants from developing their business in the long term. The HEO and the government should consider making a minimum stay in the competitive market mandatory, although the ideal would be to make the whole market competitive by July 2007 in line with EU rules.

The main reason for consumers to move into and out of the regulated market is that the regulated tariffs do not reflect the full costs of gas and system operation, and are based on previous import prices, which were much lower than the ones currently being paid. As a consequence, industrial gas prices are twice as high as domestic end-user tariffs. This situation is an obstacle to opening the market and to creating clear signals for investment in the energy sector. The low regulated price also has a very substantial negative implication for security of supply, because it encourages consumption over efficient use. The government should be commended for having raised gas prices to reflect the import price increases during 2006, but it should ensure that in the future the gas price adequately and without delay reflects import prices. At the moment, the increase in natural gas prices will leave a gap of approximately 10% to 20 % in market prices.

The subsidy to household gas bills represents an important and increasing burden on the budget of up to HUF 143 billion in 2006, which is not compatible with current budgetary constraints and encourages demand. The government is already contemplating significant changes to this system, and it should consider implementing these rapidly.

OIL

There have been important developments in the Hungarian oil market since the last review. The privatisation of MOL has continued, while the company has conducted further international expansion. The state-held stake of MOL has now been reduced to 1.7% through recent divestments, and about 60% of the shares are owned by international institutional investors. In 2005, Hungary made an important and valuable contribution to the IEA emergency action following the supply disruption caused by hurricane Katrina.

The dominance of MOL on the wholesale market in Hungary is creating a situation that needs to be closely observed by the Hungarian Competition Office. It is commendable that the Competition Office takes action it considers warranted, as it did in 2005.

Smuggling on the border with Ukraine is a serious challenge for Hungary's customs office, and the scale of the smuggling raises the possibility that oil statistics in Hungary are not correctly estimating actual demand. The government is commended for its effort to reduce the smuggling, and should continue to undertake to eradicate it as far as possible. It is important to continue anti-smuggling operations, in order to maintain the present quality of oil products as well as the reliability of the national tax system.

Despite a commendable reduction in oil demand in recent years, it is forecast that oil will continue to play a major role in the country's energy supply until 2030. Demand is estimated to increase by over 13% between 2004 and 2006, owing to the growth of oil consumption in the transport sector. Simultaneously Hungary's oil production is forecast to fall. The government does not have an active policy encouraging exploration in licensed areas. Tying licences to concrete exploration plans with the possibility of having them revert to the government if no activity takes place is a policy that has been successful in other mature oil areas, such as in Norway. The government could study such examples of encouraging exploration and production from other mature areas.

The Hungarian Administration and the Hungarian Hydrocarbon Stockpiling Association are commended for their active participation in promoting oil security as part of the IEA's outreach work with new EU entrants and other key non-IEA consuming countries.

COAL

Coal's share in Hungary's TPES is relatively low and stable. It may increase again if RWE decides to resurrect its investment plan for a new lignite-fired power station in Hungary or if another player moves forward. Also, owing to recent price increases and security of supply concerns over the use of natural gas, it is possible that other new generation facilities in Hungary will be based on imported hard coal. Hungary is sufficiently below the EU limit for CO_2 emissions that it would be possible to increase coal-fired generating capacity significantly without reaching carbon emission constraints. If new investments in coal are to be made, the government should encourage the generators to adopt efficient technologies, and urge investment in plant types that fit well into the Hungarian electricity market.

The primary use of coal in Hungary is in the power generation sector, where one large lignite plant and several smaller hard coal plants are operating. The partially state-owned (through MVM) 836-MW Mátra lignite plant in particular plays a crucial role in supporting low electricity prices in Hungary, together with the Paks NPP.

The support system for coal has been changed to a direct subsidy levied as part of the transmission charge, a system design based on the former German Coal Cent support system; the EU has accepted this revised system. The transition to a more transparent support system that will not have distortionary effects on the electricity market is commendable.

RECOMMENDATIONS

The government of Hungary should:

Natural Gas

- *Improve energy security by the following:*
  - *Promoting more gas diversification of supply sources and routes, to avoid over-dependence on a single gas supplier and to encourage gas competition inside the country.*
  - *Paying more attention to encouraging exploration and production and to disseminate geological and other relevant data, taking into consideration Hungary's geological potential.*
  - *Removing all remaining obstacles to companies wanting to export gas, including domestic gas.*
  - *Investigating cost-effective measures to supplement the implementation of the new strategic natural gas storage. Particular attention should also be paid to the cost of this new service for final consumers considering the difficulties for government to increase prices and tariffs.*

- *Introduce full market opening by the following:*
  - *Taking timely and appropriate measures to fully open the gas market in compliance with the EU directives by July 2007 and to improve competition in the gas market by removing the main barriers such as restriction of exports, or the single buyer model.*
  - *Ensuring that the price of gas reflects the costs associated with it. The social consequences of bringing gas prices to market levels could be addressed by more appropriate and focused measures to offset the impact on the poorest part of the population.*
  - *Encouraging the regulator to monitor the development of transmission and distribution networks and adapt if necessary the regulation or network code in order to facilitate access to capacities, investment in commercial storage and other infrastructure, reduce congestion and promote more transparency, in consultation with all interested parties.*
- *Promote efficiency measures in order to try to reduce gas consumption by households.*

Oil

- *Continue to act as an excellent role model for others in the fields of energy security policies and practices.*
- *Continue to ensure that the competition authority carefully monitors the market in order to maintain competition and to prevent potential abuses of market power by a dominant player.*
- *Continue successful efforts to prevent smuggling of oil products, especially gasoline and diesel.*
- *Pay more attention to encouraging exploration and production, and disseminating geological and other relevant data, taking into consideration Hungary's geological potential.*

Coal

- *Continue to reduce subsidies for non-competitive coal production.*
- *Investigate the potential for new or upgraded coal-fired power stations that could substantially increase the efficiency of coal use, as well as biomass use where co-firing is practiced.*

R&D STRATEGY AND SKILL BASE

STRATEGY

The government aims to develop a thriving research and development (R&D) sector in the country by 2025. The Hungarian R&D strategy to achieve this goal is defined in the National Development Plans NDP I (2004-2006) and NDP II (2007-2013), which are supported by EU funding. The objectives of the NDPs are to achieve the following:

- A more competitive economy.
- An improved use of human resources.
- To improve the environment and promote regional development.

The NDPs are to be implemented through Economic Competitiveness Programmes, which receive funding from EU Structural Funds. These programmes contain some R&D-related objectives, in particular to achieve scientific and technological breakthroughs in targeted areas; to establish coherence among basic and applied research as well as continued technological development; to strengthen co-operation among Hungarian R&D institutions; and finally to improve economic relations between institutions and business. The programmes also have to consider appropriate human resource requirements when implementing R&D projects. "Energy & Environment" is one of six core research themes supported by the NDPs.

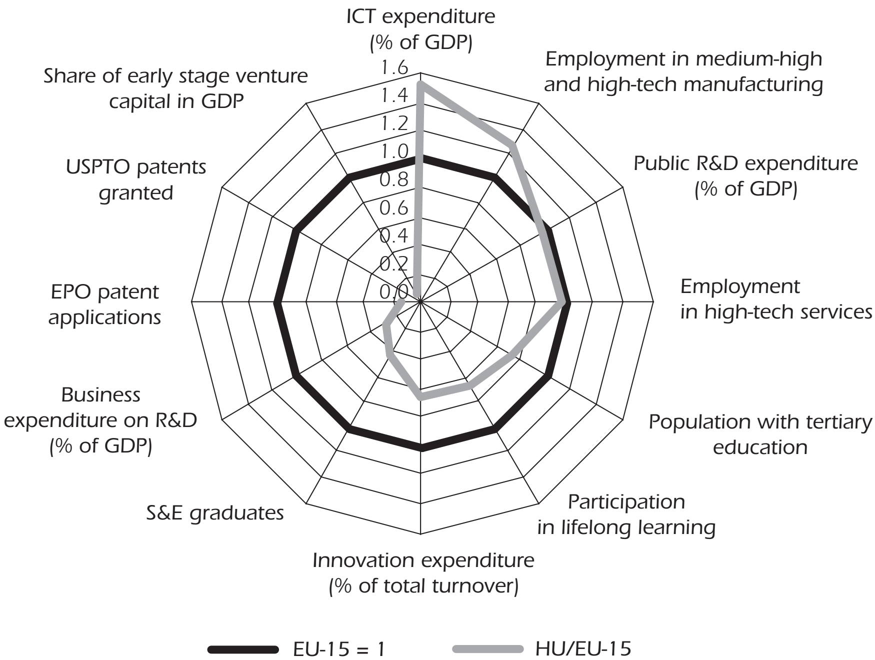
At present, there is no dedicated energy R&D strategy beyond the NDPs.

SKILL BASE

The government has identified the particular strong and weak points in its R&D environment. According to this analysis, Hungary benefits from a high-quality education system, and a highly-qualified workforce, especially in natural sciences, engineering and medical sciences. The high calibre of the Hungarian science base is internationally recognised. Also, the increasing presence of multinational companies from knowledge-intensive sectors with R&D units in Hungary, and Hungarian productivity growth should provide a good basis for R&D activities. Counteracting these positive aspects are comparatively low R&D expenditures, predominantly from the government, and a low innovation intensity of companies, especially of small and medium-sized enterprises. The existing strong science base is inadequately linked to industry, and this leads to weak efforts at commercialisation and exploitation of R&D results, and a lack of patenting. Relatively low funding of R&D has resulted in a small number of research staff, and researchers are ageing because highly-qualified individuals prefer to work abroad. Additional problems are an inadequate infrastructure, with strong regional disparities. Figure 30 below shows Hungary's performance on a range of indicators at the time of accession to the EU, compared to the average for these indicators of the pre-2004 members of the EU.

Figure 30

Comparison of Selected Indicators between Hungary and EU-15, 2004*



* ICT = Information & Communication Technology. USPTO = US Patent Office. EPO = European Patent Office. S&E = Science and Engineering.

Source: EU Innovation Scoreboard 2004.

IMPLEMENTATION STRUCTURE

Since Hungary's accession to the EU on 1 May 2004, the government has made significant structural changes to the framework that underpins the country's technology R&D. The new structure under which R&D is carried out is shown in Figure 31. The driver behind these changes was the realisation that Hungary's long-term competitiveness was linked to its ability to shift towards a knowledge-based economy, and that the existing structure was not sufficiently developed to support such a shift.

The key element of the R&D institutional change was the establishment of the Science and Technology Policy Board (TTPK). The TTPK is chaired by the Prime Minister and also includes the Minister of Education and the Minister of Economy and Transport, with the latter responsible for energy-related research. This high-level membership of the TTPK demonstrates the strong political support for developing technology R&D. The board acts as an advisory body, preparing decisions and co-ordinating and evaluating R&D policy to support the achievement of government targets.

Another key change was the establishment of the Science and Technology Advisory Committee (TTTT), which is comprised of six to eight eminent citizens who meet on a weekly basis to provide advice to the government on the management of the National Development Plan.

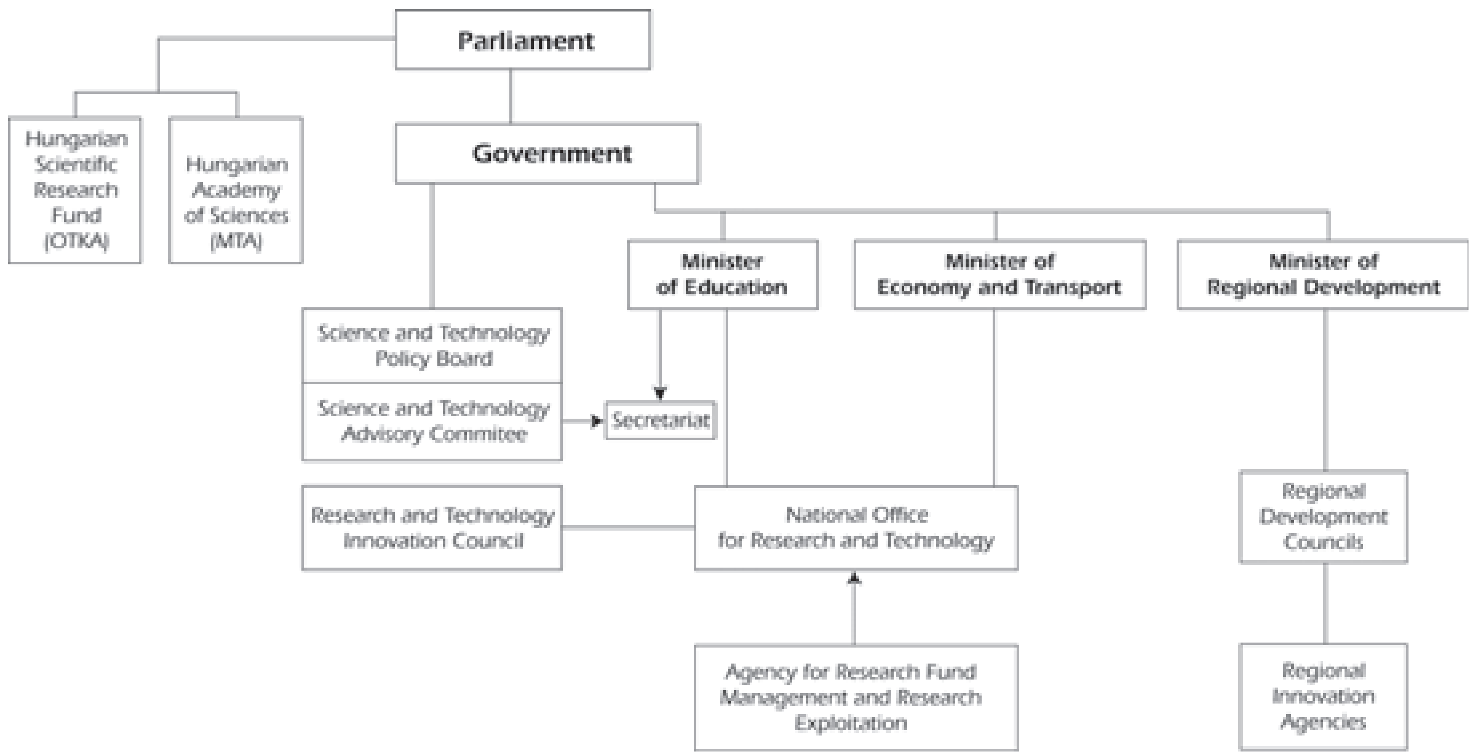
The National Office for Research and Technology (NKTH) was also established to conduct the day-to-day implementation of the government R&D policy. The NKTH is responsible for implementing the government's science and technology policy. Its duties are to provide a new framework for the national innovation system and to promote R&D that will boost the Hungarian economy. The NKTH has been jointly established, and is supervised, by the Minister of Education and the Minister of Economy and Transport. Within the Oszkár Asbóth Programme (see box below), the NKTH's role is to support the setting-up of technology platforms and innovation clusters, the establishment of Innovation Cluster Centres (ICC) in charge of co-ordination and the research, development and implementation activities of the participating organisations.

The NKTH is also advised and partially overseen by the Research and Technology Innovation Council, which has responsibility for strategic issues related to planning and monitoring the utilisation of the fund created from the business levy (see below under R&D Funding). This council is headed by a non-government representative, and of its 15 members, eight are non-governmental representatives and government officials.

Since 1 July 2003, the Agency for Research Fund Management and Research Exploitation (KPI) operates as the implementation agency, and is supervised by the President of NKTH. It manages R&D calls for proposals, innovation programmes, evaluation and follow-up activities, promotes public-private partnership and provides support services to the NKTH.

Figure 31

Structure of Hungarian R&D



Source: Country submission.

In the academic sector, the Hungarian Academy of Sciences (MTA) maintains a special academic research network. The MTA and its institutes are financed by state budget and overseen by Parliament.

Hungary's R&D funding is split between a range of research programmes. The main programmes are the Oszkár Asbóth Innovation Programme (see box below), the Regional University Knowledge Centre Programme, the Ányos Jedlik Programme, the Ede Teller Programme, and the Economical Operative Competitiveness Programme funded by EU Structural Funds. All programmes address energy as part of their overall programme design, and have different application and selection criteria for eligible projects.

The Oszkár Asbóth Innovation Programme

Objectives

Primary objective

The programme's main objective is to accelerate improvement in cutting-edge industries through the promotion of the establishment of technology platforms and innovation clusters in the following sectors:

- Health.
- Biotechnology.
- Agriculture-based renewable energy resources.

Secondary objective

- Strengthening of technology transfer in cutting-edge industries.
- Promotion of the establishment of innovation clusters of international quality.
- Creation of the intellectual and infrastructure background necessary for R&D and innovation activities at innovation clusters.
- Promotion of the establishment and settlement of knowledge and technology-intensive business.
- Attraction of new foreign capital into cutting-edge industries.
- Promotion of labour mobility and job creation.

Eligible activities under the programme are applied research, experimental development and activities specifically related to the funding of R&D. These include technology transfer; providing R&D and innovational services, analyses, studies, strategies and plans; setting-up "spin-off" and "start-up" enterprises; protecting intellectual property rights; involving PhD students; training young researchers; international co-operation and consulting.

...

Eligible applicants for this programme are teams comprising a maximum of ten members, created to carry out the tasks specified in the project proposal, which may come from the following types of institutions:

- Enterprises.
- Universities.
- Public research units.
- Non-profit research units.
- Professional and industrial lobbying bodies active in the area of innovation.

Source and budget of funding

HUF 6.5 billion from the budget of the Research and Technological Innovation Fund. A maximum of 50% of the funding received may be spent on R&D infrastructure development.

Proposal assessment, evaluation criteria

The proposals are evaluated by independent experts based on ten evaluation criteria, for which a maximum of 120 points can be reached. A minimum of 80 points is needed to receive funding support. The proposals are ranked by the Governing Board with the assistance of international experts. On the basis of the recommendations of the Governing Board, the president of NKTH decides about granting project funding.

Successful energy projects

In 2005, five projects received funding, of which two were energy-related. One project received funding of HUF 1.16 billion to create a Bioenergy Innovation Cluster and implement R&D programmes related to biomass utilisation. The Innovation Cluster Centre will co-ordinate three main R&D programmes in the fields of production and heat utilisation of biomass; utilisation of organic wastes and processing biogas; and producing biological fuels, animal fodder and glycerin. These three R&D areas will be realised in close co-operation by the members of the consortium, which aims to promote multilateral scientific co-operation, dissemination and commercial adoption of the results.

Another project to develop the use of renewable energy for the sustainable growth of agriculture received HUF 900 million.

R&D FUNDING

Since accession, Hungary has been spending less than 1% of its GDP on R&D, about half as much as its new EU partners. In addition, around two-thirds of the total amount being spent on R&D is from public finances, and this relatively low share of private funding is considered one of the main risks to Hungary's R&D. In 2002, the share of private enterprises in the financing of R&D was less than half that of countries such as Finland, Germany or Ireland (see Table 31).

To increase the share of private funding, the Research and Technology Innovation Fund was established through legislation introduced in 2003 as a means of financing selected R&D projects. The administration of the fund is a key part of the NKTH's mandate. The main aim of the fund is to help create a predictable environment for R&D funding, regardless of the current financial situation of the government. All enterprises, with the exception of micro-enterprises, are obliged to pay 0.3% of their net annual turnover into the fund. This amount is matched by a contribution from the government. Representatives of academia and industry submit joint R&D proposals to this fund. By 2004, the introduction of the fund had already had the desired effect, increasing the share of private funding while reducing the share of government funding of R&D (see Figure 32).

Table 31

Government and Business Share of Total R&D Expenditure in Selected Countries in %, 2002[1]

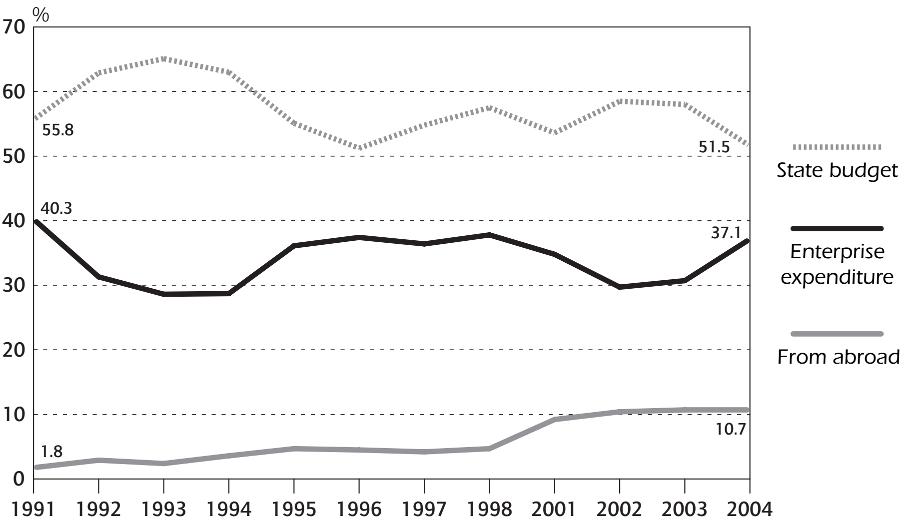
Country	*Business enterprises*	*Government sector*
Austria	44.6	33.6
Czech Republic	53.7	42.1
Finland	69.5	26.1
France	52.1	38.4
Germany	65.5	31.6
Hungary	29.7	58.5
Ireland	63.4	28.0
Netherlands	50.0	37.1
Poland	30.1	61.9
Slovak Republic	53.6	44.1
Spain	48.9	39.1
United Kingdom	46.1	27.8

1. Numbers do not add up to 100% because of other funding sources being present, *e.g.* the EU.

Source: Country submissions.

Figure 32

R&D Expenditure by Source, 1991 to 2004



Source: Country submission.

CRITIQUE

Since the last review, important developments have taken place in Hungarian R&D, and the government is to be commended for the bold steps it has taken to improve the levels of technology R&D and to change the structure of R&D funding. The government has also set itself ambitious long-term goals, and it will need to develop clear sectoral strategies to achieve these. In this context, the absence of a dedicated energy R&D strategy and the fact that no progress appears to have been made on developing a strategy since the last in-depth review gives rise to concern.

A key element of the stronger focus on developing Hungarian R&D was the introduction of the business levy in 2003. According to the government, industry and business representatives have not criticised the introduction of this levy. It is possible that this was due to the relatively low level of contribution required, even though it is expected that this could rise in future years. A more important aspect may however be industry's ability to offset the obligatory contribution by undertaking direct spending on R&D. If this effect could be confirmed, it would be consistent with the government's efforts to change the current relationship of public to private R&D investment.

Hungary is operating several multi-disciplinary R&D programmes in parallel. In a situation of limited budgets, dispersing funding across several programmes may lead to reduced effectiveness. It may be worthwhile for the government to consider following the restructuring of R&D institutions with a revision of R&D programmes, to ensure that available funding is used to its full potential.

Although Hungary's energy technology R&D funding is limited, much of the support is directed towards computer-based control systems for nuclear power stations and bioenergy production. Given limited funding, it is important that Hungary continue to select a smaller set of targeted energy projects for R&D funding which show the most promise, rather than spreading R&D expenditures across a range of energy technologies. Given the relatively high amounts of spending that are needed to advance energy R&D breakthroughs, Hungary should benefit from this sort of targeted approach.

Additional financing for R&D activities in Hungary is provided through the EU Structural Funds that became available following accession to the EU. The management of these funds is set out in the National Development Plans, which run through to 2013. One of the six priority areas eligible for funding includes "development of environment and energy". Establishing such a focus is commendable.

The government has provided important support for international collaboration on R&D, including the important area of implementation. Hungarian international collaboration in this area extends to activities in 35 countries. However, Hungary does not participate in Implementing Agreements within the IEA technology collaboration framework.

RECOMMENDATIONS

The government of Hungary should:

- *Expand upon its current progress on advancing R&D to design and implement a focused energy R&D strategy. Such a strategy could set priorities consistent with energy and environmental policy goals, and could include energy or environmental targets.*
- *Once clear targets are set, develop evaluation criteria and procedures that allow the government to track the impact of various approaches and actively engage the private sector and academic research institutions.*
- *Continue to focus national energy R&D efforts on key areas where more can be achieved, rather than funding several initiatives across a broad set of energy technologies.*
- *Develop a clear description of the roles and responsibilites of the various institutions involved. This will help resolve uncertainties among academia*

and industry as to which organisation is responsible for various aspects of R&D policy and implementation.

- *Continue to be active in international collaboration to share technology development experiences with other countries to deal with global challenges that require significant funding over the long term. This would allow Hungary to learn about energy technologies and approaches that it is not currently investing in.*

- *Consider the utility of joining IEA Implementing Agreements and other networks, in particular the Implementing Agreements on Bioenergy, Electricity Networks Analysis, and Research and Development. Also participate in institutional capacity-building activities to continue to improve the design, management, priority-setting and evaluation of R&D policies and programmes.*

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 Agency. The *Shared Goals* are set out in Annex C.

REVIEW TEAM

The In-depth Review Team visited Budapest and the Paks Nuclear Power Plant from 3 to 7 July 2006. During the visit, the team met with government administrators, energy suppliers and various other organisations and interest groups, and addressed the major issues relating to the country's energy situation.

The team is grateful for the co-operation and assistance of the many people it met during its visit. Thanks to their willingness to share information and their open hospitality, the visit was both highly productive and enjoyable. The team wishes to make special mention of the understanding and courteous professionalism displayed by Miklós Poós, Judit Kopácsy and Zsolt Pataki in preparing and accompanying the visit.

The members of the team were:

Florence Tordjman
Ministry of Industry,
France (Team Leader)

Hans-Christoph Pape
Ministry of Economics,
Germany

Sven-Olov Ericsson
Ministry of Sustainability,
Sweden

Hisashi Yoshikawa
METI, Japan

Giordano Rigon
European Commission

Stan Gordelier
Nuclear Energy Agency

Noé van Hulst
International Energy Agency

Amos Bromhead
International Energy Agency

Andreas Biermann
International Energy Agency

Andreas Biermann managed the review and drafted the report with the exception of the nuclear section, which was drafted by Stan Gordelier of the NEA. Monica Petit and Bertrand Sadin prepared the figures. Sandra Martin provided editorial assistance. Cintia Gávay ensured the correct spelling of Hungarian place and company names.

ORGANISATIONS VISITED

- AES Hungary
- Association of District Heating Companies
- Clean Air Action Group
- E.On Hungária
- Energy Club
- GDF Hungary
- Hungarian Atomic Energy Office
- Hungarian Competition Office
- Energy Centre
- Hungarian Energy Office
- Hungarian Petroleum Association
- Hungarian Hydrocarbon Stockpiling Association
- Industrial Energy Consumers' Association
- MAVIR
- Ministry of Agriculture and Rural Development
- Ministry of Economy and Transport
- Ministry of Finance
- Ministry of Environmental Protection and Water Management
- MOL Group
- MVM
- National Technical Research Office
- Nuclear Waste Management Plc
- Paks Nuclear Power Plant
- Renewable Energy Association
- Research Institute of Energy
- Technical University of Budapest
- WWF

ENERGY BALANCES AND KEY STATISTICAL DATA

Unit: Mtoe

SUPPLY		1973	1990	2003	2004	2010	2020	2030
TOTAL PRODUCTION		**12.70**	**14.33**	**10.41**	**10.24**	**9.72**	**9.13**	**8.66**
Coal[1]		6,05	4.14	2.71	2.18	2.00	1.80	1.60
Oil		2.02	2.27	1.61	1.59	1.00	0.80	0.70
Gas		4.03	3.81	2.29	2.37	1.80	1.40	1.00
Comb. Renewables & Waste[2]		0.59	0.42	0.82	0.87	1.00	1.20	1.40
Nuclear		–	3.58	2.89	3.12	3.79	3.79	3.79
Hydro		0.01	0.02	0.02	0.02	0.02	0.02	0.02
Geothermal		–	0.09	0.09	0.09	0.10	0.10	0.10
Solar/Wind/Other		–	–	0.00	0.00	0.01	0.03	0.05
TOTAL NET IMPORTS[3]		**8.66**	**14.17**	**16.35**	**16.01**	**17.40**	**21.44**	**22.81**
Coal[1]	Exports	0.11	–	0.05	0.08	–	–	–
	Imports	1.74	1.63	1.05	1.21	0.32	0.32	0.32
	Net Imports	1.63	1.63	1.00	1.13	0.32	0.32	0.32
Oil	Exports	0.92	1.52	2.51	2.86	1.50	1.50	1.50
	Imports	7.39	7.96	7.32	7.82	7.74	8.14	8.84
	Bunkers	–	–	–	–	–	–	–
	Net Imports	6.48	6.44	4.81	4.96	6.24	6.64	7.34
Gas	Exports	0.01	0.02	–	–	–	–	–
	Imports	0.17	5.19	9.94	9.28	10.68	14.16	14.95
	Net Imports	0.15	5.17	9.94	9.28	10.68	14.16	14.95
Electricity	Exports	0.09	0.19	0.61	0.26	0.16	0.16	0.15
	Imports	0.49	1.14	1.21	0.91	0.31	0.47	0.35
	Net Imports	0.40	0.96	0.60	0.64	0.16	0.31	0.20
TOTAL STOCK CHANGES		**–0.02**	**0.07**	**–0.42**	**0.11**	**–**	**–**	**–**
TOTAL SUPPLY (TPES)		**21.33**	**28.56**	**26.34**	**26.36**	**27.11**	**30.57**	**31.47**
Coal[1]		7.91	6.12	3.75	3.50	2.32	2.12	1.92
Oil		8.21	8.51	6.30	6.41	7.24	7.44	8.04
Gas		4.17	8.91	11.88	11.71	12.48	15.56	15.95
Comb. Renewables & Waste[2]		0.64	0.38	0.82	0.87	1.00	1.20	1.40
Nuclear		–	3.58	2.89	3.12	3.79	3.79	3.79
Hydro		0.01	0.02	0.02	0.02	0.02	0.02	0.02
Geothermal		–	0.09	0.09	0.09	0.10	0.10	0.10
Solar/Wind/Other		–	–	0.00	0.00	0.01	0.03	0.05
Electricity Trade[4]		0.40	0.96	0.60	0.64	0.16	0.31	0.20
Shares (%)								
Coal		*37.1*	*21.4*	*14.2*	*13.3*	*8.6*	*6.9*	*6.1*
Oil		*38.5*	*29.8*	*23.9*	*24.3*	*26.7*	*24.3*	*25.6*
Gas		*19.6*	*31.2*	*45.1*	*44.4*	*46.0*	*50.9*	*50.7*
Comb. Renewables & Waste		*3.0*	*1.3*	*3.1*	*3.3*	*3.7*	*3.9*	*4.4*
Nuclear		–	*12.5*	*11.0*	*11.8*	*14.0*	*12.4*	*12.0*
Hydro		–	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Geothermal		–	*0.3*	*0.3*	*0.3*	*0.4*	*0.3*	*0.3*
Solar/Wind/Other		–	–	–	–	–	*0.1*	*0.2*
Electricity Trade		*1.9*	*3.4*	*2.3*	*2.4*	*0.6*	*1.0*	*0.6*

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

Unit: Mtoe

DEMAND

FINAL CONSUMPTION BY SECTOR

	1973	1990	2003	2004	2010	2020	2030
TFC	**17.14**	**21.02**	**19.00**	**19.14**	**19.59**	**21.66**	**21.95**
Coal[1]	4.17	2.68	0.66	0.66	0.72	0.52	0.52
Oil	6.71	7.41	5.72	6.11	6.00	6.20	6.80
Gas	3.08	6.20	7.73	7.75	8.13	10.61	10.40
Comb. Renewables & Waste[2]	0.62	0.34	0.75	0.63	0.50	0.60	0.90
Geothermal	–	0.09	0.08	0.08	0.09	0.09	0.09
Solar/Wind/Other	–	–	0.00	0.00	–	–	–
Electricity	1.51	2.72	2.70	2.74	2.78	2.20	1.80
Heat	1.06	1.59	1.37	1.18	1.37	1.44	1.44
Shares (%)							
Coal	*24.3*	*12.7*	*3.5*	*3.4*	*3.7*	*2.4*	*2.4*
Oil	*39.1*	*35.2*	*30.1*	*31.9*	*30.6*	*28.6*	*31.0*
Gas	*17.9*	*29.5*	*40.7*	*40.5*	*41.5*	*49.0*	*47.4*
Comb. Renewables & Waste	*3.6*	*1.6*	*3.9*	*3.3*	*2.6*	*2.8*	*4.1*
Geothermal	–	*0.4*	*0.4*	*0.4*	*0.5*	*0.4*	*0.4*
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*8.8*	*12.9*	*14.2*	*14.3*	*14.2*	*10.2*	*8.2*
Heat	*6.2*	*7.6*	*7.2*	*6.1*	*7.0*	*6.6*	*6.5*
TOTAL INDUSTRY[5]	**7.90**	**8.08**	**4.87**	**4.99**	**5.13**	**5.86**	**5.90**
Coal[1]	1.87	0.80	0.38	0.41	0.52	0.32	0.32
Oil	2.34	2.11	1.42	1.66	1.38	1.27	1.41
Gas	2.29	3.76	1.69	1.56	2.01	3.11	3.11
Comb. Renewables & Waste[2]	0.02	0.00	0.08	0.07	–	–	–
Geothermal	–	–	0.00	0.00	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	0.92	1.18	0.82	0.82	0.82	0.74	0.63
Heat	0.46	0.23	0.48	0.47	0.40	0.43	0.43
Shares (%)							
Coal	*23.6*	*9.9*	*7.8*	*8.2*	*10.1*	*5.5*	*5.4*
Oil	*29.6*	*26.1*	*29.2*	*33.3*	*27.0*	*21.7*	*23.9*
Gas	*29.0*	*46.5*	*34.6*	*31.3*	*39.1*	*53.0*	*52.7*
Comb. Renewables & Waste	*0.2*	–	*1.6*	*1.4*	–	–	–
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*11.7*	*14.6*	*16.9*	*16.4*	*16.0*	*12.6*	*10.7*
Heat	*5.9*	*2.8*	*9.8*	*9.4*	*7.8*	*7.3*	*7.2*
TRANSPORT[6]	**2.37**	**3.15**	**3.82**	**3.99**	**4.05**	**4.51**	**4.94**
TOTAL OTHER SECTORS[7]	**6.88**	**9.79**	**10.30**	**10.17**	**10.41**	**11.29**	**11.10**
Coal[1]	1.93	1.88	0.27	0.25	0.20	0.20	0.20
Oil	2.45	2.25	0.57	0.56	0.65	0.49	0.50
Gas	0.78	2.44	6.04	6.18	6.12	7.51	7.29
Comb. Renewables & Waste[2]	0.60	0.34	0.67	0.56	0.50	0.60	0.90
Geothermal	–	0.09	0.08	0.08	0.09	0.09	0.09
Solar/Wind/Other	–	–	0.00	0.00	–	–	–
Electricity	0.52	1.43	1.79	1.83	1.88	1.40	1.11
Heat	0.60	1.36	0.89	0.71	0.97	1.01	1.01
Shares (%)							
Coal	*28.1*	*19.2*	*2.6*	*2.4*	*1.9*	*1.8*	*1.8*
Oil	*35.7*	*22.9*	*5.5*	*5.5*	*6.2*	*4.3*	*4.5*
Gas	*11.4*	*25.0*	*58.6*	*60.8*	*58.8*	*66.5*	*65.6*
Comb. Renewables & Waste	*8.7*	*3.4*	*6.5*	*5.5*	*4.8*	*5.3*	*8.1*
Geothermal	–	*0.9*	*0.8*	*0.8*	*0.9*	*0.8*	*0.8*
Solar/Wind/Other	–	–	–	–	–	–	–
Electricity	*7.5*	*14.6*	*17.3*	*18.0*	*18.1*	*12.4*	*10.0*
Heat	*8.7*	*13.9*	*8.6*	*7.0*	*9.3*	*8.9*	*9.1*

Unit: Mtoe

DEMAND

ENERGY TRANSFORMATION AND LOSSES

	1973	1990	2003	2004	2010	2020	2030
ELECTRICITY GENERATION[8]							
INPUT (Mtoe)	**6.37**	**10.23**	**9.77**	**9.51**	**10.73**	**11.44**	**11.76**
OUTPUT (Mtoe)	**1.52**	**2.45**	**2.94**	**2.90**	**3.20**	**3.56**	**4.07**
(TWh gross)	17.64	28.44	34.15	33.71	37.18	41.44	47.34
Output Shares (%)							
Coal	*66.0*	*30.5*	*27.1*	*24.7*	*13.4*	*10.9*	*8.5*
Oil	*17.2*	*4.8*	*4.8*	*2.3*	*6.7*	*8.4*	*7.4*
Gas	*16.2*	*15.7*	*34.8*	*34.8*	*37.7*	*42.2*	*49.6*
Comb. Renewables & Waste	–	*0.1*	*0.6*	*2.2*	*2.4*	*2.4*	*2.3*
Nuclear	–	*48.3*	*32.3*	*35.3*	*39.0*	*35.0*	*30.6*
Hydro	*0.6*	*0.6*	*0.5*	*0.6*	*0.5*	*0.4*	*0.4*
Geothermal	–	–	–	–	–	–	–
Solar/Wind/Other	–	–	*0.0*	*0.0*	*0.2*	*0.6*	*1.2*
TOTAL LOSSES	**4.87**	**7.99**	**7.17**	**7.10**	**7.52**	**8.91**	**9.52**
of which:							
Electricity and Heat Generation[9]	3.67	6.03	5.30	5.24	6.04	6.32	6.14
Other Transformation	0.21	–0.05	0.09	0.06	0.18	0.18	0.19
Own Use and Losses[10]	0.99	2.02	1.78	1.80	1.31	2.40	3.19
Statistical Differences	**–0.68**	**–0.45**	**0.18**	**0.11**	**–**	**–**	**–**

INDICATORS

	1973	1990	2003	2004	2010	2020	2030
GDP (billion 2000 USD)	30.46	43.70	52.70	55.10	69.72	108.27	168.14
Population (millions)	10.43	10.37	10.13	10.11	9.94	9.68	9.42
TPES/GDP[11]	0.70	0.65	0.50	0.48	0.39	0.28	0.19
Energy Production/TPES	0.60	0.50	0.40	0.39	0.36	0.30	0.28
Per Capita TPES[12]	2.05	2.76	2.60	2.61	2.73	3.16	3.34
Oil Supply/GDP[11]	0.27	0.19	0.12	0.12	0.10	0.07	0.05
TFC/GDP[12]	0.56	0.48	0.36	0.35	0.28	0.20	0.13
Per Capita TFC[12]	1.64	2.03	1.88	1.89	1.97	2.24	2.33
Energy-related CO_2 Emissions (Mt CO_2)[13]	68.4	70.6	57.7	56.8	55.7	62.6	64.2
CO_2 Emissions from Bunkers (Mt CO_2)	0.2	0.5	0.6	0.7	0.9	1.3	2.1

GROWTH RATES (% per year)

	73–79	79–90	90–03	03–04	04–10	10–20	20–30
TPES	4.9	0.1	–0.6	0.1	0.5	1.2	0.3
Coal	1.2	–3.0	–3.7	–6.6	–6.6	–0.9	–1.0
Oil	5.6	–2.6	–2.3	1.6	2.1	0.3	0.8
Gas	10.0	1.7	2.2	–1.5	1.1	2.2	0.2
Comb. Renewables & Waste	–2.6	–3.3	6.2	6.0	2.3	1.8	1.6
Nuclear	–	–	–1.6	8.1	3.3	–	–
Hydro	6.3	1.3	–	20.0	–1.9	–	–
Geothermal	–	–	–	–	2.5	–	–
Solar/Wind/Other	–	–	–	–	30.8	9.6	7.2
TFC	4.5	–0.5	–0.8	0.8	0.4	1.0	0.1
Electricity Consumption	6.0	2.2	–0.0	1.3	0.3	–2.3	–2.0
Energy Production	2.4	–0.2	–2.4	–1.7	–0.9	–0.6	–0.5
Net Oil Imports	7.1	–3.8	–2.2	3.1	3.9	0.6	1.0
GDP	4.3	1.0	1.5	4.6	4.0	4.5	4.5
Growth in the TPES/GDP Ratio	0.6	–0.9	–2.0	–4.3	–3.4	–3.2	–4.0
Growth in the TFC/GDP Ratio	0.2	–1.5	–2.2	–3.6	–3.5	–3.3	–4.2

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

FOOTNOTES TO ENERGY BALANCES AND KEY STATISTICAL DATA

1. Includes lignite.
2. Comprises solid biomass, liquid biomass, biogas, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.
3. Total net imports include combustible renewables and waste.
4. Total supply of electricity represents net trade.
5. Includes non-energy use.
6. Includes less than 1% non-oil fuels.
7. Includes residential, commercial, public service and agricultural 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 (formerly known as public) and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of 33% for nuclear, 10% for geothermal and 100% for hydro.
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 International Panel on Climate Change (IPCC) Tier I Sectoral Approach. In accordance with the IPCC methodology, emissions from international marine and aviation bunkers are not included in national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 2004 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.

INTERNATIONAL ENERGY AGENCY "SHARED GOALS"

The 26 member countries* of the International Energy Agency (IEA) seek to create the conditions in which the energy sectors of their economies can make the fullest possible contribution to sustainable economic development and the well-being of their people and of the environment. In formulating energy policies, the establishment of free and open markets is a fundamental point of departure, though energy security and environmental protection need to be given particular emphasis by governments. IEA countries recognise the significance of increasing global interdependence in energy. They therefore seek to promote the effective operation of international energy markets and encourage dialogue with all participants.

In order to secure their objectives they therefore aim to create a policy framework consistent with the following goals:

1. **Diversity, efficiency and flexibility within the energy sector** are basic conditions for longer-term energy security: the fuels used within and across sectors and the sources of those fuels should be as diverse as practicable. Non-fossil fuels, particularly nuclear and hydro power, make a substantial contribution to the energy supply diversity of IEA countries as a group.

2. Energy systems should have **the ability to respond promptly and flexibly to energy emergencies.** In some cases this requires collective mechanisms and action: IEA countries co-operate through the Agency in responding jointly to oil supply emergencies.

3. **The environmentally sustainable provision and use of energy** is central to the achievement of these shared goals. Decision-makers should seek to minimise the adverse environmental impacts of energy activities, just as environmental decisions should take account of the energy consequences. Government interventions should where practicable have regard to the Polluter Pays Principle.

4. **More environmentally acceptable energy sources** need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of IEA members wish to retain and improve the nuclear

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

option for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

5. **Improved energy efficiency** can promote both environmental protection and energy security in a cost-effective manner. There are significant opportunities for greater energy efficiency at all stages of the energy cycle from production to consumption. Strong efforts by governments and all energy users are needed to realise these opportunities.

6. Continued **research, development and market deployment of new and improved energy technologies** make a critical contribution to achieving the objectives outlined above. Energy technology policies should complement broader energy policies. International co-operation in the development and dissemination of energy technologies, including industry participation and co-operation with non-member countries, should be encouraged.

7. **Undistorted energy prices** enable markets to work efficiently. Energy prices should not be held artificially below the costs of supply to promote social or industrial goals. To the extent necessary and practicable, the environmental costs of energy production and use should be reflected in prices.

8. **Free and open trade** and a secure framework for investment contribute to efficient energy markets and energy security. Distortions to energy trade and investment should be avoided.

9. **Co-operation among all energy market participants** helps to improve information and understanding, and encourage the development of efficient, environmentally acceptable and flexible energy systems and markets worldwide. These are needed to help promote the investment, trade and confidence necessary to achieve global energy security and environmental objectives.

(The Shared Goals were adopted by IEA Ministers at their 4 June 1993 meeting in Paris.)

GLOSSARY AND LIST OF ABBREVIATIONS

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

bcm	billion cubic metres
bpd	barrels per day
CCGT	combined-cycle gas turbine
CH_4	methane
CHP	combined production of heat and power
CO_2	carbon dioxide
COMECON	Council of Mutual Economic Assistance
DH	district heating
EC	European Commission
EIA	environmental impact assessment
ESCO	Energy Service Company
EU	European Union
EU-ETS	European Union Emissions Trading Scheme
GDP	gross domestic product
GEF	Global Environment Facility
GHG	greenhouse gas
GJ	gigajoule, or 1 joule x 10^9
GW	gigawatt, or 1 watt x 10^9
GWh	gigawatt-hour
GW_{th}	gigawatt thermal

HAEA	Hungarian Atomic Energy Authority
HEO	Hungarian Energy Office
HUF	Hungarian forint
IAEA	International Atomic Energy Agency
IEA	International Energy Agency
IMF	International Monetary Fund
IPCC	International Panel on Climate Change
JI	Joint Implementation
kV	kilovolt, or one volt x 10^3
kWh	kilowatt-hour, or one kilowatt x one hour, or one watt x one hour x 10^3
LNG	liquefied natural gas
MAVIR	Hungarian Power System Operator Company
mcm	million cubic metres
MOL	Hungarian Oil and Gas Company
Mt	million tonnes
MTBE	methyl tertiary-butyl ether
MVM	Hungarian Electricity Companies
MW	megawatt of electricity, or 1 Watt x 10^6
MWh	megawatt-hour = one megawatt x one hour, or one watt x one hour x 10^6
NEA	Nuclear Energy Agency of the OECD
NEP	National Environment Programme
N_2O	nitrous oxide
NO_x	nitrogen oxides
NPP	nuclear power plant
OECD	Organisation for Economic Co-operation and Development
PJ	petajoule, or 1 Joule x 10^{15}
PPA	power purchase agreement

ppm	parts per million
PPP	purchasing power parity
PURAM	Public Agency for Radioactive Waste Management
R&D	research and development (may include the demonstration and dissemination phases as well (RD&D))
SO_2	sulphur dioxide
TFC	total final consumption of energy
toe	tonne of oil equivalent, defined as 10^7 kcal
TPA	third-party access
TPES	total primary energy supply
TSO	transmission system operator
TW	terawatt, or 1 watt x 10^{12}
TWh	terawatt x one hour, or one watt x one hour x 10^{12}
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
US	United States
VAT	value-added tax
VOCs	volatile organic compounds
VVER	Vodiano Vodianoi Energuyeticheski Reaktor, Russian-design

IEA PUBLICATIONS, 9, rue de la Fédération, 75739 PARIS CEDEX 15
PRINTED IN FRANCE BY STEDI MEDIA
(61 2006 26 1P1) ISBN : 92-64-1099–51 – 2007