# ENERGY POLICIES OF IEA COUNTRIES

# Hungary

## 2017 Review

International Energy Agency
Secure Sustainable Together

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## INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its primary mandate was – and is – two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its 29 member countries and beyond. The IEA carries out a comprehensive programme of energy co-operation among its member countries, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency's aims include the following objectives:

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

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# Executive summary

## Introduction

During the period since the last IEA in-depth review in 2011, Hungary has continued to make progress in the development and implementation of energy policy in some sectors. A number of key policy recommendations contained in the last review, most notably the need to improve security and flexibility of energy supply and clarification on the role of new nuclear power plants, have been implemented. Some recent policy measures, however, may risk having a negative impact on the energy sector over the longer term.

In 2012, the country finalised and published a new energy strategy, the National Energy Strategy to 2030 (NES 2030), which represented a major step in the formulation of a long-term vision for state policy in the energy sector. The main objective of the Strategy is to ensure a sustainable and secure energy sector while supporting the competitiveness of the economy. While the Strategy sets a clear long-term vision for the energy sector, a large amount of work remains to be done. Formulation of clear measures and allocation of responsibilities by means of action plans, highlighted in the NES 2030, are still in progress. Some action plans are under preparation and are expected to be finalised shortly. They should improve the long-term stability of the energy sector. The introduction of an independent process to monitor and evaluate progress in the implementation of policy measures on a regular basis is necessary to advance the realisation of the NES 2030.

## Reforming retail markets

Over the past five years, the retail energy market underwent significant changes. Utility costs represented an important proportion of family expenditure. In 2012, mindful of high energy costs and the impact on family budget, the government initiated a policy framework to reduce the costs for households. To address this situation, in December 2012 the government decided to reduce utility costs. The legislative amendments, carried out on the basis of the proposals of the Hungarian Energy and Public Utility Regulatory Authority (HEA), resulted in end-user prices decreasing by 10% for residential consumers benefiting from universal natural gas, electricity and district heating services from 1 January 2013. This was followed on 1 November 2013 by a second cut, which further reduced the price of natural gas, electricity and district heating by 11.1%. In early February 2014, parliament approved a third series of cuts to household energy and utility bills. This time, the price of natural gas fell by 6.5% from April 2014; the price of electricity by 5.7% from September 2014, and district heating prices by 3.3% from 1 October 2014.

The sale of natural gas to end-users entitled to universal supply has gradually become concentrated as the state-owned Hungarian Development Bank (MFB) and a state-owned energy holding company have bought privately owned gas retailers (subsidiaries of German utility RWE and French utility GDF). Other retailers (subsidiaries of E.ON and ENI) ceased operations and handed back their USP (universal service provider) licence to the regulator, leaving end-users with no option other than being supplied by the state-owned universal supplier. While the wholesale markets remain competitive, owing to exposure to regional markets, this policy led to consolidation in the retail market and left the government-owned incumbent with a two-third market share in wholesaling (OECD, 2016). This consolidation of market power is likely to have repercussions on the investment climate in the energy sector and on competition in the retail sector.

The decision of the foreign-owned companies to exit the Hungarian energy sector can be closely linked to the erosion of profits in their regulated businesses and increased regulatory uncertainty caused by the government mandating end-user price cuts. These price cuts applied to households and small users only; they have, to some extent been cross-subsidised by higher prices for industrial users excluded in these cuts (OECD, 2016).

While these price cuts, also imposed on the electricity sector, boosted the purchasing power of households and smaller companies, the accumulated costs to the retailers may be significant, depending on prevailing wholesale prices. Should global energy prices increase over time, the associated increase in contingent liabilities risks negatively impacting public finances. Energy price regulation in Hungary is based on universal service obligations, which cover all households and some small enterprises. The definition of universal service obligation is very wide and may lead to significant tariff deficits as some other European countries have experienced, when retail tariffs are set below cost. The reintroduction of market-based retail tariffs could help to avoid deficits while protection for less well-off consumers could be ensured via alternative measures.

Over the past decade, Hungary introduced a series of sector taxes, which tended to complicate the tax system and created uncertainty for investors and weakened the investment climate. These taxes included a special tax on energy service providers, which must be paid in addition to the corporation tax. In January 2013, a utility line tax was introduced, the basis of which was the length of the public utility lines with an annual levy amounting to Hungarian forint 125 (or EUR 0.44) per metre. In recent years, however, most of the taxes introduced earlier in an effort to mitigate the impacts of the crisis and directly burden enterprises operating in certain sectors have been phased out.

As per the experiences of IEA member countries – and embodied in the IEA Shared Goals of 1993 – free and open energy markets and undistorted energy prices enable markets to work efficiently and strengthen energy security. Therefore, it is recommended that the Hungarian government strive to implement these principles in its energy policy and examine the use of market-based mechanisms in the energy sector.

## Building a sustainable energy system

Greenhouse gas (GHG) emissions have fallen significantly in Hungary in recent decades and have continued to decline as several sectors have become less carbon-intensive. The National Climate Change Strategy 2008-2025 (NCCS) was adopted by parliament in

2008. It established a national GHG emissions reduction target range of 16% to 25% of the 1990 level by 2025. Owing to the successful implementation of NCCS, Hungary has met its Kyoto and EU obligations. In 2014, Hungary's total GHG emissions were 40% below 1990 levels and 24.6% below 2005 levels. GHG emissions outside the EU Emissions Trading Scheme sector were 5% below target in 2015, thereby achieving a 7% emission reductions compared to 2005. This decline in GHG emissions is not only the outcome of industrial restructuring following the end of communist rule. According to the Hungarian government, half the aggregate decline is the result of measures and policies applied over the past 15 years. The second National Climate Change Strategy, which will be submitted to the parliament in 2017, includes a series of measures and actions required in order to implement the Paris Agreement, which Hungary was one of the first EU member countries to ratify. Nonetheless, there is room for the country to adopt more ambitious and challenging targets for GHG reductions across all non-traded sectors.

The EU 2030 Climate and Energy Framework will impose greater GHG emissions reduction demands on Hungary than it faced in the past, and achieving further reductions will require measures to mitigate growing emissions in the non-traded sector most notably from transport. New programmes such as the e-mobility programme (the Jedlik Ányos Plan) and developments in public transport have the potential to reduce emissions. Implementing further measures aimed at reducing emissions and improving energy efficiency in road transportation should be a priority.

Hungary's National Energy Strategy and the *National Energy Efficiency Action Plan* (NEEAP) prioritised energy efficiency as a means to reduce energy imports and strengthen energy security. Nonetheless, the 2020 energy intensity targets in the NEEAP could be more ambitious than recent energy consumption trends. A revision of the NEEAP is under way in 2017 and provides an ideal opportunity to increase its ambition. There is a need to improve data collection and analysis, as well as regular monitoring to verify that targets are met and that the most cost-effective measures are implemented first. Energy auditing requirements set by the EU Energy Efficiency Directive (EED) are the main policy tool for achieving energy efficiency in the industry sector. The auditing process should be carried out by certified auditors, and the government needs to implement a system for certifying and approving energy auditors to fulfil the EED requirements. Furthermore, the government should develop programmes to encourage small and medium-sized enterprises to perform energy audits.

The residential sector has seen significant energy efficiency improvements in its building stock in recent years; however, artificially low energy prices could hinder this progress. There is also room for further stimulating energy savings in the existing building stock and for introducing stricter energy efficiency standards for new buildings. The current housing stock offers a large potential for further energy efficiency improvements, particularly in prefabricated houses and older buildings.

District heating (DH) remains an important energy source in Hungary, and the government recognises its role in increasing energy efficiency and renewable energy use in the country. Improved efficiency in buildings has, however, led to a decline in demand for heat, and DH struggles to compete with low natural gas prices. The natural gas market is regulated in a similar way as the DH market, with end-user prices for natural gas fixed on a level below market price. Low natural gas prices make DH and combined heat and power (CHP) a less competitive heating source in the residential sector.



EXECUTIVE SUMMARY AND KEY RECOMMENDATIONS

The share of renewable energy in Hungary's energy system has increased significantly in the last decade, but this growth has levelled off in recent years. Every year, Hungary has outperformed the targets for renewable energy as a share of gross final energy consumption set out in the EU Renewable Energy Directive. Increased use of biomass for heat and power production has been the main driver of growth in renewable sources. Further growth can also be attributed to solar, which has increased from1 gigawatt-hour (GWh) in 2010 to 186 GWh in 2015. Renewable energy policies should also focus on energy sources other than biomass; otherwise Hungary runs the risk of missing its EU 2020 target. In this regard, the recent reform of the support mechanism and the introduction of the support system for electricity generation from renewable sources (METÁR), are helpful. The government acknowledges that solar, geothermal and other renewable energy sources could significantly contribute to meeting its 2020 targets where renewable energy makes an important contribution to the Nuclear-Coal-Green Scenario set out in NES 2030. In 2016, the government introduced new regulations, the impact of which is to limit the installation of new wind turbines in the country. As the amendment to the energy law bans wind turbines within a 12-kilometre radius of populated areas, it hinders the penetration of wind energy.

The new support system METÁR is a fundamental reform of the feed-in tariff system, which the government claims will result in a cost-effective, less expensive, more predictable system. It represents progress following a delay in the process of reforming the support mechanism. However, there are many details that remain to be clarified. Furthermore, network development plans, which provide the information needed to guide investment in renewable generation, are prepared by the transmission system operator (MAVIR) and approved the by the Hungarian Energy and Public Utility Regulatory Authority (HEA). These network development plans should be published to provide greater clarity to investors.

## Securing energy supply

In the electricity market, Hungary successfully coupled its day-ahead electricity market with markets in both the Slovak and the Czech Republics in 2012. Coupling was later extended to Romania in November 2014 and has led to a gradual convergence of wholesale prices in the region and more effective use of interconnector capacities. The government is seeking to further increase electricity exchanges with more neighbouring countries and other European partners. New interconnector projects with Slovak Republic and Slovenia will facilitate international electricity trade and will also strengthen system security and security of supply. Increased trading volumes and the number of market participants on the Hungarian Power Exchange (HUPX) day-ahead and intraday market are positive signs for the liquidity of the wholesale electricity market. Nonetheless, the continued dominance of state-owned power company MVM Group Ltd remains a cause for concern.

The regulatory authority HEA considers that current power plant capacity reserves are sufficient, thanks to the excellent regional integration of the country which allows the country access to capacity in neighbouring countries. Nonetheless, the expected retirement of power plants over the next decade as a result of either lack of competitiveness or their advanced age, gives rise to the possibility of insufficient domestic generating capacity and continued import dependence. A working group has been set up to examine future generation needs, including reserve capacity, and work is under way concerning the strategy to adopt for the future power plant fleet and the source for the necessary investments.

*Nuclear energy* is the main contributor to electricity production and is expected to meet the bulk of the domestic generating capacity needed in the future. Four reactors have been in operation at the Paks site since the 1980s. The reactors, of Soviet Union origin, have a 30-year original design lifetime. Lifetime extension programmes are ongoing, with three already finalised, to allow operation for an additional 20 years. The plan for nuclear expansion, with new units at the Paks site, is organised as a stand-alone project and is a legal entity directly under the responsibility of the Prime Minister's Office, demonstrating the national strategic importance of the project.

In January 2014, Hungary signed an Inter-Governmental Agreement with the Russian Federation (hereafter, "Russia") for the construction and technical support of two units of 1 200 megawatts electrical ($MW_e$) at the Paks site. The units should start operation in 2025 and 2026. In March 2014, Hungary and Russia signed a financial agreement providing for a EUR 10 billion credit line from Russia to cover 80% of the capital expenditure for the construction of the two units. The Hungarian government will finance the remaining 20%. In particular, it is important to ensure that the project is properly designed to be effectively embedded in the development of the electricity market once the plant is put in operation. *Oil* is the second-largest primary energy source after natural gas, representing 28% of Hungary's total primary energy supply (TPES) in 2015. Hungary is a net importer of crude oil mainly from Russia (approximately 85% in 2015), but its dependence dropped from 100% in 2012, when the country started importing from other sources, with Iraq being the main alternative to date. Domestic oil production is in decline but meets about 10% of demand at present. Steps have been taken to arrest this trend such as by developing a tendering system for granting exploration and mining licences for oil and gas in which companies bid on royalty rate and contract fee, and by optimising production by the major producer MOL. Hungary is consistently compliant with the IEA and the EU emergency oil stock requirements.

*Natural gas* is the largest primary energy source in Hungary, accounting for almost one-third of both total supply and final consumption. Most of natural gas consumed in the country is imported from Russia. An extension of the 20-year contract between Hungary's principal importer, Hungarian Gas Trade Ltd (part of MVM Group) and Panrusgaz Gas Trading Plc was negotiated in 2015. Hungary is well-interconnected and further infrastructure improvements will provide ample potential for diversification of supply routes. Hungary also plays an important role in advancing natural gas market integration in Central Europe. The process of further diversification of supply sources and routes and expanding Hungary's role as a transit country includes the development of the reverse flow on the Hungarian-Croatian border (which requires further construction on the Croatian sides), reverse flow on the Hungarian-Romanian interconnector (which is under preparation and requires some construction on both Hungarian and Romanian side), as well as future consideration of capacity upgrades for existing interconnectors. Following the 2006 and 2009 Ukrainian/Russian natural gas crises, the country implemented one of the most comprehensive energy security policies in Europe. It now has a very large storage capacity in comparison to its market size. Hungary has provided reverse-flow gas to Ukraine since April 2013.

## Key recommendations

***The government of Hungary should:***

- ☐ Translate the key priorities contained in the National Energy Strategy to 2030 into action plans and implementation measures with clear responsibilities and deadlines, including an integrated and efficient implementation mechanism.
- ☐ Develop a clear and transparent programme for the implementation of full retail market liberalisation, including the elimination of administratively determined end-user prices.
- ☐ Adopt more ambitious targets for energy efficiency to support the wider energy policy goals of energy security, affordability and sustainability.
- ☐ Develop a clear strategy to secure a sufficient level of generating capacity in a competitive power sector, which ensures generation adequacy and security of supply.
- ☐ Ensure that the Paks new-build nuclear framework is consistent with EU principles, rules and regulations, so as to allow the smooth implementation of the project, which is one of the cornerstones of the National Energy Strategy 2030.

### References

OECD (Organisation for Economic Co-operation and Development) (2016), *OECD Economic Surveys: Hungary 2016*, OECD Publishing, Paris.

# 1. General energy policy

## Key data
(2015)

**Total primary energy supply (TPES):** 25.2 Mtoe (natural gas 29.7%, oil 27.2%, nuclear 16.4%, biofuels and waste 11.7%, coal 9.3%, geothermal 0.4%, solar 0.3%, wind 0.2%, hydro 0.1%, electricity imports 4,7%), -4.9% since 2010

**TPES per capita:** 2.6 toe (IEA average: 4.4 toe)

**TPES per GDP:** 107 toe/USD million PPP (IEA average: 111 toe/USD million PPP)

**Energy production:** 11.3 Mtoe (nuclear 36.7%, biofuels and waste 27.8%, coal 13.4%, natural gas 12.1%, oil 7.7%, geothermal 0.9%, solar 0.6%, wind 0.5%, hydro 0.2%), -4.8% since 2010

**Total final consumption (TFC):** 18.9 Mtoe (residential 31.6%, industry and non-energy use 31.5%, transport 22.3%, commercial including agriculture 14.7%)

**Exchange rate (2015):** HUF 1 = USD 0.00358 or EUR 0.00323; USD 1= EUR 0.901

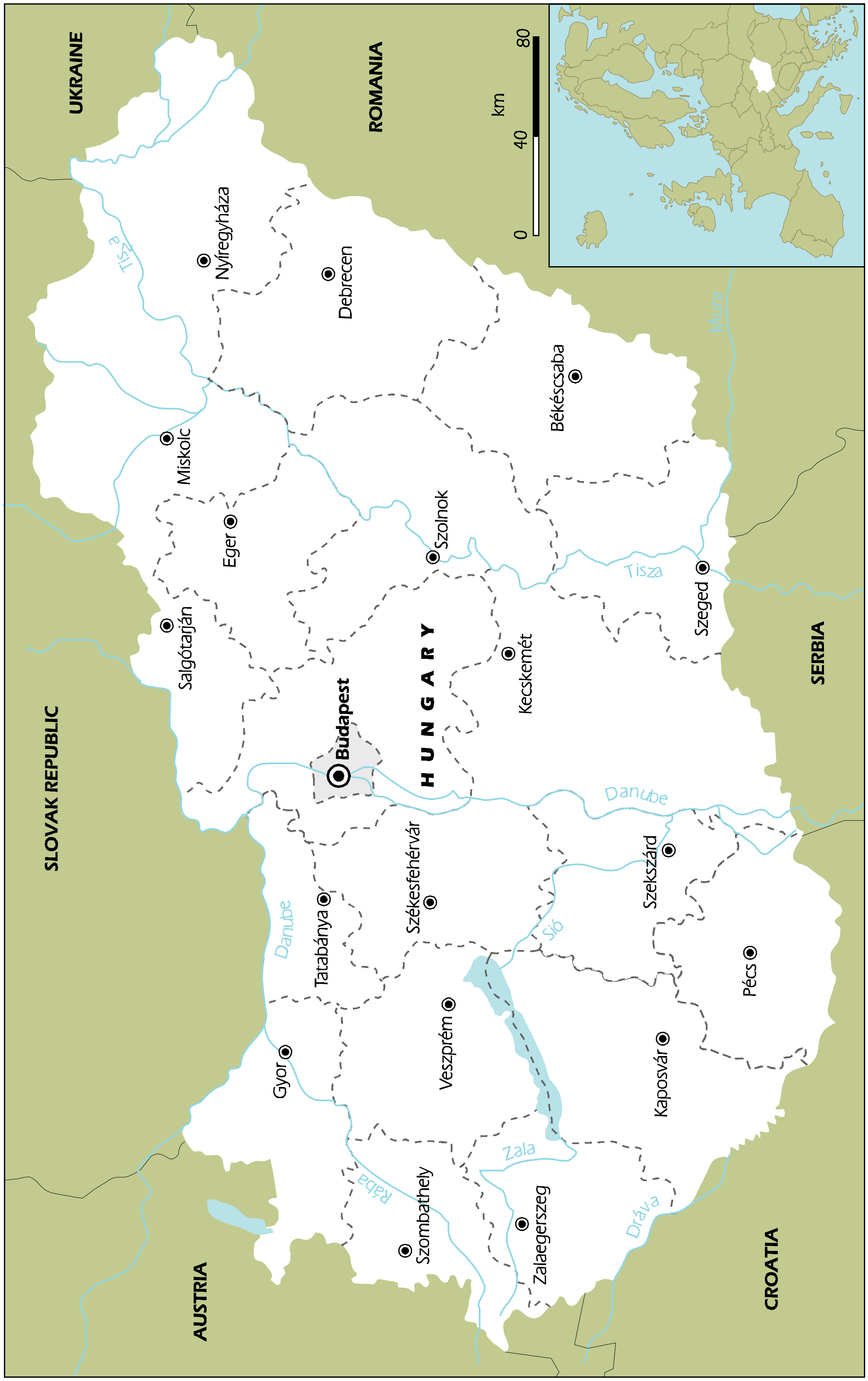
## Country overview

Hungary is a central European country that borders Slovak Republic, Austria, Slovenia, Croatia, Serbia, Romania and Ukraine. Its population has been stable at around 9.8 million for several decades although it experienced a slight decline of 2% between 2005 and 2015. Budapest, with a population of approximately 1.7 million, is the capital and largest city.

Hungary's economy is dominated by services which account for around two-thirds of economic activity. Industry's share of the economy was 31% and other sectors contributed 4.5%. Exports are dominated by machinery and equipment, which made up 49% of the total in 2015. Economic growth was relatively sluggish, at around 1.3% per year, from 2010 to 2014 (OECD, 2016a). In 2015, the economy was estimated to have grown by 2.7 %, down from 3.7 % in 2014 (EC, 2016). GDP per capita is around 65% of the OECD average. The unemployment rate was 6.3% of the workforce in 2016.

Hungary is a parliamentary democracy and parliament consists of 199 members, elected every four years. The government is the executive institution run by the Prime Minister who is elected by the parliament on a four-year term. Hungary is also a republic with a president who is elected by the parliament for a five-year term. The President is the official Head of State with the role of appointing ministers according to the Prime Minister's recommendations. The national conservative party Fidesz (Hungarian Civic Union) is led by Prime Minister Victor Orbán who assumed leadership in 2003.

## Figure 1.1 Map of Hungary

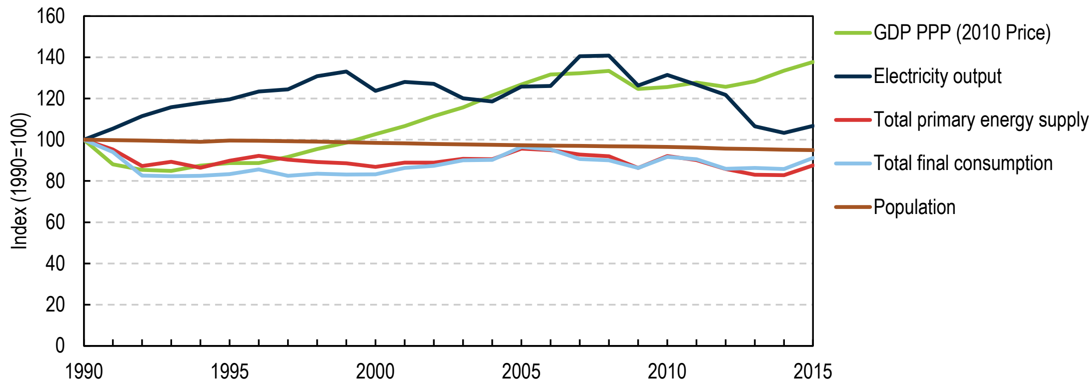



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

The current president is János Áder, also from the Fidesz Party, elected in 2012. The last parliamentary election took place in April 2014, and the next one is expected some time in 2018.

Together with the Czech Republic, Slovak Republic and Poland, Hungary is part of the Visegrád Group (V4), which was formed in February 1991 nine months before the break-up of the Soviet Union. The four members of the V4 work together in a number of fields of common interest. They became members of the European Union at the same time in 2004 (V4, 2015).

### Figure 1.2 Economic and energy indicators, 1990-2015

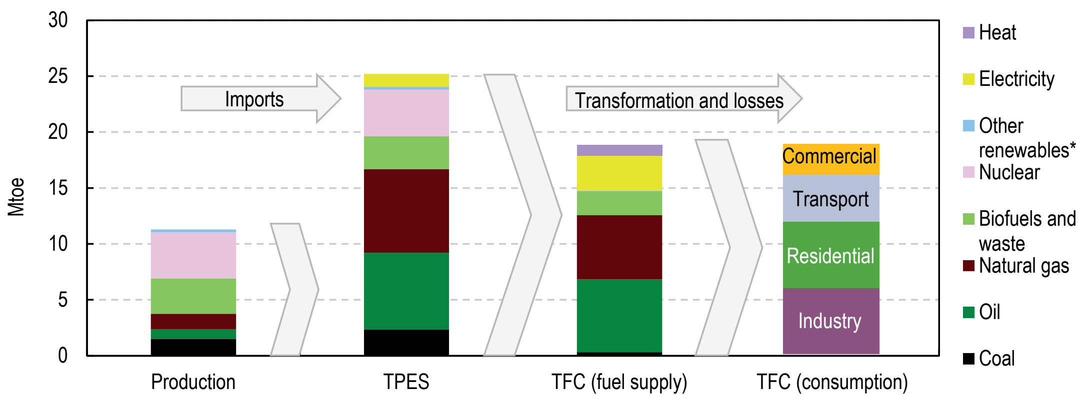



Note: Data are provisional for 2015.
Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## Supply and demand

Domestic energy production accounts for 45% of the total primary energy supply (TPES) and the country is becoming more import-dependent. Natural gas and oil are the largest primary energy sources and nuclear power accounts for the greatest share of electricity generation. Oil is used largely in the transport sector and natural gas represents the largest share of energy consumption in the residential and commercial sectors.

### Figure 1.3 Overview of energy production, TPES and TFC, 2015

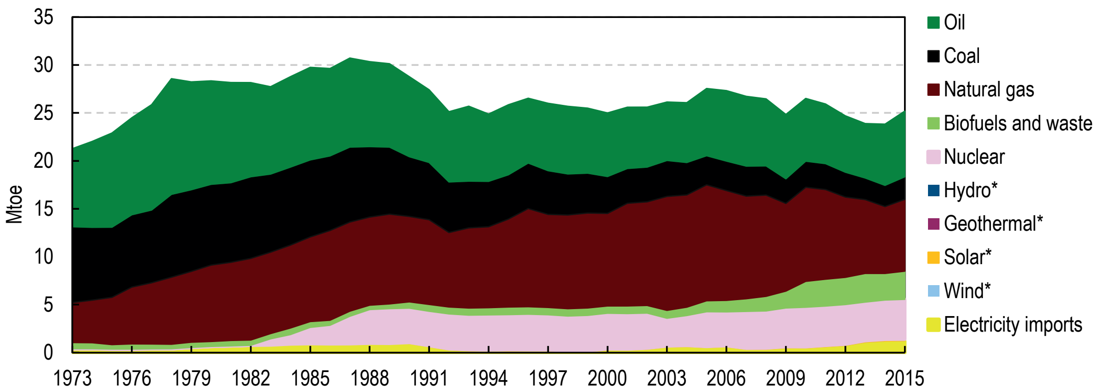



* *Other renewables* constitutes small shares of wind, hydro, solar and geothermal.
Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## Supply

TPES has been slowly declining in Hungary since a 1987 peak of 31 Mtoe (see Figure 1.4), to 25 Mtoe in 2015. Between 2010 and 2015, TPES fell by 5%, despite a rebound in the last two years. Natural gas and oil account for almost 30% of TPES each, with the remaining energy supply coming mainly from nuclear, coal, biofuel and electricity imports.

### Figure 1.4 Total primary energy supply, 1973-2015




Notes: Data are provisional for 2015. Hungary has changed its methodology for collecting statistics for solid biofuels, which results in a significant increase in biofuels and waste from 2010 onwards.

* Negligible.

Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

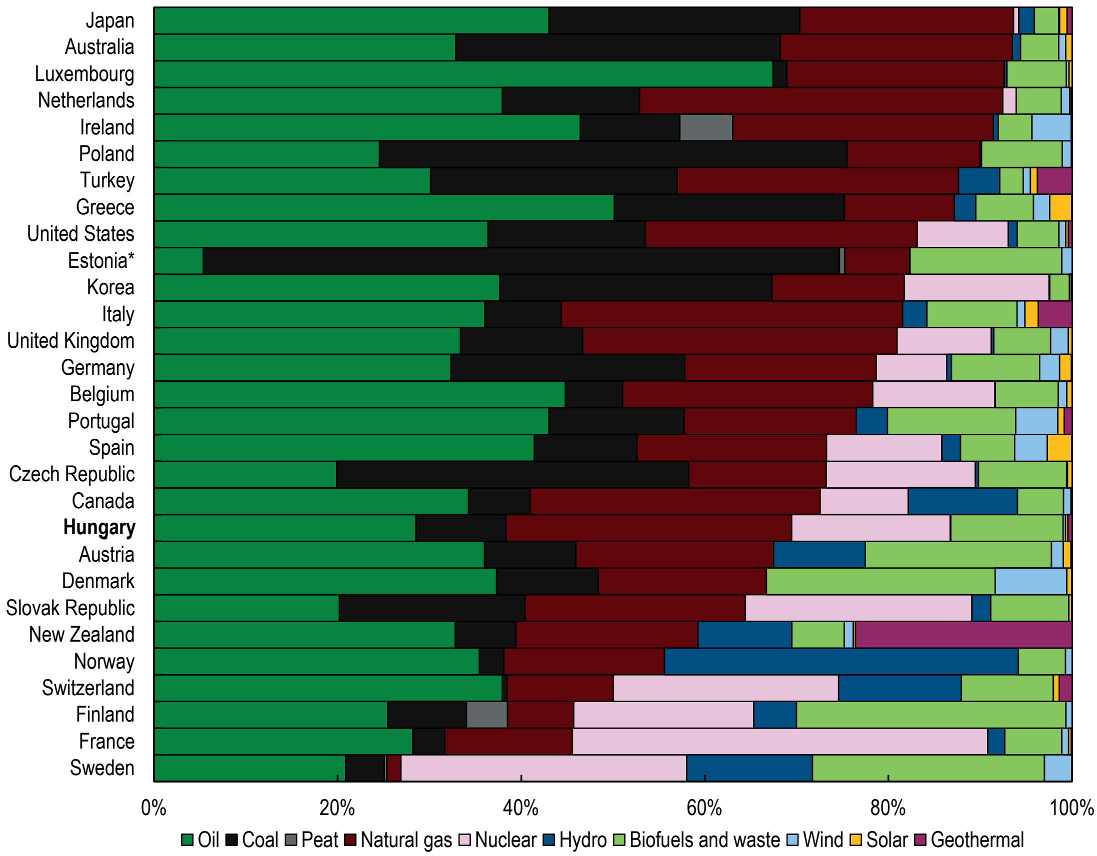
Hungary has the fifth-highest share of natural gas and sixth-highest share of nuclear in energy supply among IEA member countries (see Figure 1.5). The shares of hydro, wind and solar energy are among the lowest in the IEA.

Energy production peaked at 16.8 Mtoe in 1987 and has declined by one-third since (see Figure 1.6) since. A major change to the composition of the production balance was the introduction of nuclear energy in the 1980s. It has been the largest domestic energy source since 1996 and accounted for 37% of total production in 2015. As a result of capacity improvements in the nuclear power plants, nuclear energy output increased by 14% from 2005 to 2015.

Fossil fuel production has declined significantly over 40 years, from 15 Mtoe in 1978 to below 4 Mtoe in recent years. Coal production was 1.5 Mtoe in 2015, representing a decline of 5% since 2010. Natural gas declined by 39% and oil production by 21% over the same period to record lows of 1.4 Mtoe for natural gas and 0.9 Mtoe for oil. In 2015, biofuel and waste production was 3.1 Mtoe, an increase of 18% compared to 2010. Other renewable energy production is much smaller, with a total production of 0.25 Mtoe from geothermal, wind, solar and hydro in 2015.

Energy production has declined faster than energy demand, which has led to increased import dependence, especially for oil and natural gas (see Figure 1.7). In 40 years, Hungary has gone from being almost self-sufficient in natural gas production to importing around 80% of its needs. Oil import dependence was higher in the past but has increased in the last decade from 80% in 2005 to 87% in 2015. Domestic coal production still meets about two-thirds of demand.

## Figure 1.5 Breakdown of TPES in IEA member countries, 2015

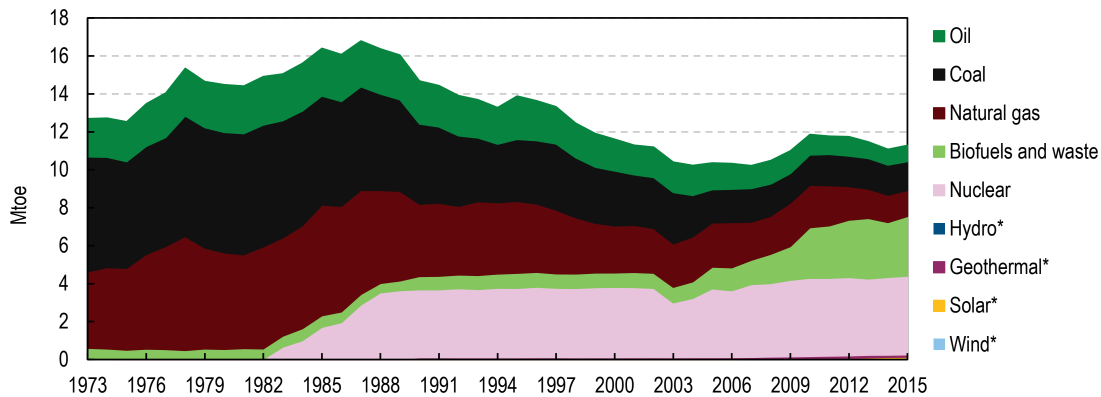



Notes: Data are provisional for 2015. Electricity imports are not included.

* Estonia's coal represents oil shale.

Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## Figure 1.6 Energy production by source, 1973-2015

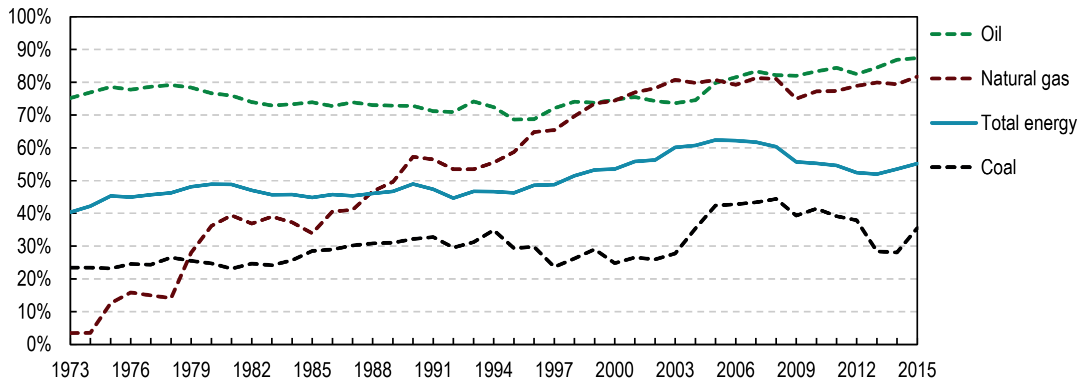



Notes: Data are provisional for 2015. Hungary has changed its methodology for collecting statistics for solid biofuels, which results in a significant increase in biofuels and waste from 2010 onwards.

* Negligible.

Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

### Figure 1.7 Import dependence by fuel, 1973-2015



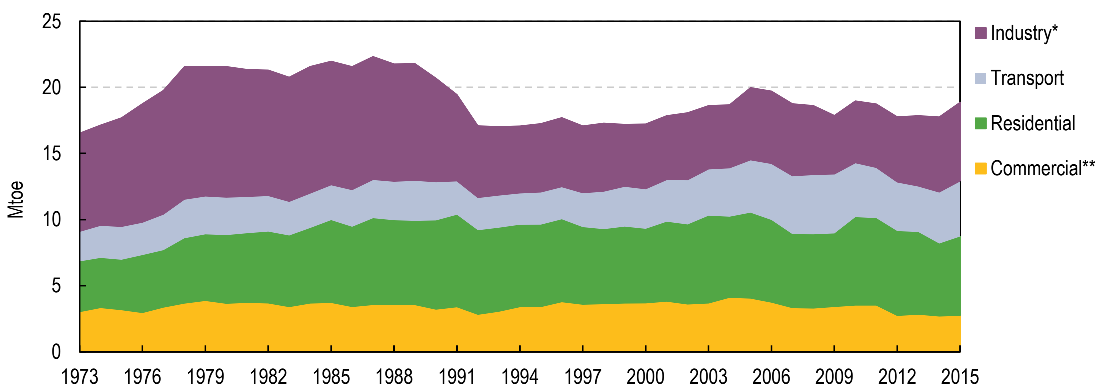

Note: Share of TPES from other sources than domestic production (net import and stocks). Data are provisional for 2015.
Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## Demand

Total final consumption (TFC) of energy experienced a slight increase from the early 1990s until 2005 and has fluctuated since. TFC increased by 6% in 2015 compared to the year before, to a level similar to 2010. The residential and industry sectors account for nearly one-third of TFC each, but have shown different trends recently. Consumption increased by 27% in the industry in the five years from 2010 to 2015, while the residential consumption fell by 10%. The transport sector accounts for almost one-quarter of TFC and consumption in this sector has been stable in recent years. The commercial sector accounts for the smallest share of TFC, and consumption has declined by 22% from 2005 to 2015.

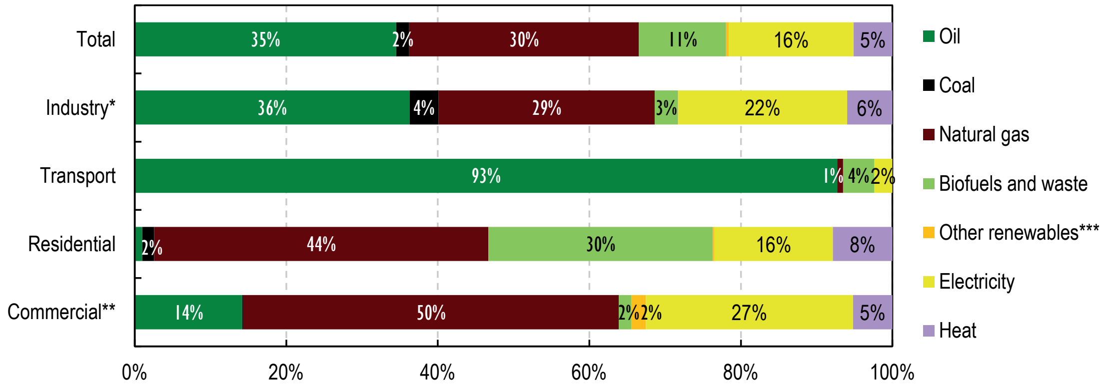
Oil and natural gas are the largest sources of energy in final consumption, accounting for roughly one-third of TFC each. The transport sector is the largest oil consumer, accounting for 60% of Hungary's total oil consumption in TFC in 2015, followed by the industry sector, which uses oil both as a fuel and as a feedstock. Natural gas and electricity are the main energy sources consumed in the residential, commercial and industry sectors.

### Figure 1.8 Total final consumption by sector, 1973-2015




* *Industry* includes non-energy use.
** *Commercial* includes commercial and public services, agriculture, fishing and forestry.
Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

**Figure 1.9 Fuel share of TFC by sector, 2015**




* *Industry* includes non-energy use.

** *Commercial* includes commercial and public services, agriculture, fishing and forestry.

*** *Other renewables* consists of small shares of wind, hydro, solar and geothermal.

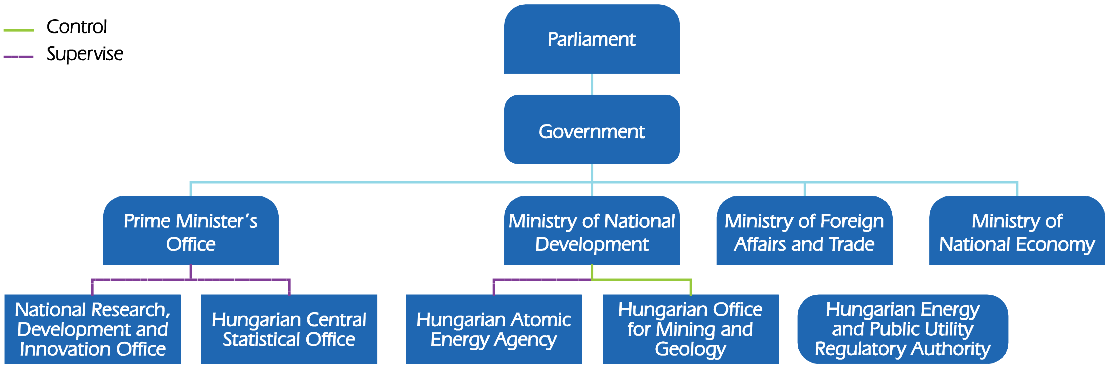
Note: Data are provisional.

Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## Institutions

In Hungary, only central governmental organisations are involved in energy-related policy tasks. There have been several changes in the division of responsibilities since the last review in 2011. Figure 1.10 represents the ministries and national authorities with responsibility for energy-related matters.

**Figure 1.10 Organisational structure of Hungarian institutions in energy and climate policy**




The **Ministry of National Development** is the lead energy policy institution. It is responsible for conventional energy resources (crude oil, natural gas and coal), electricity and nuclear energy (except for capacity expansion at the Paks nuclear power plant). The ministry is also responsible for renewable energy, climate policy and energy efficiency.

The **Ministry of National Economy** provides input to energy efficiency plans and handling the greenhouse gas (GHG) emissions rights. It is also responsible for electro-mobility plans and for energy efficiency in buildings.

The **Prime Minister's Office** is the project owner of capacity expansion at the Paks nuclear power plant, sometimes known as the Paks 2 project. The First National Public Utility Holding Company operates under the supervision of the Prime Minister's Office. The **Ministry of Foreign Affairs and Trade** is responsible for energy security and diplomacy. The **Ministry of Agriculture** is responsible for collection, storage and processing of GHG emission data by means of the **National Meteorological Service**.

The **Hungarian Energy and Public Utility Regulatory Authority** is an independent agency responsible for reporting statistics (energy and stocks), exercising regulatory oversight in electricity, natural gas, district heating, water utility and waste management. It determines network usage and access charges and issues the relevant permits. The Hungarian Atomic Energy Agency has regulatory oversight of nuclear facilities.

The **Hungarian Central Statistical Office** is responsible for reporting of statistics. The **National Research, Development and Innovation Office** manages and supports public research, development and innovation funds and is responsible for Horizon 2020 planning. It also provides statistics on energy research expenditures. The **Hungarian Office for Mining and Geology** manages a list of entities involved in geothermal activities and a list of natural gas/crude oil producers.

## Key policies

### The National Energy Strategy 2030

Published in 2012, following consultation with stakeholders, the fundamental goal of the National Energy Strategy 2030 (NES 2030) is to seek ways out of Hungary's energy dependence. NES 2030 identifies five means to achieve this goal: *i)* greater energy savings and energy efficiency, *ii)* increasing the share of renewable energy sources, *iii)* maintaining existing nuclear energy capacity, *iv)* closer integration with the Central European electricity and natural gas networks and construction of the required cross-border connections, and *v)* renewing the government's energy institutions. NES 2030 also recognises that, for the time being, the country cannot afford to give up fossil fuels.

On this basis, NES 2030 presents a "joint effort vision", which the government considers to be the most realistic objective to be implemented. It is represented by the Nuclear-Coal-Green Scenario in terms of electricity generation. Its most important elements are:

- The long-term preservation of nuclear energy in the energy mix.
- The maintenance of the current level of coal-based energy generation.
- The extension of Hungary's *National Renewable Energy Action Plan* (NREAP) after 2020.

The implementation of the Nuclear-Coal-Green Scenario would enable a reduction of electricity imports, which in 2012 accounted for the equivalent of 13% of domestic consumption, notably during the summer months. Nonetheless, if certain external and internal economic policy conditions are met, the government may change its energy preferences, and a different scenario may deliver a more reliable guarantee for the safety of energy supply under these changed conditions. A biennial review of NES 2030 is therefore an important element of the strategy.

*Targets and goals:*

- Energy savings: NES 2030 targets 92 petajoules (PJ) of total primary energy savings by 2030 (revised in 2015 as part of a biennial review).
- Increased use of renewable and low-carbon energy: The share of renewable energy in TPES will rise from 7% in 2012 to approximately 20% by 2030; the share of nuclear will remain stable at approximately 25%.
- Power plant modernisation: In order to ensure the reliable supply of electric power, detailed proposals will be drawn up for the replacement of soon to be closed down power plants. Electricity generation-related $CO_2$-intensity will be reduced from 370 grams of $CO_2$/kilowatt-hour in 2012 to about 200 g$CO_2$/ kWh by 2030.
- Modernisation of community district heating and private heat generation: The share of heat generated from renewable energy sources will increase to 25% by 2030 from 10% in 2012.
- Increased energy efficiency and reduction of the $CO_2$ intensity of transport: Increase the share of electric and hydrogen-based transport to 9% and the share of biofuels in transport to 14% by 2030 in order to reduce both the sector's oil dependence and $CO_2$ emissions.
- Green industry and renewing agriculture: Agriculture is responsible for 13% to 15% of total GHG emissions. Promotion of agricultural technologies and organic farming will help reduce emissions. Energy efficiency in agriculture may also be improved by supporting greenhouse cultivation based on the utilisation of sustainable geothermal energy.
- Waste-to-energy: Since municipal organic waste qualifies as biomass, its energy utilisation is added to the share of renewable energy sources. The utilisation of up to 60% of municipal waste in incineration plants is in strict adherence to environmental standards.
- Strengthening the role of the state: In 2012, government participation was moderate. While the government has a strong presence in the electricity sector, a similar presence should be established in the natural gas and oil sectors.

## Climate policy

Hungary has also submitted six national communications to the United Nations Framework Convention on Climate Change (UNFCCC), the most recent in January 2014, and was one of the first countries to ratify the Paris Agreement. The National Climate Change Strategy 2008-2025 (NCCS) was adopted by parliament in 2008. It established a national GHG emissions reduction target range of 16% to 25% of the 1990 level by 2025. The strategy defines three main policy directions: a reduction of GHG emissions, adaptation and raising public awareness of climate change. General objectives have also been defined for the energy, transport, agriculture, forestry and waste sectors. An updated National Sustainable Development Strategy (NSDS) was adopted by parliament in 2013 and the fourth National Environmental Protection Programme for the period 2015 to 2020 was adopted by parliament in 2015.

### Transport policy

The transport sector is oil-intensive, accounting for 3.9 Mtoe or 60% of total final oil consumption in 2015. Two-thirds of transport-derived GHG emissions come from vehicles, the number of which has increased while more than 45% of the motor car fleet is over 10 years old (ACEA, 2016).

NES 2030 contains some important goals relating to transport such as increasing the energy efficiency of the sector and reducing its $CO_2$ intensity. It highlights the need to increase the share of electric (road and rail) transport and hydrogen-based road transport to 9% of transport activity. It also aims to increase the share of biofuels to 14% by 2030 for the purpose of reducing the oil dependence of transport.

A draft National Transport Strategy (NTS) was published for public consultation in October 2013. The purpose of the NTS, which has not been finalised, is to determine the strategic nature of the development of the transport system in the short term (2020) with a medium-term (2030) perspective and long-term vision (up to 2050). The National Reform Programme of Hungary 2015 called for measures to increase the sustainability of the public transport system, *inter alia* by reducing operating costs and reviewing the tariff system of state-owned enterprises in the sector. Furthermore, it also called for the restructuring of MÁV Zrt (Hungarian State Railways) and VOLÁNBUSZ (the state-owned bus company.

## Energy security

Hungary produces small volumes of oil and gas but for the most part relies on imports to meet its needs. The Russian Federation (hereafter, “Russia”) is a major source for both oil and gas but significant efforts have been made to diversify supply routes along both the north-south and east-west axes. Increasingly, greater diversity can be seen in the country’s portfolio of crude oil sources. As a land-locked country, Hungary is supplied by several crude oil product and gas pipelines.

Oil represents roughly one-quarter of TPES and is expected to remain at this level until at least 2020. Domestic oil production, which was 0.86 million tonnes (Mt) in 2015, is expected to continue to decline, thereby increasing dependence on imports. Oil consumption increased from 6.6 Mt in 2014 to 7.1 Mt in 2015. The transport sector dominated oil consumption, accounting for 60% of final consumption in 2015.

Natural gas demand has declined significantly since its 2005 peak of 15 billion cubic metres (bcm) but it retains the largest share of Hungary’s TPES, accounting for 30% in 2015. The country produced 1.8 bcm or 19% of its demand in 2015 but domestic production has been in steady decline, a trend that is likely to continue.

The use of publicly held stocks is central to Hungary’s emergency response policy for both oil and gas. The Hungarian Hydrocarbon Stockpiling Association (HUSA) is entrusted with public stockpiling of both oil and gas. HUSA was founded and is operated and financed by the domestic oil and gas industry and the government exercises special control rights over the association. Its public oil stocks are composed of gasoline, diesel and crude oil and remain comfortably above the 90-day IEA requirement. The stored quantity was 105 days of net imports in September 2016. According to the Stockpiling Act, a minimum of one-third of the strategic stocks shall consist of petroleum products, i.e. diesel and/or gasoline, and the present ratio of petroleum products to crude is 60:40. When counted together with industry stocks, the total puts Hungary well beyond the IEA minimum stockholding obligation of 90 days of net imports with total stock levels standing at 176 days. In an IEA co-ordinated response to a supply disruption, Hungary can respond with the release of public stocks.

Hungary has also developed strategic gas reserves, which are under government control. These were created in the aftermath of the January 2006 Russia-Ukraine gas crisis. Although these stocks reached the planned level of 1.2 bcm in early 2010, matching decreasing demand, stocks have since been reduced to 915 million cubic metres (mcm). The level of stocks is determined by a ministerial decree.

Electricity production was 30.34 terawatt-hours (TWh) in 2015, while total consumption was 37.3 TWh. These amounts are expected to continue to grow in the future as electricity consumption per capita is still relatively low compared to the OECD average. Hungary is a net electricity importer and also a major transit country, mostly to its southern neighbours. A little more than half of the country's generation depends on the single nuclear power plant in Paks, with most of the remaining generation depending on coal, natural gas and about 11% of renewables. The most prominent renewable energy sources are solid biofuels with 8% of total generation. Variable renewable generation (wind and solar) are very limited, but solar photovoltaic (PV) capacity started to grow rapidly in recent years.

The country's transmission system operator, MAVIR, is responsible for grid management and system security, under the supervision of HEA, the Hungarian Energy and Public Utility Regulatory Authority. MAVIR has contracts for mutual assistance with neighbouring operators. Every power plant over 50 megawatts (MW) is required to keep an equivalent of 16 days of stocks of alternative fuel. In case of under-frequency in the grid, the TSO can make use of automatic or manual load shedding. The response system was well tested during two major weather-related disturbances in recent years.

Nuclear energy was the source of 52% of domestically generated electricity in 2015 and will continue to play a major role in the power sector into the foreseeable future. NES 2030 states that the long-term preservation of nuclear energy in the energy mix is an important objective of long-term energy policy.

This objective can be ensured in a number of ways: a lifetime extension of Paks 1, which has already happened in the case of two units; sustaining high capacity utilisation; responsible management of nuclear waste; and the construction of two additional units at the Paks site. The construction of these new units would be the largest investment in the Hungarian energy sector for several decades, and is therefore considered a flagship project by the government; the ownership rights are exercised directly by the Prime Minister's Office. Once the new units commence operation, it will need to be integrated into the electricity market and contribute in a competitive way to the Nuclear-Coal-Green Scenario, which is envisaged in NES 2030.

The four Paks 1 nuclear units are planned to close down in sequence between 2032 and 2037, after 50 years of operation. To ensure the timely replacement by new units, the Hungarian parliament authorised the start of preparatory works for the new units in 2009. A decision for the selection of a proven pressurised water reactor (PWR) technology with load following capabilities was initially expected in 2013.

In January 2014, Hungary signed an Inter-Governmental Agreement with Russia for the construction and technical support of two units of 1 200 megawatt electrical ($MW_e$) at Paks. The units should start operation in 2025 and 2026. In March 2014, Hungary and Russia signed a financial agreement providing for a EUR 10 billion credit line from Russia to cover 80% of the capital expenditure for the construction of the two units. The Hungarian state will be financing the remaining 20%.

## Local air quality

Despite the obligation for EU member states to ensure satisfactory air quality for their citizens, air quality has remained a problem in many places for a number of years. According to the European Environment Agency, for example, about 16% of the EU population was exposed to amounts of large particulate matter ($PM_{10}$), such as coarse dust in amounts above the daily limit value (EEA, 2016) in 2014. Exceedances of limit values for $PM_{2.5}$ (fine particulates under 2.5 microns in diameter), $PM_{10}$ (large particulate matter) and benzo(a)pyrene (BaP) in the winter season remain a problem in some parts of the country. However, overall concentration levels of $PM_{10}$ are generally below the EU daily limit value. Likewise, national levels of $PM_{2.5}$ are also below the EU daily limit value. Levels of benzo(a)pyrene (BaP), a potent carcinogen, while relatively high, also fall well below the EU daily limit value.

## Energy taxation

The European Union (EU) Energy Tax Directive (2003/96/EC) sets the EU framework for the taxation of energy products and electricity. The directive sets minimum tax rates for all energy products, including coal, natural gas and electricity. For each, it sets a minimum level of tax expressed in terms of volume, weight or energy content of the fuel. The Directive is also intended to reduce distortions of competition, both between member states as a result of divergent rates of tax on energy products, and between mineral oils and the other energy products (OECD, 2016b).

In the final quarter of 2016, excise duties and value-added tax (VAT) together accounted for 57.8% of the final price of a litre of premium unleaded gasoline, 55.2% of the final price of a litre of automotive diesel and 45% of the final price of a litre of light fuel oil for households (IEA, 2017b).

Motor car purchases are also taxed and VAT is payable at 27% alongside a registration tax. The registration tax varies from HUF 45 000 to HUF 400 000 on new passenger cars according to engine type (diesel or petrol) and engine cylinder capacity, and from HUF 20 000 to HUF 230 000 on motorcycles according to engine cylinder capacity. For cars generating great levels of emissions, higher rates are levied (400%, 600%, 800% or 1 200%), but the rate is reduced according to a scale based on age (until 90%). A reduced rate is levied to hybrid cars (HUF 76 000) and no tax is levied on electric vehicles.

The transfer of motor vehicles is also liable to tax: the rate of duty is determined on the basis of the vehicle's engine capacity in kilowatts (kW). The tax rate varies from HUF 300/kW to HUF 850/kW depending on the age of the vehicle (the older the vehicle, the lower the liability). Reduced rates apply to cars with hybrid engines or with gas-powered engines (HUF 76 000) and no tax for cars with electric engines.

### Sector taxes in Hungary

Over the past decade, Hungary introduced a series of sector taxes, which tended to complicate the tax system and induced a sentiment of uncertainty in investors, weakening the investment climate. Over recent years, most of the taxes introduced to mitigate the impacts of the crisis and directly burden enterprises operating in certain sectors have been phased out. They were replaced by new consumption-turnover and wealth-type taxes which have less distortionary effects on investments and economic growth, because they are imposed on the services provided by companies. These sector measures included a special tax on the energy sector and a utility line tax which have remained in place (since 2013). In January 2013, the government introduced a utility line tax to which owners of water, sewage, gas, district heating, electricity and telecommunications lines, as well as operators of state or municipality-owned utilities companies were liable. The basis of the tax is the length of the public utility lines, with the annual levy amounting to HUF 125 (or EUR 0.44) per metre. The government forecast HUF 30 billion (or EUR 105 million) revenues per year from the tax. In addition, it raised the rate of corporate tax on energy service providers to 31% from its previous level of 8%. The amount of profit tax may be reduced by up to 50% by deducting the costs of investments (Schonherr, 2013).

The sector taxes have complicated the tax system, which is otherwise relatively simple, and are often based on turnover, which itself tends to distort activity. In addition, the rates tend to increase with their tax bases. As of 1 January 2016, the utility line tax remains in place.

### Administered prices in the energy sector

Over the past five years, the retail energy market underwent some significant changes. The sale of natural gas to end-users entitled to universal supply has gradually become concentrated as the state-owned Hungarian Development Bank (MFB) and a state-owned energy holding bought privately owned gas retailers (subsidiaries of German utility RWE and French utility GDF). Other retailers (subsidiaries of E.ON and ENI) ceased operations and handed back their USP (universal service provider) licence to the regulator, leaving end-users with no option other than being supplied by the state-owned universal supplier. While the wholesale markets remain competitive, owing to exposure to regional markets, this policy led to consolidation in the retail market and has left the government-owned incumbent with a two-third market share in wholesaling (OECD, 2016a). This consolidation of market power is likely to have repercussions on the investment climate in the energy sector and on competition in the retail sector. An additional concern is that the mandated price cuts were in favour of households, which are cross-subsidised by relatively high prices for industrial users (OECD, 2016a).

The first phase of the reduction of utility costs started in January 2013, with a 10% decrease in the prices of natural gas, electricity universal service and district heating for households. From November 2013, the second reduction brought about another 11.1% decrease in end-user prices in the aforementioned sectors. The third reduction resulted in a further decrease of 6.5% in natural gas prices from April 2014, a decrease of 5.7% in electricity prices from September 2014, and a decrease of 3.3% in district heating prices from October 2014.

While these measures boost the income of consumers, the accumulated costs to the retailers may amount to a significant sum. Should international energy prices rise, the costs are likely to increase over time and the associated increase in contingent liabilities risks to negatively affect public finances. Energy price regulation is based on universal service obligations with the regulatory authority HEA making recommendations to the Minister of National Development, who determines end-user price levels. HEA continues to determine the level of transmission and distribution tariffs.

The universal service obligation, whose definition is very wide, covers all households (and some small enterprises). Other European countries have encountered substantial problems as a result of the imposition of broad definitions of universal service and incurred significant tariff deficits, which emerge when there is a shortfall of revenues because retail tariffs are set below costs.

The Hungarian government considers regulated end-user price as a necessary and important tool to provide consumers with sustainable energy services at affordable prices. Households spend a significant part of their income on utility costs. Without price regulation, the government argues, energy poverty would increase. For this reason, the government decided to reduce the energy-cost burden on households. In view of Hungarian household income levels and energy expenditure, the reduction of utility costs is more than an energy policy question: it is also a significant social and economic policy question. The government must look to solutions that have been developed and implemented elsewhere with a view to returning retail tariffs to market levels while at the same time ensuring that less well-off consumers are protected via alternative measures.

## Assessment

Since the last IEA in-depth review in 2011, Hungary has made some progress in energy policy. It developed and approved its National Energy Strategy 2030, which represents a step towards the formulation of a long-term vision of state policy in the energy sector. The main objective of the strategy is to ensure a sustainable and secure energy sector while supporting the competitiveness of the economy. In order to achieve this objective, the strategy sets out five means: *i)* increasing energy savings and energy efficiency, *ii)* increasing the share of renewable energy sources, *iii)* maintaining existing nuclear energy capacity, *iv)* integrating more closely with the Central European natural gas and electricity networks and construction of the required cross-border capacities, and *v)* renewing the government's energy institutions.

While the strategy sets a clear long-term vision for the energy sector, a large amount of work remains to be done. Formulation of clear measures and allocation of responsibilities by means of action plans, which are highlighted in the strategy, are important. The longer the time gap between the formulation of the long-term vision and its translation into implementation measures, the more difficult it is to influence the long-term stability of the energy sector.

A number of policies and funding schemes have been introduced since 2011 or are about to be introduced in the near future. A number of these policies are crafted to fulfil specific goals but they indirectly influence other aims. Hungary has also introduced a number of measures to support energy efficiency, which could lead to the fulfilment of strategic goals; however, it is not clear whether these measures are the most efficient or whether they will achieve their aims. An efficient integrated implementation mechanism, for example an implementation agency or a ministerial steering group, is needed to ensure that all elements of energy policy are consistent and that the goals of NES 2030 are achieved in the most cost-effective manner.

Hungary continues to play an important role in regional energy market integration. The country has successfully interconnected its natural gas system with all of its neighbours with the exception of Slovenia, thereby enhancing its security of supply and further opening up the possibility to gain the benefits from interconnected markets. In 2013, Hungary launched a gas exchange platform, which is also important for market development. Its day-ahead electricity market is coupled with Slovak Republic, Czech Republic and Romania. An exchange-based intraday electricity market was also established with hourly and quarterly products, which will facilitate further market integration. It also facilitates the incorporation of variable renewable energy sources. Price convergence resulting from these measures can make a large contribution to competitive retail energy prices.

Hungary has imposed a number of fiscal measures that influence the domestic energy sector. Within the past decade, a special tax on energy suppliers and a utility line tax have been introduced. Taxation forms an important indirect tool for the implementation of energy policy but these taxes play a clear role in motivating behavioural changes in the energy sector by creating disincentives to expand through investment.

In 2008, the public utility scheme was replaced by a universal service obligation for most households, municipalities and small business customers. The prices of electricity, natural gas and district heating are determined on an administrative basis, and formally remain outside the responsibility of the national regulatory authority, the HEA. It is possible to opt out of this mechanism, but alternative suppliers are unlikely to offer prices that are competitive with regulated prices set below cost. During 2013 and 2014, there were three phases of energy price reductions for household customers (served through universal service supply schemes) with the aim to reduce the energy costs of households. As a result of these administrative price decreases, Hungarian retail prices are now below the regional average. Regulated below-cost retail prices do not send signals to end-users about the relative scarcity of energy, which can have unintended impacts on other policies such as energy efficiency and security. The current system also leads to a complex sharing of market risks without the possibility of gains through changes in consumption behaviour. There is also a significant risk that this policy will lead to underinvestment throughout the energy system and will undermine efforts to achieve the country's strategic energy policy goals.

The National Energy Strategy 2030 highlights energy efficiency as one of the five strategic tools for implementing it. Progress has been made over the past few years and a number of energy efficiency policies and promotion schemes have been introduced or are under preparation. The future goals for increasing energy efficiency of the economy, however, are not as ambitious as they could be and the country should adopt more challenging targets and develop complementary funding mechanisms and implementation agencies.

As in many other European countries, Hungary is facing a challenge on how to compensate for the gradual decrease of installed capacity in the electricity generation fleet following a prolonged period of low wholesale electricity prices. According to the transmission system operator's projections, only 4 887 MW, or 57%, of installed capacity of currently operating power plants will remain in place in 2030. Decreasing generating capacity has to a large extent been addressed by the strategic decision to build two nuclear units. Nonetheless, it is important to carefully assess how much flexibility will be needed. This assessment should also take into account future possibilities and costs of importing electricity.

## Recommendations

***The government of Hungary should:***

- Translate the key priorities contained in the National Energy Strategy 2030 into action plans and implementation measures with clear responsibilities and deadlines, including an integrated and efficient implementation mechanism. There should also be an independent process to monitor and evaluate progress in the implementation of policy measures on a regular basis.
- Adopt more ambitious targets for energy efficiency to support the wider energy policy goals of energy security, affordability and sustainability.
- Develop a clear and transparent programme for the implementation of full retail market liberalisation, including the elimination of administratively determined end-user prices. Protection measures to help on vulnerable customers and less well-off households should form part of social policy rather than energy policy.

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## 2. Energy and the environment

### Key data

(2015)

**GHG emissions without LULUCF*:** 57.2 $MtCO_2$-eq, -39% since 1990

**GHG emissions with LULUCF*:** 52.6 $MtCO_2$-eq, -43% since 1990

**$CO_2$ emissions from fuel combustion:** 42,5 $MtCO_2$, -35% since 1990

**$CO_2$ emissions by fuel:** natural gas 38.7%, oil 37.9%, coal 21.7%, other 1.6%

**$CO_2$ emissions by sector:** transport 28.1%, heat and power generation 27.9%, residential 15.8%, industry (manufacturing and construction) 14.9%, commercial and other services 10.5%, other energy industries 2.9%

**Carbon intensity** per GDP:** 0.18 $tCO_2$/USD 1 000 GDP PPP (IEA average 0.25)

**Carbon intensity** per capita:** 4.32 $tCO_2$/capita (IEA average 9.88)

**2014 data, source: OMSz (2016), National Inventory Report for 1985-2014, Hungary.*

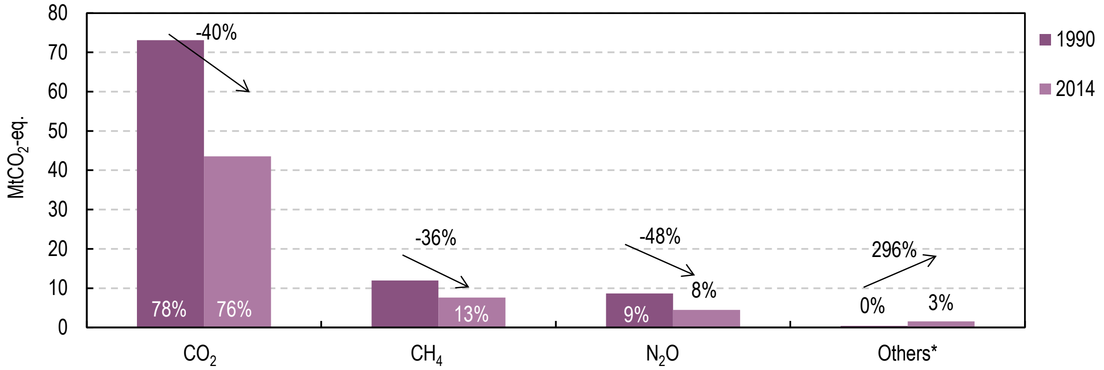
***$CO_2$ from fuel combustion.*

### Greenhouse gas emissions overview

Greenhouse gas (GHG) emissions have been reduced significantly in Hungary in recent decades. They fell rapidly during the economic downturn following the fall of the Soviet Union and continued to decline as several sectors became less carbon-intensive. Total GHG emissions were 57 million tonnes of carbon dioxide ($MtCO_2$) in 2014, a reduction of 39% since 1990.

The most important GHG is carbon dioxide ($CO_2$), which accounts for over three-quarters of total emissions in terms of $CO_2$-equivalents (see Figure 2.1). The majority of $CO_2$ emissions come from fossil fuel combustion in the energy sector, including transport (see Figure 2.2). Methane ($CH_4$) and nitrous oxide ($N_2O$), mainly emitted from waste disposals and the agriculture sector, account for most of the remaining emissions. A small share of total GHG emissions comes from other gases, such as hydrofluorocarbons (HFCs) which have increased since 1990 as a result of replacing chlorofluorocarbons as refrigerants (OMSZ, 2016).

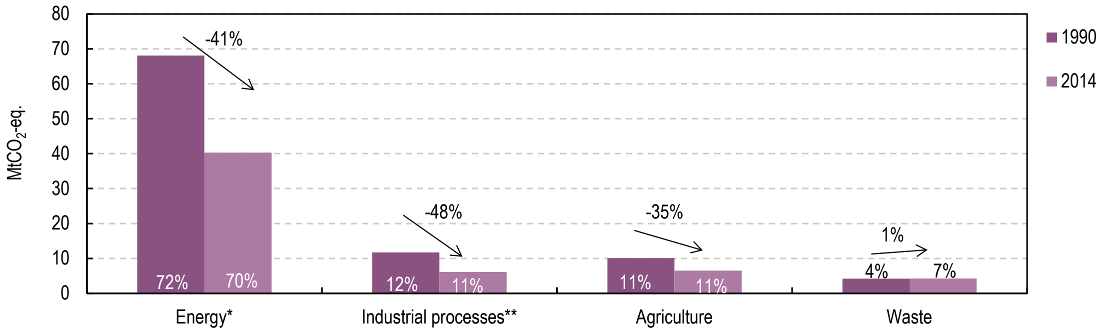
## Figure 2.1 GHG emissions by gas, 1990 and 2014




* Other gases are HFCs, PFCs and $SF_6$.

Source: OMSz (2016), *National Inventory Report for 1985-2014*, Hungary.

## Figure 2.2 GHG emissions by emitting sector, 1990 and 2014




* *Energy* includes emissions from transport and manufacturing industries and construction.

** *Industrial processes* include emissions from processes and product use in different industry sectors (mainly mineral, chemical and metal industries).

Source: OMSZ (2016), *National Inventory Report for 1985-2014*, Hungary.

## Energy-related $CO_2$ emissions

Energy-related emissions include total $CO_2$ emissions from fuel combustion, which have been declining significantly from a peak of 85 $MtCO_2$ in 1978 down to 40 $MtCO_2$ in 2014, followed by an increase to 42.5 $MtCO_2$ in 2015 (see Figure 2.3). Emissions were reduced as a consequence of a transition in the energy system and in the economy. The first committed step towards a marked GHG reduction was the installation of the Paks nuclear power plant in 1983-87 that replaced nearly all coal-fired power plants. The second important factor was the result of a large decrease in heavy industrial activity in the early 1990s, which reduced both direct emissions of the industrial sector and indirect emissions from industry-related power and heat generation. As the share of renewables in the Hungarian electricity mix gradually increased, the carbon intensity of the economy continued to decline further.

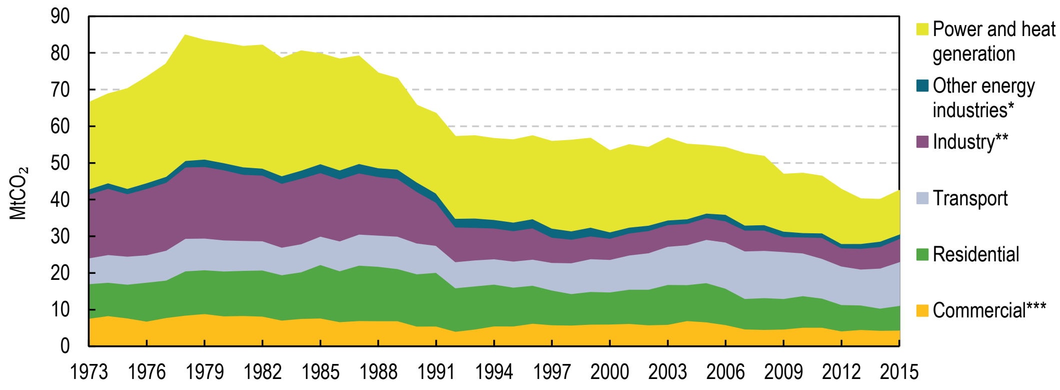
### Emissions by sector

The two largest emitting sectors of energy related $CO_2$ emissions are power and heat production, and the transport sector. Emissions from the power sector, which were 11.8 $MtCO_2$ in 2015, have almost halved since 1990. The sector accounts for 28% of total $CO_2$ emissions, which is a significant decline from around 40% in the 1990s. The three main reasons for this decline are *i)* the replacement of coal-fired power plants by the Paks nuclear power plant in 1983-87, *ii)* increased electricity imports, and *iii)* the gradual growth of the share of renewables in the electricity mix. Net electricity imports more than tripled in the period between 2007 and 2014. They accounted for over one-third of total electricity consumption in 2015.[1] Natural gas and biofuels have displaced some coal and oil in power production, which has also contributed to emissions reductions, but the use of gas has declined in recent years. The transition towards low-carbon power generation, such as nuclear energy and renewables, will further reduce emissions from the sector.

Emissions reductions from power and heat production have partly been offset by increased emissions from the transport sector in the last decades. Transport emissions that grew by 42% between 1990 and 2015, despite a temporary decline during 2007-13, and it stands out as the only sector − besides waste-originated GHG emissions (Figure 2.2) – in which emissions increased compared to 1990. The sector accounted for 28% of total $CO_2$ emissions in 2015, almost as much as from power and heat generation.

The industry sector generated 6.3 $MtCO_2$ in 2015 and accounted for 15% of total emissions. $CO_2$ emissions from industries fell rapidly as a result of the economic downturn in the early 1990s and continued to decline until 2012, before increasing again in recent years.[2] Emissions from the residential and commercial sectors also reduced in the last decade, mainly as a result of buildings becoming more energy-efficient. The residential sector emitted 6.7 $MtCO_2$ in 2015, which was a reduction by 53% since 1990. The commercial sector emitted 4.5 $MtCO_2$, a decline by 20% from 1990. The commercial sector includes agriculture, which also contributes large amounts of $CH_4$ and $N_2O$ emissions. These are not, however, included in energy-related $CO_2$ emissions.

**Figure 2.3 $CO_2$ emissions by sector, 1973-2014**




* *Other energy industries* includes other transformations and energy own-use.

** *Industry* includes manufacturing industries and construction.

*** *Commercial* includes commercial and public services, agriculture/forestry and fishing.

Source: IEA (2017), *$CO_2$ Emissions from Fuel Combustion, 2017 Preliminary edition*, www.iea.org/statistics/.

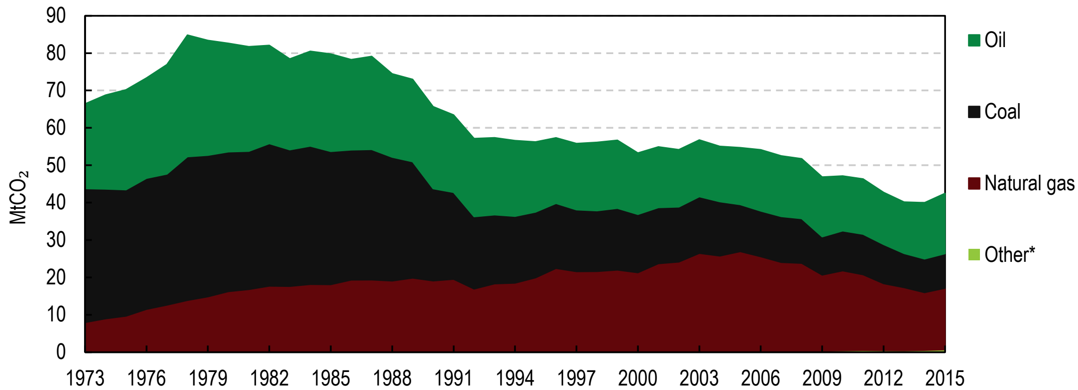
[1]. Emissions from the heat and power sector only include domestic fuel combustion. Imported electricity does not show up in the power sector emissions.

[2]. The ecent emissions increase in industry is partly a consequence of changed reporting methodology. In 2013, the Hungarian Administration started to use a new methodology for reporting data on supply and demand of electricity and heat. This leads to breaks between 2012 and 2013, with increased consumption in the industry sector and decreases in the commercial sector.

## Emissions by fuel

Energy-related $CO_2$ emissions have steadily declined since 1990. Emissions from coal have fallen by 63%, oil emissions by 27% and natural gas emissions by 14% between 1990 and 2015. The share of emissions by fuel type has, however, shifted several times. Coal's share in total emissions has been reduced from 40% in 1990 to 22% in 2015. This decrease corresponds to an increased share of emissions from natural gas, which has partially replaced coal in power generation and in residential heating applications. Natural gas accounted for almost half the total $CO_2$ emissions in 2005, but has since declined as a result of reduced heat demand and a lower use of natural gas-fired power plants. Oil accounted for the largest share of $CO_2$ emissions in 2014 for the first time in over two decades, but was overtaken again by natural gas in 2015. Emissions from oil use increased in recent years as a result of growing consumption in both transport and industry.

**Figure 2.4 $CO_2$ emissions by fuel, 1973-2014**




* *Other* fuels are mainly fossil fractions in waste incineration.

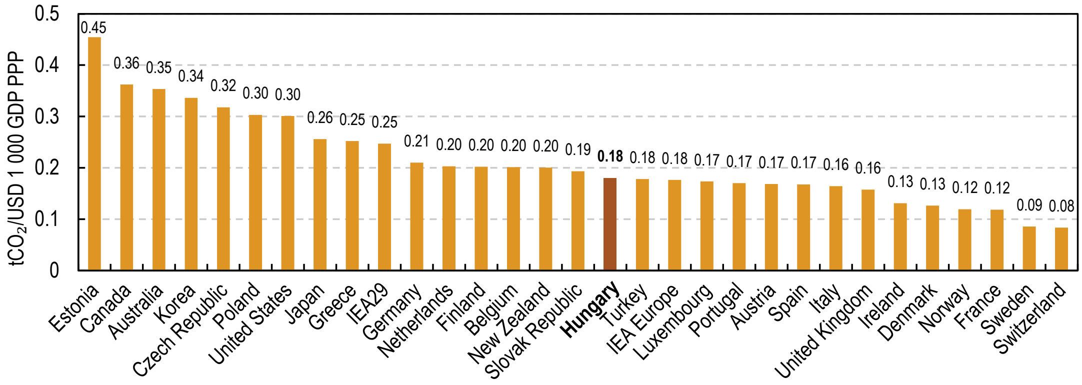
Source: IEA (2017), *$CO_2$ Emissions from Fuel Combustion, 2017 Preliminary edition*, www.iea.org/statistics/.

## Carbon intensity

Hungary's energy related $CO_2$ emissions per GDP are close to the median among the 29 IEA member countries (see Figure 2.5). Carbon intensity has gradually decreased, reaching 0.18 $kgCO_2$/USD in 2015, which is 27% lower than the IEA total average. It is also lower than in the neighbouring Visegrád countries and equal to the average among European IEA countries. Hungary has had relatively low carbon intensity for many years, while in other Eastern European countries, such as Poland and the Slovak Republic, it has fallen more dramatically over the last fifteen years (see Figure 2.6).

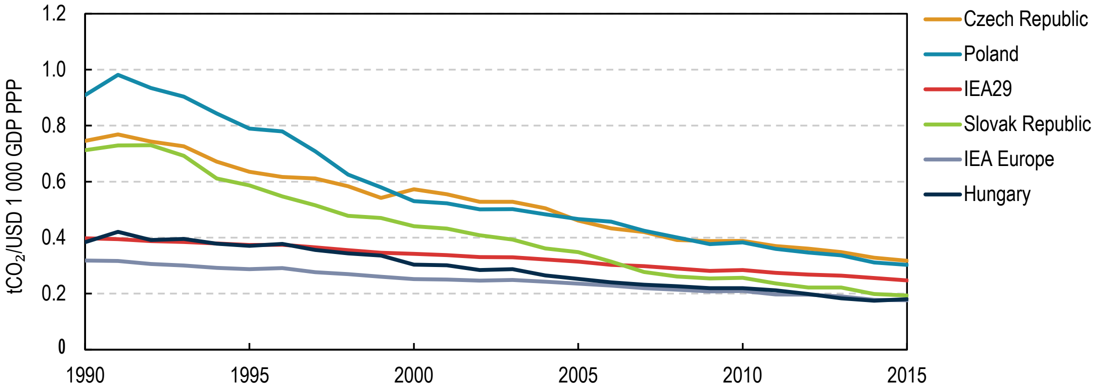
Important drivers for carbon emissions in an economy are population, GDP and energy consumption. These factors are often correlated, as population growth and GDP tend to drive up total energy demand and emissions. Since 1990, energy consumption has remained stable and even declined somewhat despite a flat population curve and significant growth in GDP (see Figure 2.7). This implies a less energy-intensive economy. At the same time, energy supply has become less carbon-intensive as $CO_2$ emissions decreased at a faster rate than TPES. The result has been a 54% reduction in carbon intensity between 1990 and 2014 (in terms of energy-related $CO_2$ emissions per GDP).

### Figure 2.5 Energy-related $CO_2$ emissions per unit of GDP in IEA member countries, 2015



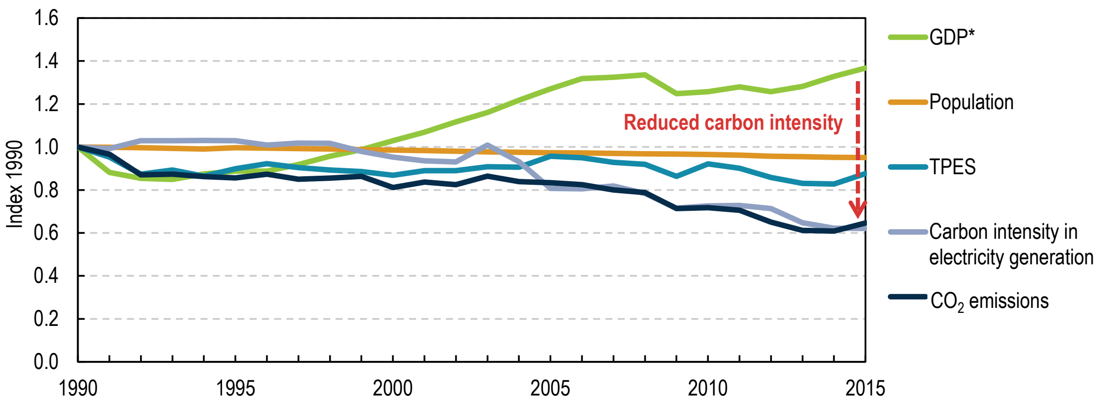

Source: IEA (2017), *$CO_2$ Emissions from Fuel Combustion, 2017 Preliminary edition*, www.iea.org/statistics/.

### Figure 2.6 Energy-related $CO_2$ emissions per unit of GDP in Hungary and in other selected IEA member countries, 1990-2015




Source: IEA (2017), *$CO_2$ Emissions from Fuel Combustion, 2017 Preliminary edition*, www.iea.org/statistics/.

### Figure 2.7 $CO_2$ emissions and main drivers in Hungary, 1990-2015




* Real GDP in USD 2010 prices and purchasing power parities.

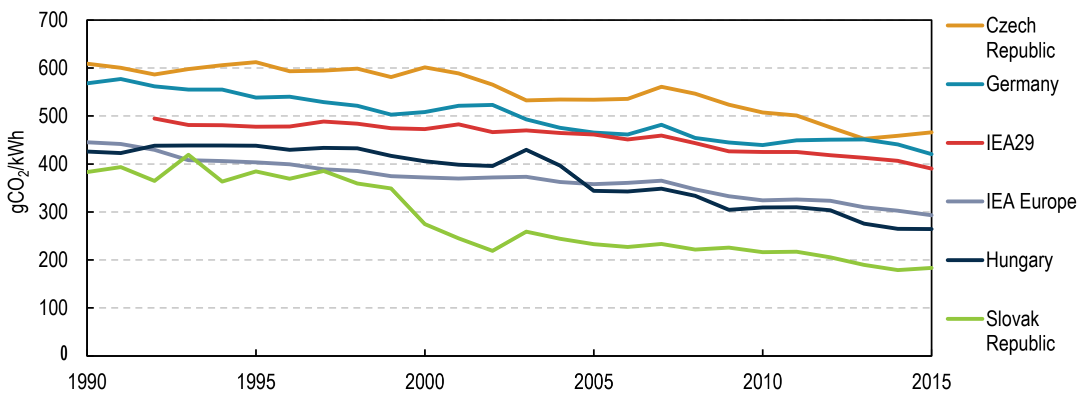
Source: IEA (2017), *$CO_2$ Emissions from Fuel Combustion, 2017 Preliminary edition*, www.iea.org/statistics/.

PART I. POLICY ANALYSIS

Power and heat production accounts for the largest share of energy-related $CO_2$ emissions, and reduced carbon intensity of Hungary's electricity generation contributes to overall declining emissions. This is mainly a result of nuclear power that was introduced in 1983 and accounted for over half Hungary's total electricity generation in 2015.

Carbon intensity of electricity and heat generation was 264 $gCO_2$ per kWh in 2015, which was lower than in the other Visegrád countries, with the exception of the Slovak Republic, and 32% below the IEA average (see Figure 2.8). Since 2005, the carbon intensity of Hungary's heat and power system has fallen by 23%.

### Figure 2.8 $CO_2$ emissions per kWh heat and power in Hungary and in other selected IEA member countries, 1990-2015




Source: IEA (2017), *$CO_2$ Emissions from Fuel Combustion, 2017 Preliminary edition*, www.iea.org/statistics/.

## Policies and institutions

Following the 2010 general election, the Ministry of National Development has been responsible for climate and energy policy in Hungary. As a member of the European Union, Hungary's climate policy is dominated by EU targets and policies. Hungary has committed to contributing 20% GHG emissions reductions in 2020 compared to 1990 under the 2020 European Union Climate and Energy Framework. The 2020 target is equivalent to an EU-wide target of 14% emissions reduction compared to 2005. This has been divided between sectors covered by the Emissions Trading Scheme (ETS) and the non-traded sectors that fall under the Effort Sharing Decision (ESD).

In 2014, the European Council agreed on the 2030 policy framework for climate and energy. The framework sets a binding emissions reduction target of at least 40% by 2030 compared to 1990 (EU, 2017a). This target has also been divided between the ETS and ESD systems, and forms part of EU's commitment to the Paris Agreement (see Box 2.1).

### Box 2.1 The Paris Agreement

Following the 21st Conference of the Parties (COP21) negotiations of the United Nations Framework Convention on Climate Change (UNFCCC), the Paris Agreement on Climate Change was reached in December 2015 by 197 Parties, marking a milestone in global climate change efforts. With the signature of the Agreement in New York in April 2016, parties began joining the Agreement according to their own legal systems (through ratification, acceptance, approval, or accession). On 4 November 2016, the Agreement entered into force, after the threshold was reached of at least 55 Parties which together represent at least 55% of global GHG emissions. As of 30 November 2016, 115 Parties had deposited their instruments of ratification, acceptance or approval.

The Paris Agreement is the first-ever global climate deal with commitments for all Parties. It is based on several key elements:

- The overall objective to limit the global average temperature rise to well below 2°C and pursuit of efforts to limit the temperature increase to 1.5°C.
- An aim to reach global peaking of GHG emissions as soon as possible and to undertake rapid reductions thereafter, so as to achieve a balance between emissions and removals in the second half of this century.
- Self-determined actions by Parties to reduce emissions outlined in their nationally Determined contributions (NDCs) and a commitment to review the NDCs every five years;
- A common framework (with flexibility for countries that need it) to track progress towards an achievement of NDCs for all countries on the basis of a robust transparency and accountability system.
- Periodic collective stocktakes of progress towards the long-term aims of the Agreement.

Other outcomes of COP21 besides the adoption of the Paris Agreement were:

- Launch of Mission Innovation and the Breakthrough Energy Coalition and support for accelerating technology innovation.
- Highlighting role of cities, regions and local authorities, and of non-governmental stakeholders in supporting climate change mitigation and adaptation.

The Agreement also encourages countries to develop long-term, low-emission development strategies. The Paris Agreement was reached under the French COP Presidency which was able to garner the participation of political and business world leaders − 150 heads of state were present at the opening of COP21 − and non-governmental stakeholders and society at large. This altogether enhanced the openness and transparency of the climate talks.

## EU Climate Framework

As a member of the EU, Hungary is part of the European Union Emissions Trading Scheme (EU-ETS), covering most of the emissions from energy production and the industry sector, as well as the EU Effort Sharing Decision (ESD). The ESD established binding annual GHG targets for EU member states for the period 2013-20. These targets concern emissions from those sectors not included in the EU-ETS, such as transport, buildings, agriculture and waste. The ESD established national emission targets for 2020, expressed as percentage changes from 2005 levels. It also laid down how the annual emission allocations (AEAs) in tonnes for each year from 2013 to 2020 are to be calculated. The EU submitted its intended contribution to the Paris Agreement in March 2015 and is taking steps to implement its target to reduce emissions by at least 40% by 2030 (UNFCCC, 2015).

In the case of Hungary, the ESD imposes a target that allows for a 10% increase of emissions from non-ETS sectors in 2020 compared to the level in 2005. The quantified annual reduction targets 2013-20 of Hungary started from 50.4 million AEAs in 2013 and will increase to 58.22 million allocations in 2020 (Table 2.1). Large previous emissions reductions and generous effort-sharing between EU member states places Hungary in a good position to meet its targets. There is room for the government to adapt a more ambitious approach to reducing GHG emissions.

**Table 2.1 Hungary's annual emission allocation for the years 2013 to 2020**

| **Annual emission allocation** (tonnes of carbon dioxide equivalent) | | | | | | |
|---|---|---|---|---|---|---|
| 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
| 50 398 977 | 51 516 636 | 52 634 296 | 53 751 955 | 54 869 615 | 55 987 274 | 57 104 934 |

Note: Emission allocation calculated by applying global warming potential values from the second Intergovernmental Panel on Climate Change assessment report.

Source: EU Commission decision of 26 March 2013 on determining member states' annual emission allocations for the period 2013 to 2020 pursuant to Decision No 406/2009/EC of the European Parliament and of the Council (2013/162/EU).

## EU Emissions Trading Scheme (ETS)

The EU-ETS is a cap-and-trade system introduced in 2005 as a way to use market mechanisms to decrease GHG emissions from the largest emitters in the Union. It covers the power and heat generation sector and energy-intensive industries and, since 2012, commercial aviation (EU, 2017b). Two trading periods have been completed since it started in 2005, and the system is currently in its third phase.

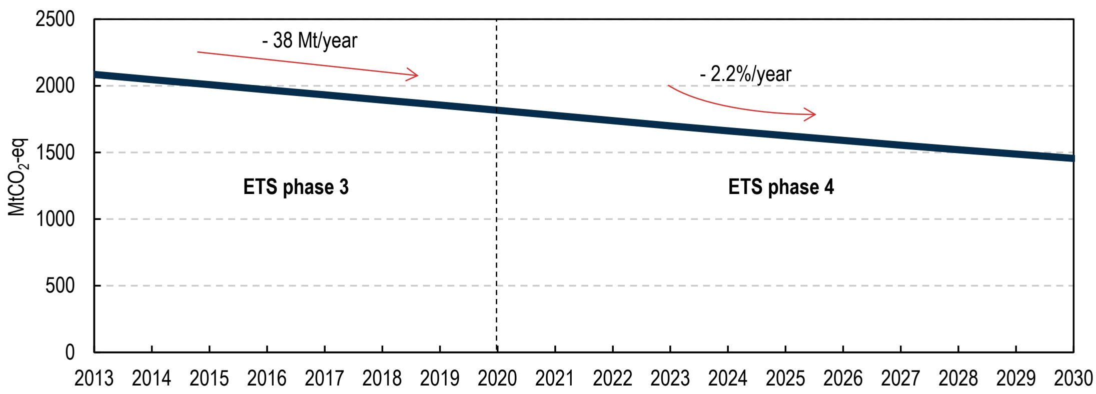
ETS emissions are required to decrease by 21% in 2020 relative to 2005 levels, achieved through a linear annual reduction by 38 Mt$CO_2$-eq (see Figure 2.9). As a result of the common EU-wide cap, Hungary does not have a national reduction target within the EU-ETS, but trades on the ETS market together with the other EU countries.

In the first two trading periods, (2005-07 and 2008-12), each EU member state determined the size and allocation of their emission allowances in a national allocation plan. The sum of the national emission allowances gave the EU-wide cap (EU, 2017b). A majority of emission allowances was allocated for free, on the basis of historical emissions. In the third trading period (2013-20), a single EU-wide cap on emissions was introduced in replacement of the previous system of national caps. Furthermore, auctioning became the default method for the allocation of allowances, replacing free allocation for most emitters. Some industries still receive a significant share of allowances for free to avoid carbon leakage, but power generators have to buy all emission allowances on the market. [3]

The economic downturn in the EU following the financial crisis in 2008 has led to lower growth than expected in industrial production and energy demand. This has resulted in lower emissions and a surplus of emission allowances, which has driven down the trading price of carbon. A low price for $CO_2$ emissions leads to weaker incentives to make the necessary investments in a cost-effective long-term transition towards a low-carbon economy. To address this problem, the Union is establishing an ETS market stability reserve to be operational from 2019, and the surplus emission allowances will be placed and used for adjusting the annual auction volume. The stability reserve will include 900 million allowances that have been back-loaded from the 2014-16 trading period (EU, 2017b).

In the revision for the fourth phase (2021-30), new targets to 2030 are being set for the ETS to meet the overall target of emissions 40% lower by 2030 than in 1990. The ETS cap will be lowered by 2.2% per year from 2021, resulting in 43% emissions reductions between 2005 and 2030 (Figure 2.9). Free allocations will be limited and focused on sectors in highest risk of carbon leakage (EU, 2017b).

**Figure 2.9 Reduction in cap for emissions from fixed installations in the EU-ETS, 2013 to 2030.**




Source: EU (2017b), *The EU Emissions Trading System*, https://ec.europa.eu/clima/policies/ets_en.

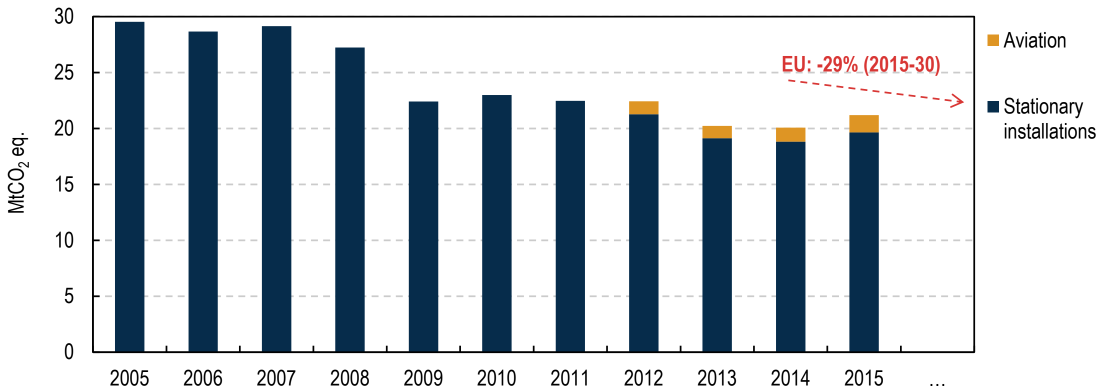
## EU 2030 Climate and Energy Framework

As part of the 2030 Climate and Energy Framework, the European Commission has proposed new binding emission targets in the ESD sectors for the period 2021-30. To reach this target, Hungary is required to reduce its emissions by 7% by 2030 compared to the level in 2005 (EU, 2017c).

[3]. Carbon leakage refers to the possibility for industries to move their production and emissions outside the EU zone, thus not reducing global GHG emissions but rather moving them to another country where the cost of emissions is lower.

Since 2005, all EU member states have reduced their emissions under the ESD system below the allowed annual limits in 2013-14 (EU, 2016). In Hungary, emissions in the ESD sectors declined by 17% between 2005 and 2013 and are projected to remain stable until 2020. This places Hungary significantly below the allowed 10% emission increase under the EU 2020 targets and also below the 2030 target of 7% emissions reduction. In 2015, the trend changed as emissions in Hungary increased both in the ETS and in the ESD system (see Figures 2.10 and 2.11). ESD emissions in 2015 were 5% below the 2030 target.

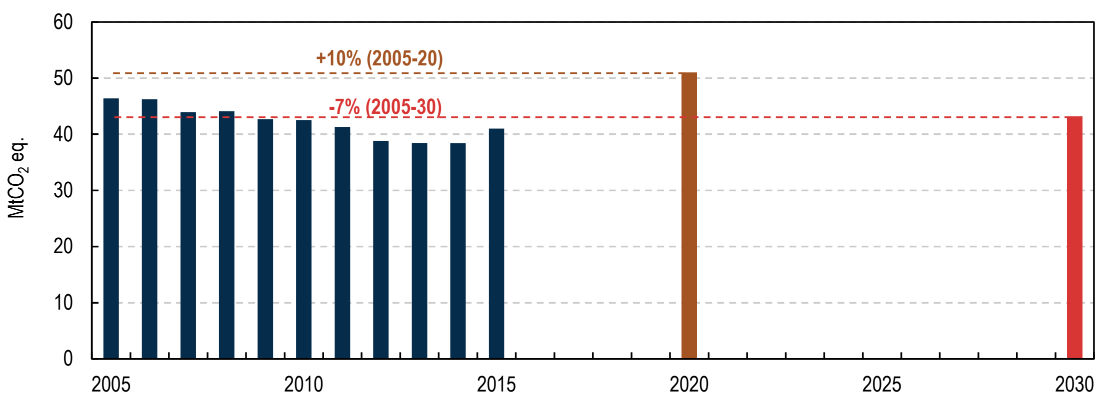
### Figure 2.10 Hungary's emissions in EU-ETS, 2005-15




Note: Stationary installations are mainly heat and power plants and large industries.

Source: EEA (2016a), EU-ETS data viewer, www.eea.europa.eu/data-and-maps/data/data-viewers/emissions-trading-viewer-1.

### Figure 2.11 Hungary's historic emissions and targets in EU ESD, 2005-30




Note: ESD data for 2015 are estimated from proxy and ETS data.

Source: EEA (2017), *Effort Sharing Decision (ESD) dataset 2016*, www.eea.europa.eu/data-and-maps/data/esd.

## Domestic policy and strategy

### *National Climate Change Strategy*

Hungary's first National Climate Change Strategy (NCCS) for 2008-25 was adopted by the parliament in 2008. It contained a GHG emissions reduction target of 16% to 25% for 2025 compared to 1990. The NCCS emphasised the government's obligation to create the necessary regulatory framework, to review and adjust subsidy systems and to raise awareness of sustainability in the society. The residential sector was given high priority.

A second revised National Climate Change Strategy (NCCS II) was submitted in 2015, but it has not yet been adopted by the parliament. The NCCS II was developed by the National Adaptation Center of the Geological and Geophysical Institute of Hungary for the Ministry of National Development. It contains the National Decarbonisation Strategy, the National Adaptation Strategy and the Climate Awareness Plan (NAK, 2013). Hungary is also developing a National Greenhouse Gas Database, which is expected to be available some time in 2018.

### *Transport policy*

The transport sector is an important and growing source of GHG emissions and many recent policy proposals look at how to make the sector more energy-efficient and less carbon-intensive.

The *National Transport Strategy* (NTS), currently under public consultation, examines the transport system development strategy over a short-term perspective (2020), a medium-term perspective (2030), and a long-term vision (up to 2050). The *National Energy Strategy 2030* (NES) sets targets for increasing the share of low-carbon modes of transport as a way to reduce carbon emissions and oil dependence. In accordance with the EU 2020 targets, the share of renewable energy in transport should reach 10% by 2020. For Hungary this will be achieved primarily through the use of biofuels. In 2030, the target is to increase the share of biofuels to 14%. Furthermore, a share of 9% of energy consumption in transport should be electric and hydrogen-based (Ministry of National Development, 2012).

Hungary has developed a *Transport Energy Efficiency Improvement Action Plan* (TEEIAP) with a set of initiatives for supporting sustainable low-carbon modes of transport. Electrification of the transport sector is supported through the E-mobility Programme (the Jedlik Ányos Plan), with incentive schemes in favour of electric vehicles (EV) and plans for increasing the number of EV charging stations (Ministry of National Economy, 2015).

### *Policy support for emissions reductions*

Hungary uses 50% of its revenues from ETS emission allowance payments to fund support schemes for emissions reductions. This is divided equally between the *Economy Greening Scheme* (EGS) under the Ministry of National Economy and the *Green Economy Financing Scheme* (GEFS) under the Ministry of National Development.

The EGS and GEFS both offer funding for renewable energy production and energy efficiency measures, as well as research and development in these fields. One of the main purposes of EGS is support for low-emission transport. In 2015, the scheme was focusing on support of electro-mobility through the "Jedlik Ányos Plan".

The GEFS was launched in 2016 to support policy programmes for renewable energy, energy efficiency and GHG emissions reductions. It complements the *Green Investment Scheme* (GIS), which uses revenues from selling emission units under the Kyoto Protocol. GIS support is focused on the building sector and mainly supporting energy efficiency measures. GEFS support can be given to a broad set of measures with the purpose of reducing GH gases, creating GHG sinks, or reducing the effects of climate change.

The *Warmth of Home* programme 2014-16 was launched in order to reduce households' energy costs and address energy poverty. Among other things, the programme enabled the replacement of outdated an inefficient household boilers, a measure that can reduce both household emissions and the cost of energy in poor households.

The transition towards more renewable energy is a key means for achieving emissions reductions. In 2011, Hungary published its National Renewable Energy Action Plan (NREAP), setting a target of 14.65% renewable energy in gross final consumption to 2020. The share of renewable energy in TPES was 8.5% in 2015 (9.51% of gross final energy consumption in 2014). A new renewable energy support scheme (METÁR) is being developed, which will take effect in 2017.

### Local air quality

Despite the obligation for EU member states to ensure satisfactory air quality for their citizens, local air quality remains a problem in many parts of Europe. Hungary has made good progress in improving air quality, but exceedances of limit values for $PM_{2.5}$ (fine particulates under 2.5 microns in diameter), $PM_{10}$ (large particulate matter) and benzo(a)pyrene (BaP) in the winter season remain a problem in some parts of the country. Small-scale combustion of coal and biomass and concentrated local pollution (particularly in the heating season) are the main factors driving these emissions.

Exposure to high concentrations of $PM_{2.5}$ has been linked to a variety of health concerns, including asthma, heart problems and premature death of people with heart or lung disease. Background $PM_{2.5}$ concentration values in Hungary are relatively high but fall below the EU target maximum value. $PM_{10}$ concentration levels are also relatively high but marginally below the EU-target maximum values. Annual mean concentration values of BaP, found in coal tars and a cause of lung cancer, are also relatively high (EEA, 2016b).

## Assessment

The EU 2030 Framework for Climate and Energy imposes greater GHG emissions reductions targets on EU member states than in the past. Hungary's emissions under the ESD are expected to remain constant until 2020. The reduction of GHG emissions related to buildings and waste is expected to counterbalance the growth of emissions in the transport sector. Thanks to earlier emissions reductions and generous effort sharing between EU member states, Hungary's non-ETS emissions in 2015 were 5% below the target, achieving 7% emissions reductions in 2030 compared to 2005. This indicates there is room for a more ambitious target to be set at national level, to ensure the country keeps the positive trend with declining emissions. The new NCCS II offers an opportunity for increasing ambitions in the climate change mitigation work. The process should be open to all stakeholders to improve transparency and legitimacy of the strategy.

Achieving further reductions will require measures to mitigate growing emissions in the transport sector. These emissions have been stimulated in part by significant investment in road transport infrastructure and insufficient support for less carbon-intensive modes of transport, as well as the age of the vehicle fleet which is among the oldest in Europe. New programmes such as the e-mobility programme (Jedlik Ányos Plan) and developments in public transport have the potential to reduce emissions. Implementing further measures to reduce emissions and improve energy efficiency in road transportation should be a priority.

Another important source of non-ETS emissions is coal and waste use in households, as both emit $CO_2$ and other pollutants. Some financial support and incentives are available for the replacement of old boilers with cleaner and more efficient ones. This can help improve local air quality and reduce GHG emissions. The government should examine present incentives in the household space-heating sector to ensure that the mechanism provides less well-off households with the means to switch from burning coal or waste towards cleaner solutions such as electricity, natural gas or district heating.

One policy tool available to Hungary is the possibility of introducing a carbon tax for those sectors of the economy outside the EU-ETS. This carbon tax could initially be set at a low level that increases over time to a level that will directly influence behaviour. There are a number of countries where such a tax has been successfully introduced, which can provide useful learning experiences for Hungary.

For emissions within the ETS sector, mainly from power generation and industry, the cap-and-trade system limits the emissions on a European scale. The cap is steadily being reduced, and the current low prices for emission allowances will increase once the current surplus of allowances is removed. Hungary has largely relied on increased electricity imports to improve carbon intensity of the power sector in recent years. If additional improvements are to be achieved without further increasing the reliance on imports, more low-carbon power sources should be developed. Using natural gas or renewable energy sources instead of coal, which accounts for one-fifth of electricity generation, would reduce emissions from the sector. Detailed action plans and roadmaps need to be developed and implemented alongside harmonisation with policies in other sectors such as environment, agriculture and waste.

Hungary will have to examine the climate resilience of the energy system within the broader context of energy security, generation adequacy and protection of critical energy infrastructure. The National Adaptation Strategy (NAS) will be developed as part of the implementation of NCCS II and this is likely to include assessment of resilience. The government expects that the flow rate of rivers may decrease over the medium term and this could affect the supply of water to nuclear power plants and also to hydropower generation. Electricity demand for cooling is also likely to grow over the medium term, which may increase stress on the electricity system. Implementation of the NAS should include measures to assess the climate resilience of existing energy infrastructure.

## Recommendations

***The government of Hungary should:***

- ☐ Complete the process of developing the National Climate Change Strategy II and ensure that the process is open to all stakeholders, including non-governmental organisations. Adopt more ambitious and challenging targets for greenhouse gas reductions across all sectors.
- ☐ Develop a set of policies and measures, including roadmaps for implementation, to mitigate emissions in the non-ETS sectors. Specific targets should be set for the transport sector and buildings.

- Accelerate the introduction of measures and incentives to eliminate inefficient coal boilers in households and replace them with cleaner and more efficient heating solutions.
- Conduct a detailed analysis of the feasibility and effectiveness of introducing a carbon tax for the non-ETS sectors to encourage energy savings and cleaner energy consumption, and use the revenues generated to stimulate these switches.
- Ensure that the Hungarian Adaptation Strategy includes an assessment of the climate resilience of existing and future energy infrastructure. Identify and prepare appropriate measures.

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# 3. Energy efficiency

## Key data
(2015)

**Energy supply per capita:** 2.6 toe/cap (IEA average: 4.4), -6% since 2005

**Energy intensity:** 107 toe/USD million PPP (IEA average: 111), -16% since 2005

**TFC:** 18.9 Mtoe (oil 34.5%, natural gas 30.3%, electricity 16.5%, biofuels and waste 11.5%, heat 5.1%, coal 1.7%, geothermal 0.3%, solar 0.1%), -0.5% since 2010

**Consumption by sector:** residential 31.6%*, industry 31.5%, transport 22.3%, commercial and public services including agriculture, forestry and fishing 14.7%

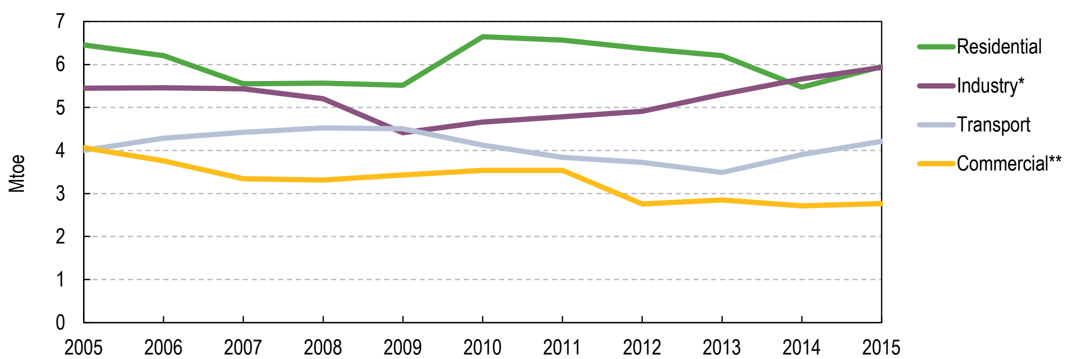
**Exchange rate:** HUF 1 = USD 0.00358 or EUR 0.00323; USD 1= EUR 0.901

**Due to a change in data collection methodology, consumption of biofuels in the residential sector increased by 170% from 2009 to 2010, which makes long-term comparisons less reliable.*

## Overview

Hungary's Energy Strategy and the *National Energy Efficiency Action Plan* both set energy efficiency as a priority for reducing energy imports and thus improving energy security. Total final energy consumption (TFC) has fallen over a ten-year period, despite increased consumption in the residential sector in 2010 as a result of a new methodology for collecting biofuel data. The residential and commercial sectors combined represent 46% of TFC and their energy consumption has declined as a result of several measures for improving energy efficiency in buildings. Energy consumption in industries and transport has increased in recent years. The industry sector accounts for almost one-third of TFC and transport accounts for nearly one-quarter of TFC.

**Figure 3.1 Energy consumption by sector, 2005-15**




*Industry includes non-energy use.

**Commercial includes commercial and public buildings and services, and agriculture, forestry and fishing.

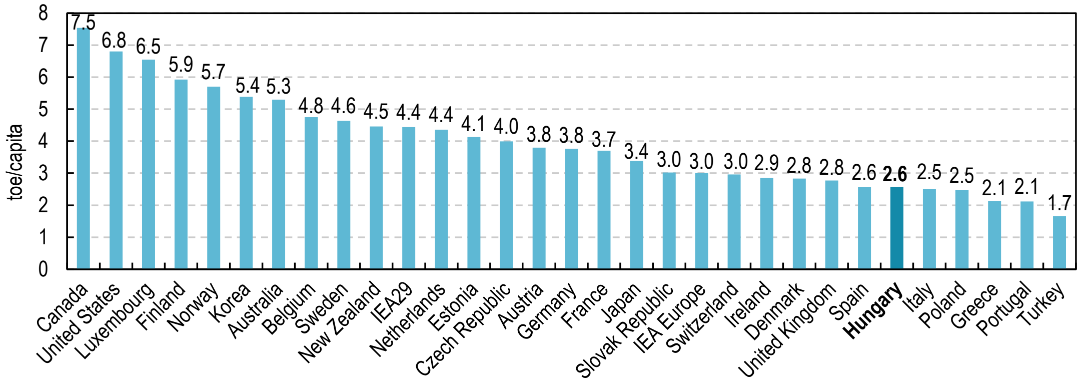
Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## Energy intensity

Hungary's primary energy supply (TPES) per capita is the sixth-lowest among the IEA member countries (see Figure 3.2). Energy intensity in terms of energy use per GDP places Hungary in the middle among IEA countries, 4% below the IEA average, but 20% above the average among IEA European countries (see Figure 3.3).[1]

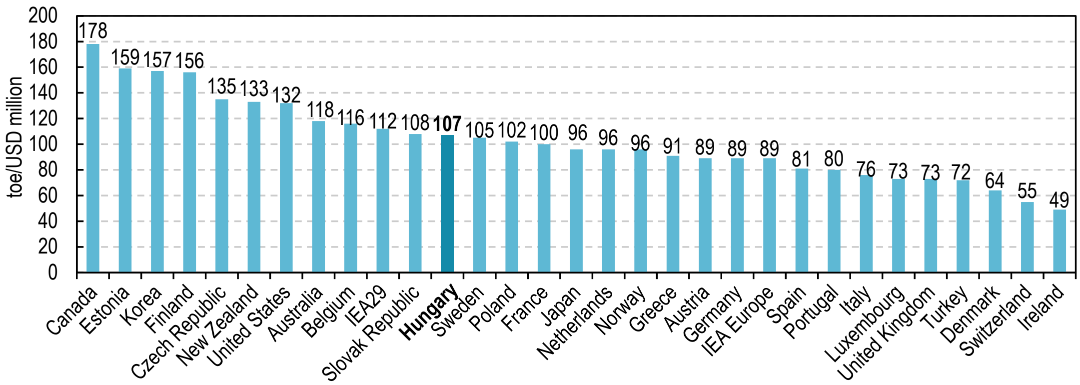
Hungary's energy intensity has historically been low compared to neighbouring Visegrád countries, although Poland, the Czech Republic and the Slovak Republic have reduced their energy intensity at a faster rate in recent decades (see Figure 3.4). In recent years from 2010 to 2015, energy intensity declined by 14% in Hungary, compared to 18% in Poland and in the Slovak Republic.

### Figure 3.2 TPES per capita in IEA member countries, 2015




Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

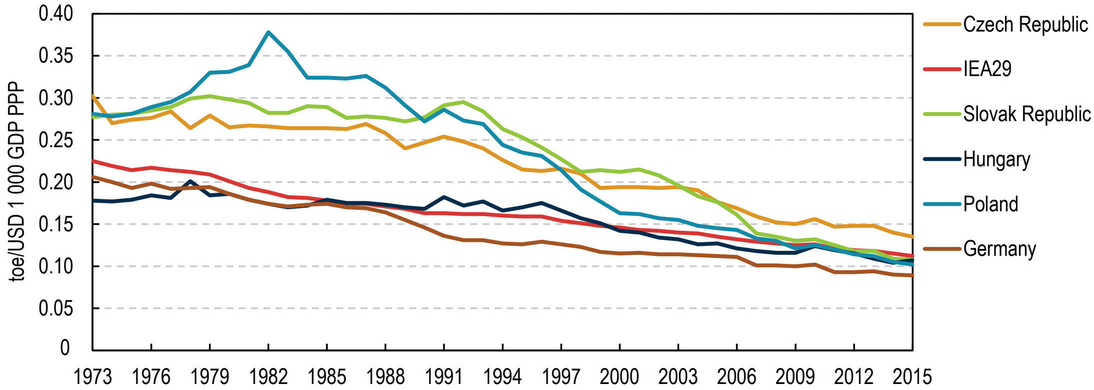
### Figure 3.3 TPES per GDP in IEA member countries, 2015




Note: GDP in real numbers for US dollar per purchasing power parity (PPP), in 2010 values.
Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

[1]. The main reason for the difference between the IEA total and IEA Europe is that the United States has a relatively high level of energy consumption per unit of economic output, and a GDP that made up 36% of total GDP in all IEA countries in 2015.

**Figure 3.4 Energy intensity in Hungary and in other selected IEA member countries, 1973-2015**




Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## National Energy Efficiency Action Plans

The EU Energy Efficiency Directive (EED) 2012/27/EU provides the framework for national policy in EU member states. It establishes a set of binding measures to help the Union reach its 20% energy efficiency target by 2020. Under the directive, all EU countries are required to use energy more efficiently at all stages of the energy chain, from production to final consumption (EU, 2012).

In accordance with article 24 of the EED, EU member states are required to submit *National Energy Efficiency Action Plans* (NEEAP) every third year. These must include targets for energy savings and information on energy efficiency measures. In the third and latest NEEAP in 2015, Hungary established 2020-targets for TPES at 1009 petajoules (PJ) and TFC (excluding non-energy use of fuels) at 693 PJ (NEEAP, 2015).

On the basis of energy consumption levels in 2012 and projected demand increase, Hungary has calculated a total energy savings target of 73 PJ to 2020, with an intermediary target of 36.5 PJ (half the savings to 2020) in 2016. This is divided among each of the consuming sectors (see Table 3.1). The greatest savings potential is found in the residential sector, both in real terms and as percentage of the 2012 consumption. Total final energy consumption (excluding non-energy fuel consumption) increased by 5% between 2012 and 2015 to 707 PJ. This is 30 PJ above Hungary's projected value for 2020, and 2% above the target of 693 PJ.

**Table 3.1 Hungary's energy savings targets for the period 2012-20 per sector (PJ).**

| Sector | Energy consumption 2012 (IEA data) | National savings target 2012-20 | Expected energy consumption 2020 | Energy consumption 2015 (IEA data) |
|---|---|---|---|---|
| Industry* | 135 | 10 | 114 | 166 |
| Transport | 156 | 14 | 147 | 176 |
| Residential | 267 | 40 | 207 | 249 |
| Commercial** | 115 | 9 | 135 | 116 |
| **Total** | **673** | **73** | **603** | **707** |

**Industry* excludes non-energy fuel consumption.

***Commercial* includes agriculture and fishery, trade and service, and public bodies.

Source: NEEAP (2015), *Hungary's National Energy Efficiency Action Plan until 2020*; IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## Energy efficiency funding schemes

Hungary has several financing schemes supporting energy efficiency programmes. These are either state-financed, using revenues from the European Union Emissions Trading Scheme (EU-ETS), money directly from the state budget, or financed by means of an EU fund. Important programmes are the *Green Economy Financing Scheme* (GEFS) and the *Environment and Energy Efficiency Operational Programme* (EEEOP).

The Union provides funding to reach the EED targets, partly through the European Structural and Investment Funds (ESI), which will allocate EUR 18 billion to energy efficiency in 2014-20 (EU, 2016a).

### *Green Economy Financing Scheme*

The Green Economy Financing Scheme (GEFS) is a government-funded financing system managed by the Ministry of National Development. It supports green economic development in Hungary by implementing environmental schemes related to energy efficiency and renewable energy sources, with a focus on energy efficiency in the residential sector. Applicants for GEFS projects can also apply for an interest-rate subsidy (up to 100%) in order to cover the cost of loans to realise their projects.

In 2015, the state budget financing of GEFS was HUF 5.5 billion (EU, 2016b). This is topped up with 25% of the revenues earned from the sale of the country's EU allowance units (EUA) quotas under the EU-ETS. Total EU-ETS revenue in 2015 was EUR 83 million, which adds approximately HUF 6.4 billion to programme financing (Ecologic Institute, 2016). The GEFS has been in place since 2014, when it replaced the Green Investment Scheme (GIS), which was funded by revenues raised from selling the country's emission units under the Kyoto Protocol (see the residential and commercial section below).

### *Environment and Energy Efficiency Operational Programme*

The Environment and Energy Efficiency Operational Programme (EEEOP) aims to support sustainable growth and contribute to achieving the Europe 2020 targets. It has five focus areas: climate change adaption, water management, waste management, promoting energy efficiency and the use of renewable energy. EEEOP is co-financed by the Union by means of the ESI, which will contribute EUR 3.2 billion from 2014 to 2020, complemented by EUR 0.57 billion from the Hungarian state (EU, 2016a). Approximately one-quarter of the total budget of EUR 3.8 billion will be allocated to reducing $CO_2$ emissions through the use of renewable energy or energy efficiency measures over all sectors (Ministry of National Development, 2014).

### Institutions

Energy efficiency policy and regulation in Hungary is divided over several ministries. The **Ministry of National Development** is responsible for the National Energy Strategy and the *National Energy Efficiency Action Plan*, as well as for energy efficiency in transport. Electro-mobility, on the other hand, is the responsibility of the **Ministry of National Economy**, which is also responsible for energy efficiency in industry as well as for compliance with the European directives on eco-design and energy labelling. The **Prime Minister's Office** is in charge of the implementation of the Energy Performance in Buildings Directive (EPBD) and is responsible for public procurement. The **Hungarian Energy and Public Utility Regulatory Authority (HEA)** is in charge of collecting energy statistics, which is important for monitoring progress in energy efficiency. HEA is responsible for the registration of energy audits and auditors. A **National Energy Efficiency Advisory Network** has been set up to provide advice on energy efficiency measures.

## Industry

### Energy consumption and intensity

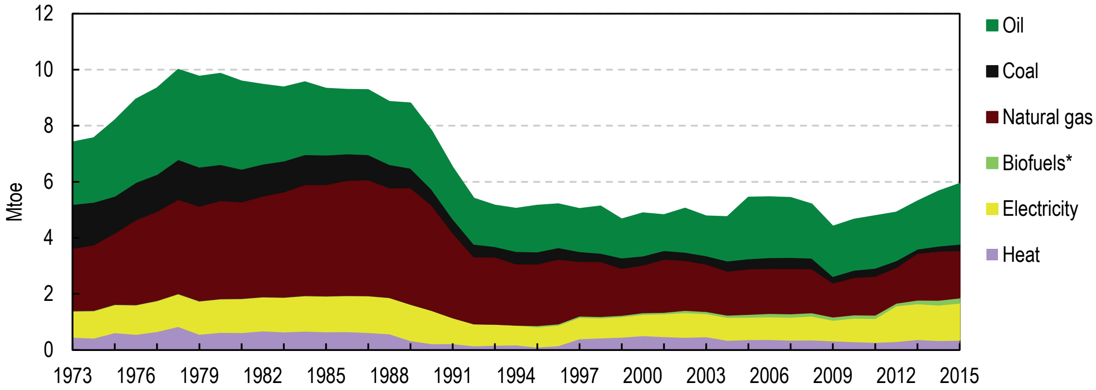
The industry sector accounted for almost one-third of total energy demand in 2015. Consumption was 5.9 Mtoe, of which 2.0 Mtoe was for non-energy use (fuels used as feedstock in industrial processes). Energy consumption in industry declined after the financial crisis in 2008 but has recovered since with a 27% increase from 2010 to 2015.

Oil accounts for 36% of energy consumption in industry, followed by natural gas (29%) electricity (22%) and small shares of heat, coal and biofuels (see Figure 3.5). The fuel mix has been stable in the sector over the last years with oil and natural gas holding the largest shares. Coal consumption declined by 13% from 2010 to 2015 while the use of biofuels increased by over 56% over the same period; however, the shares of these fuels are small in comparison with total consumption. Electricity use increased by 57% from 2010 to 2015, but this was mostly a result of changed reporting methodology.[2]

The five largest industry sectors account for 80% of total energy demand in the sector, with the chemical and petrochemical industry holding the largest share (see Figure 3.6). In terms of value creation in the industry, the machinery sector contributes with almost half of total economic value. Energy intensity defined as energy consumption divided by the value creation is thus very low for the machinery sector (approximately 2 MJ/USD), while the chemicals industry is significantly more energy intensive (approximately 22 MJ/USD).

[2]. From 2013 data, the Hungarian government started to use a new methodology for reporting supply and demand of electricity and heat. This leads to breaks between 2012 and 2013, where electricity consumption increases in the industry sector and decreases in the commercial sector.

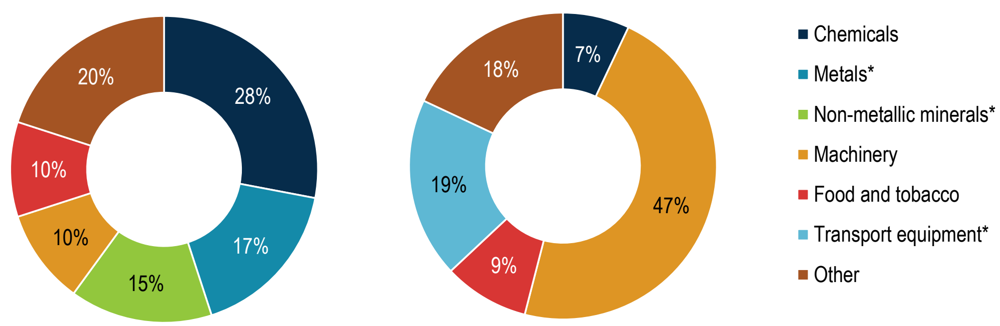
**Figure 3.5 TFC in the industry sector (including non-energy use) by source, 1973-2015**




*Negligible.

Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

**Figure 3.6 Industry TFC and value added broken down by industry sector (energy use only), 2013**




*Metals and Non-metallic minerals are part of *Other* in the right-hand chart. Transport equipment is part of *Other* in the left-hand chart.

Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*; IEA (2016) *Energy Efficiency Indicators Highlights 2016*, www.iea.org/statistics/.

## Policies and institutions

Industrial energy efficiency developments and support programmes are the responsibility of the Ministry of National Economy. Under the Economic Development and Innovation Operational Programme (EDIOP), Hungary has a planned energy efficiency programme directed at small and medium-sized enterprises (SMEs) for the modernisation of buildings and industrial processes and for the use of renewable energy sources (NEEAP, 2015). The main policy for industrial energy efficiency is energy auditing requirements, driven by Union's EED. Energy efficiency measures driven by energy services companies (ESCOs) have been a large business in Hungary.

### *Energy audits*

Article 8 of the EED requires EU member states to carry out the energy audits of large enterprises.[3] The energy audits are performed by either in-house experts or qualified auditors. Each country must ensure that there is a system in place to guarantee the quality of the audits. As a first step, EU member states have to identify the enterprises that fall under this obligation. The first deadline for completed energy audits of large enterprises was December 2015, and new audits are to be performed every fourth year (EU, 2016d).[4] The regulation requires that between 1 500 and 2 000 enterprises perform the audits, of which between 100 and 150 have chosen to implement ISO50001. A registered energy auditor must be an appropriately qualified engineer, with five years of work experience, who has passed an exam prepared by the Hungarian Chamber of Engineers. The regulatory authority HEA supervises the registration of energy auditors (EU, 2016b). EU member states are further obliged to develop programmes that encourage SMEs to undergo energy audits and implement recommended measures.

### *Energy services companies*

An energy services company (ESCO) is a company that offers energy services which may include implementing energy-efficiency projects (and also renewable energy projects) and in many cases on a turnkey basis. The Hungarian ESCO market was thriving in the 1990s following the economic transition that led to market liberalisation and growth in energy prices. The economy was energy-intensive, not least in the industry sector, and there were many projects available that offered opportunity to make energy efficiency investments with short payback times. When most of the attractive projects were completed, the government initiated programmes supporting the ESCO market to further encourage energy efficiency measures in industry and buildings. In recent years, public support for ESCOs has been reduced, and the market has declined (Transparense, 2015).

## Transport

### Energy consumption and intensity

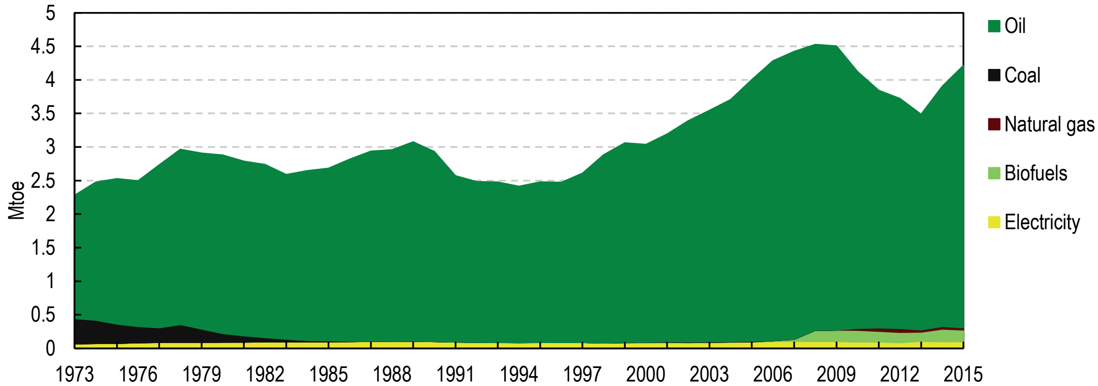
The transport sector accounted for almost one-quarter of TFC and 60% of final oil consumption in Hungary. Energy consumption in transport has varied significantly in the past from less than 2.5 Mtoe in 1996 to over 4.5 Mtoe in 2009 and dropped again to 3.5 Mtoe in 2013. In 2015, consumption has recovered to 4.2 Mtoe, resulting in a 2% growth over a five-year period from 2010. Road transport accounts for 96% of energy demand in the sector.

Oil accounts for 93% of energy supply in the transport sector with the rest supplied by biofuels, electricity and natural gas. Although alternative fuels have increased significantly in the last decade, growth has slowed and the level of non-oil energy sources in the transport sector has been stable at around 0.3 Mtoe since 2010.

[3]. Large enterprises are defined as enterprises that are not SME small and medium-sized enterprises (SMEs). An SME is defined as an enterprise that employs fewer than 250 persons and has an annual turnover of EUR 50 million or less.

[4]. Companies were allowed to be a year late with performing the first audit without being fined.

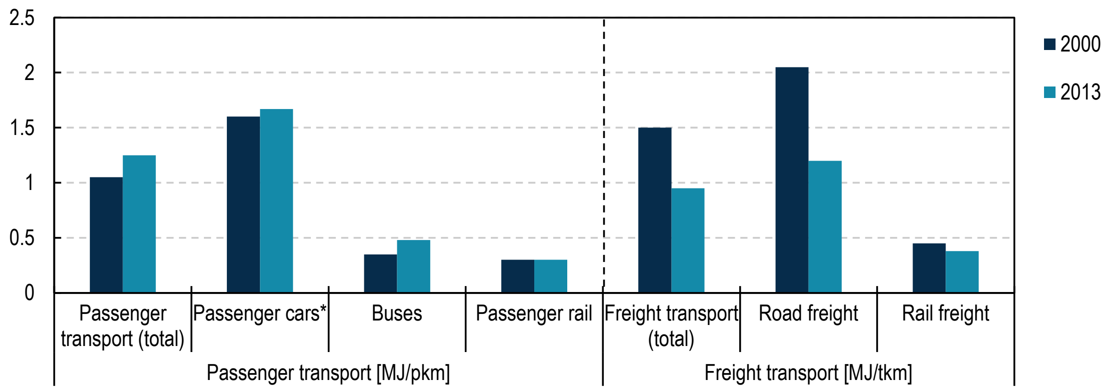
## Figure 3.7 TFC in the transport sector by source, 1973-2014




Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

Passenger cars are the largest energy consumers in the transport sector, accounting for 60% of total consumption in 2013, followed by road freight (30%), buses (6%) and rail (4%). Energy intensity in passenger cars increased slightly between 2000 and 2013 while freight transport by road has become significantly more efficient (see Figure 3.8). Energy-intensive passenger transport is a consequence of Hungary's old car fleet, which is among the oldest in Europe. Only 8% of passenger cars were less than five-years old in 2014 (see Figure 3.9).

## Figure 3.8 Energy intensity for passenger and freight transport, 2000 and 2013

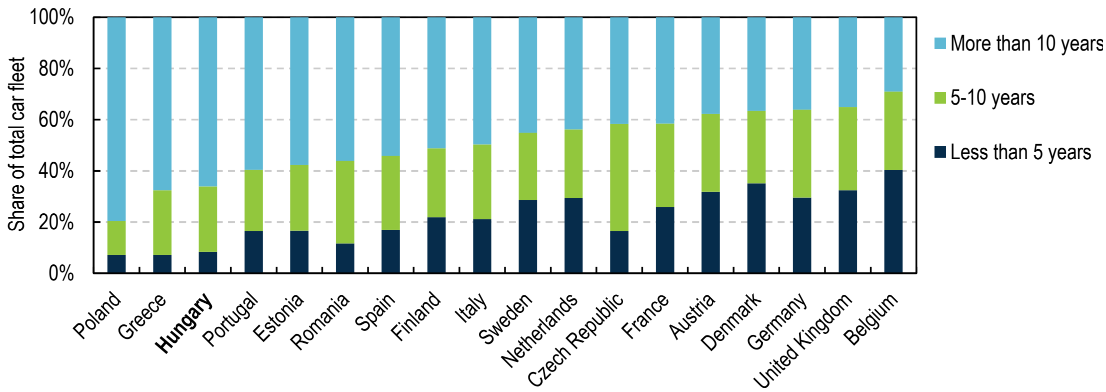



Note: pkm = passenger kilometre, tkm = tonne kilometre; MJ = megajoule.

* Passenger cars include cars, sports utility vehicles and personal trucks.

Source: IEA (2016), *Energy Efficiency Indicators Highlights 2016*, www.iea.org/statistics/.

**Figure 3.9 Age of the passenger car fleet in European countries, 2014**




Note: Data not available for all European countries.

Source: ACEA (2016), *Average Vehicle Age 2014*, www.acea.be/statistics/article/average-vehicle-age.

## Policies and measures

The EU Directive on the Deployment of Alternative Fuels Infrastructure (2014/94/EU) requires EU member states to adopt a national policy framework for the development of alternative fuels infrastructure. In order to meet EU requirements and to increase energy efficiency in the transport sector Hungary has launched initiatives such as the electro-mobility programme and development and reform of public transport.

### *Electro-mobility*

The national policy framework for alternative fuels infrastructure development includes setting a target for an appropriate number of public charging points for electric vehicles, and ensuring that it is reached within 2020. The EU Directive 2014/94 recommends at least one public charging point for every ten electric vehicles as a guideline.

With the electro-mobility programme, the government intends to promote the use of electric vehicles by means of a number of legislative measures, including reviewing and amending the Electricity Act, introducing green licence plates for hybrid and electric vehicles, permitting the use of bus lanes, as well as introducing parking and road toll incentives. The government will also formulate an authority protocol for the installation of electric vehicle chargers, consistent with EU legislation (Ministry of National Economy, 2015).

### *Other measures*

Besides electric vehicles, the EU directive on alternative fuels includes requirements on preparations for increased use of gas, biofuels and hydrogen in the transport sector. Hungary has included a target in the Climate Change National Strategy (CCNS) to prepare for an increase in the use of alternative fuels and the setting-up of the required infrastructure conditions. This primarily consists of developing the legislative framework and, to a lesser extent, the introduction of other incentives (NEEAP, 2015).

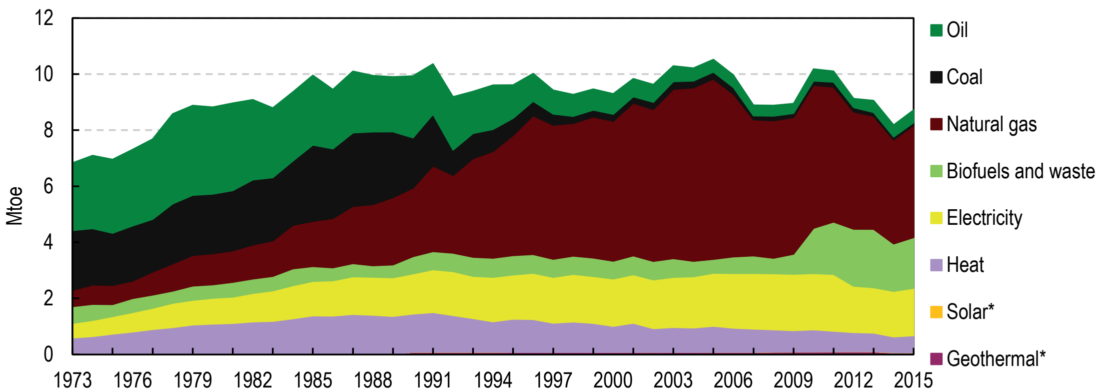
As part of the Transport Infrastructure Development National Strategy, Hungary developed a *Transport Energy Efficiency Improvement Action Plan* (TEEIAP). In the TEEIAP, the government is introducing initiatives for the development of bicycle lanes, improving energy efficiency in rail transport (railway electrification and network modernisation), encouraging public transport through improving facilities to combine different ways of commuting, as well as introducing road taxes, a bus-replacement programme and eco-driving training (NEEAP, 2015).

## Residential and commercial

### Energy consumption and intensity

The residential sector accounted for 32% of total final energy consumption in 2015 and the commercial sector consumed 15% (see Figure 3.1). Both sectors have experienced large declines in energy consumption over the past decade, except for an increase in residential use of biofuels, which is the result of changed methodology for data collection. In the five years from 2010 to 2015, consumption in the residential sector fell by 10% and commercial sector consumption fell by 23%. The decline is to a large extent a result of more efficient buildings that require less energy for heating.

**Figure 3.10 TFC in the residential and commercial sectors by source, 1973-2014**




*Negligible

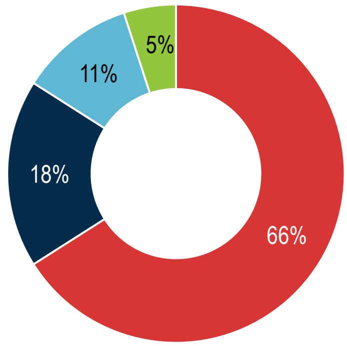
Note: The large increase in biofuel consumption from 2010 was a result of a new methodology for collecting data for use of solid biofuels in households.

Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

The fuel mix is similar in the residential and commercial sectors, with natural gas supplying almost half the total energy consumption (see Figure 3.10). After increasing steadily since the 1970s, natural gas consumption has fallen by 22% between 2010 and 2015, as a result of an overall declining energy demand in both sectors. The period of growth was a result of fuel replacement, when coal (mainly in the residential sector) and oil (mainly in the commercial sector) were replaced by natural gas. Biofuels and electricity are the other large energy sources in the sectors, accounting for around one-fifth of total energy consumption each. There was a drop in electricity consumption from 2012 to 2013, but this was mostly a result of changes to the calculation methodology (as described in footnote 2).

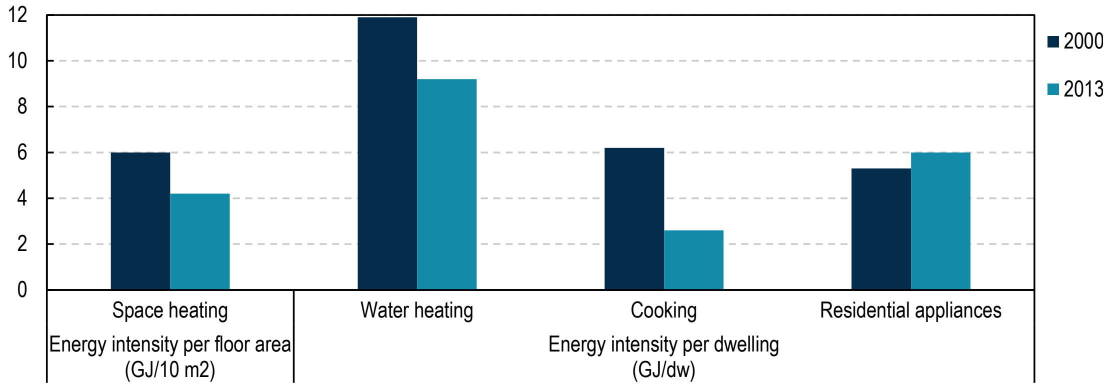
Space heating accounts for two-thirds of energy consumption in the residential sector, followed by energy used for water heating, appliances and cooking (Figure 3.11). Energy intensity has improved significantly in the residential sector, especially in space heating which used almost one-third less energy per metre of floor area in 2013 than in 2000 (see Figure 3.12). This confirms that measures for improving energy efficiency in buildings have had a positive impact. Only appliances have increased their energy intensity, as a result of the growing number of electronic devices per person and per household.

**Figure 3.11 Energy consumption in the residential sector by end-use, 2013**




Source: IEA (2016), *Energy Efficiency Indicators 2016* (database), www.iea.org/statistics/.

**Figure 3.12 Energy intensity in the residential sector, 2000 and 2013**




Note: GJ = gigajoule.

Source: IEA (2016), *Energy Efficiency Indicators Highlights 2016*, www.iea.org/statistics/.

## Policies and measures

Hungary's National Energy Strategy 2030 (NES 2030) adopted in 2011 points to the building sector as a key component for improving energy efficiency (Ministry of National Development, 2012). A number of actions for achieving the energy efficiency targets are proposed and will be further developed in a new *Building Energy Action Plan*. Proposed actions include measures to support schemes for energy efficiency and renewable energy projects on the existing building stock, reviewing energy performance for new buildings, including specific requirements for public buildings, and promoting knowledge enhancement and sharing between different stakeholders (Ministry of National Development, 2015). Energy performance standards and financial support programmes addressing the residential sector have contributed to declining energy consumption in the sector.

### *Energy performance in buildings*

In 2015, Hungary adopted the National Building Energy Performance Strategy (NABEPS), in accordance with article 4 in the EED. Its main focus is on implementing energy modernisation of the domestic building stock (Ministry of National Development, 2015). The NABEPS states targets for savings from improving the energy performance of residential, public and business buildings. From 2012 to 2020, the energy savings target is 49 petajoules, of which 40 PJ should come from renovation of residential buildings (38.4 PJ) and public buildings (1.6 PJ) (see also Table 3.1).

In 2015, stricter building energy requirements were introduced through the Ministry of Interior. New standard regulations with stricter U-values for façades and windows must be used for any significant refurbishment with EU or national support, and for new building construction or major renovations (IEA, 2017b).[5]

### *Financing schemes for energy efficiency in buildings*

From 2009, the Green Investment Scheme (GIS) was a support mechanism financed by means of revenues raised from the sale of emission units under the Kyoto Protocol. GIS provided support to projects that improved energy efficiency in households, with sub-programmes focused on specific areas (see Table 3.2). The objective of these sub-programmes was to provide investment grants for work that contributes to the reduction of residential energy consumption, moderating the overhead burdens for households and also reducing GHG emissions. The key objective of the sub-programmes was to support the renovation of homes built using prefabricated technology to achieve energy savings through retrofitting (IEA, 2017b).

**Table 3.2 Green Investment Scheme sub-programmes 2009-10.**

| Sub-programme | Year | Objective | Budget (HUF) |
|---|---|---|---|
| Climate-Friendly Home Panel Sub-programme | 2009 | Improving insulation of buildings through refurbishment, and increasing the use of renewable energy for heating. | 27.9 billion |
| Climate-Friendly Home Energy Efficiency Sub-programme | 2009-10 | Construction of new, energy-efficient houses. | 2 billion |
| Energy-Efficient Household Appliance Replacement Sub-programme | 2010 | Replacement of old washing machines or fridges with new, energy-efficient household appliance. | 1 billion |
| Energy-Efficient Bulb Replacement Sub-programme | 2010 | Replacement of conventional light bulbs with energy-efficient bulbs. | 0.45 billion |
| "Our Home" Renovation and Building New Home Sub-programme | 2011 | Promote energy efficiency and use of renewable energy in renovation of building blocks and construction of new, energy-efficient building blocks. | 1.6 billion |
| Solar Collector Promotion Sub-programme | 2011 | Promotion of renewable energy usage through installation of multi-functional solar collector systems for the generation of residential water- and space-heating purposes | 2.97 billion |

Sources: Ministry of National Development (2010), *Green Investment Scheme Annual Report 2010*, http://zbr.kormany.hu/download/1/b9/20000/GIS_Hungary_Annual_Report_2010_final.pdf; and Ministry of National Development (2011), *New GIS Sub-programs*, http://zbr.kormany.hu/new-gis-sub-programs.

[5]. U-value is a measure of thermal transmittance (energy leakage) for a building material or structure. A lower U-value means better insulation capabilities of the material and improved energy efficiency of the building.

The *Green Economy Financing Scheme* (GEFS), funded through the revenue from the sale of emission allowances in the EU Emissions Trading System (ETS), replaced GIS from 2014. A sub-programme of the GEFS, the *Warmth of Home Programme*, was launched in 2014 to further reduce energy costs in households. In 2016, the programme included a scheme to support the renovation of family homes.

Another multi-annual programme financed by the European Regional Development Fund starts in 2017 and provides financial support, such as interest rate subsidies, for energy-saving measures in all types of dwellings. In the case of building refurbishment, an energy audit is to be carried out before and after the improvement to assess the results of the investments on the energy efficiency of the dwelling.

## District heating

District heating use has declined over the last decade as a result of more efficient buildings, but it is still considered an important part of Hungary's energy system. The main competing energy source for heating is natural gas, which accounts for over half of total domestic heat supply, and biofuels that account for over one-third of supply, compared to 9% for district heating.[6] Natural gas is also the dominant fuel in district heating production, often used in combined heat and power plants (CHP).

There are over 100 district heat suppliers on the Hungarian market, supplying heat to 650 000 apartments, which represents 17% of the total number of households. Prices are regulated on the household market and a subsidy scheme has been introduced to cover losses for district heating companies as a result of price regulation.

### Supply

Total heat production was 1.2 Mtoe in 2015, of which 40% was generated in CHP plants whose share of heat produced has decreased from 71% in 2010, partly as a result of the removal of feed-in tariffs for non-renewable CHP-produced electricity. Another reason for declining CHP production is the unfavourable power-to-gas price relationship, where gas prices are higher for the heat and power producer than the wholesale electricity price.

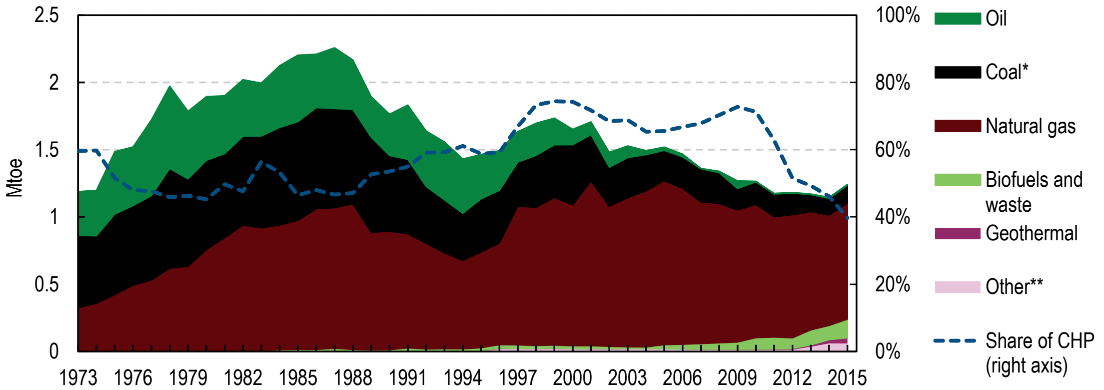
Natural gas is the main energy source used in district heating, accounting for 69% of total heat production in 2015. Another 11% was from coal and industrial by-products, including furnace gases. The use of all fossil fuels has declined as total district heating demand has decreased over the last decade. Conversely, the share of renewable energy sources has increased significantly in district heating production in the last decade, mainly through growth in solid biofuels from 2% of the total share in 2005 to 11% in 2015. The share of geothermal energy in total heat production is also growing rapidly and accounted for approximately 3% in 2015.

A small share of the biofuels used in district heating production is municipal waste. Hungary has only one waste incineration plant located in Budapest, burning approximately half of the city's municipal waste (EEA, 2013). It has been operating since the 1980s and was upgraded in 2005 to comply with standards set by the EU Waste Incineration Directive. FŐTÁV, the largest district heating company in the country, is

[6]. Measured as final energy consumption other than electricity in the residential sector.

considering investing in a new plant, which could be a combined heat and power plant producing heat to be sold as district heating. Waste-to-energy potential will be assessed in a new waste management strategy for Hungary, which could have an impact on the district heating development.

**Figure 3.13 Heat production by fuel, and share of heat from CHP, 1973-2015**




**Coal* includes blast-furnace gas and coke-oven gas.

***Other* contains waste heat from nuclear power production, solar heating and other heat sources.

Note: The figure shows total heat generated by heating and CHP plants, some of which is not included in official statistics on the sale of district heat.

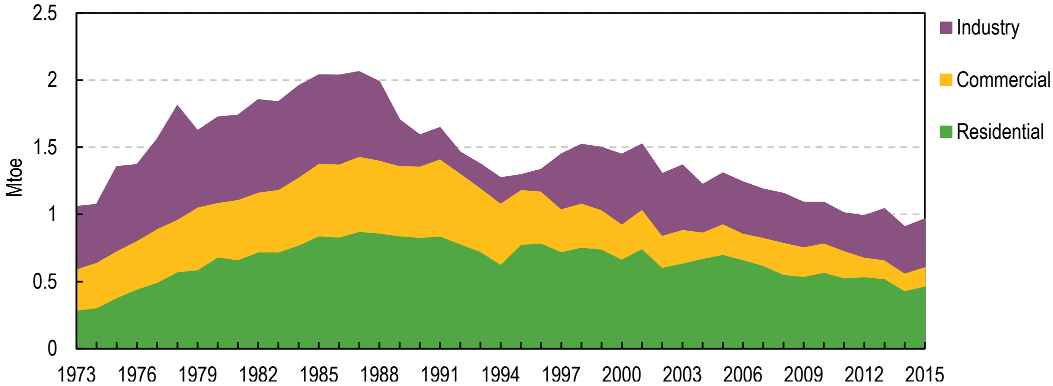
Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## Demand

Total final consumption (TFC) of heat was 0.9 Mtoe in 2014 (see Figure 3.14). The difference between production and consumption is mainly due to distribution losses. Many district heating networks are old and should be replaced as they decrease the energy efficiency of the system (HEA, 2016). The residential sector is the largest heat consumer, accounting for 48% of total demand. Public and commercial buildings represent 14% of the heat demand, with the remaining 38% consumed in industries. As a result of energy efficiency improvements in buildings, total heat demand in the residential and commercial sectors decreased by 35% from 2004 to 2014. This is a major challenge for the district heating sector, hitting its sales and profits. Industry consumption has been relatively stable in the last decade, with a 3% decline from 2004 to 2014.

The EED requires each EU member state to assess the national potential of district heating. In their assessment for 2015, Hungary's district heating demand is forecast to decline by 20% between 2015 and 2020 and another 8% between then and 2025, as a result of energy savings obtained from further refurbishment in the residential sector (EU, 2015).

**Figure 3.14 Heat consumption, 1973-2015**




Note: The figure shows heat in TFC, some of which (mainly for industry) is not included in official statistics over district heat sold. Total heat sold by district heating suppliers was 0.62 Mtoe (25.9 PJ) in 2015 (HEA, 2016).

Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## Market design and regulations

### *Market players*

The regulatory authority HEA is responsible for licensing district heating producers and suppliers. The district heating market consists of 103 suppliers, operating over 200 district heating systems in 94 municipalities.

Heat producers sell heat to district heating suppliers, who in turn sell it to end-customers. There are also district heating traders who buy heat from producers and resell to suppliers (see Figure 3.15). Some of the heat suppliers also hold production licences, thus becoming vertically integrated district heating companies.

### *Prices, taxes and subsidies*

Hungary's district heating market is regulated in terms of both wholesale and household retail prices. End-user prices for residential customers are decided by the Ministry of National Development. The end-user price was lowered in three steps with a total reduction of 23% in 2013 and 2014. The wholesale price from the district heating producer is also regulated, on the basis of the cost of production and a maximal allowed profit. To support renewable energy, a profit margin of 4.5% on top of the gross asset value is allowed for district heat produced from renewable energy sources, compared to a 2% profit from fossil fuel-based heat.

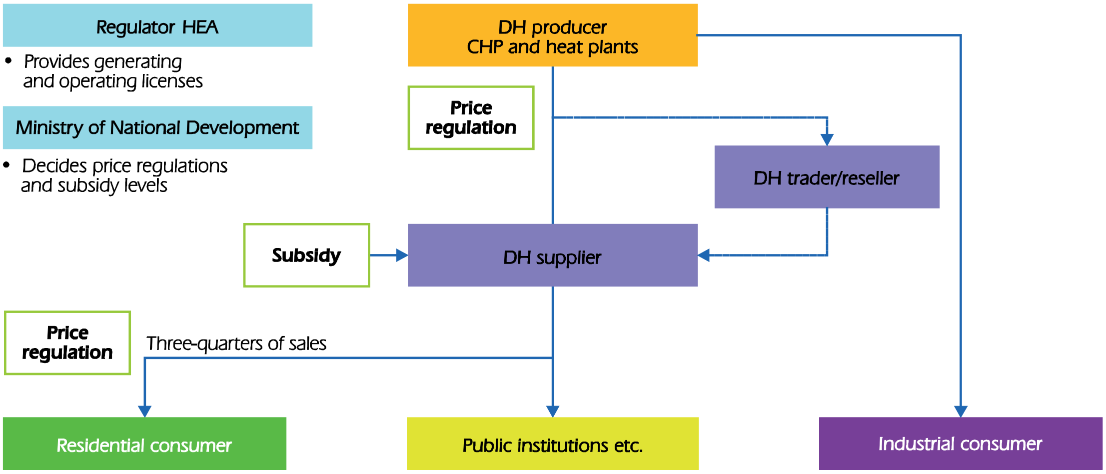
Fixed consumer prices will lead to losses for the district heating supplier if the wholesale price from the heat producer increases. To compensate for this effect and ensure the allowed profit, the Ministry of National Development provides a subsidy in the framework of price regulation that covers potential losses. The subsidy represents a significant part (over 20%) of the total revenue for district heating suppliers.

Another indirect subsidy for district heat is a reduction of the value-added tax (VAT). The general level of the VAT is 27%, while the rate for district heating services was lowered to 5% in 2010. On the other hand, district heating network owners are obliged to pay the public cable tax of HUF 125/metre.

### *District Heating Development Action Plan and support*

The Hungarian Ministry of National Development is defining five *Energy Action Plans*, one of which concerns district heating development. The *District Heating Development Action Plan* has been drafted but not approved yet. It sets out an ambition to increase renewable energy sources in district heating production, have more energy-efficient networks and increase social acceptance of district heating. There is a will to maintain the role of district heating in Hungary's energy system with investment support for efficiency improvements and new facilities in the EEEOP programme.

**Figure 3.15 District heating market structure and players**




Sources: IEA illustration based on Hungary's submission to the District Heating Questionnaire; and HEA (2016).

Earlier measures under Hungary's NEEAP submitted in 2011 supported programmes to renovate district heating systems in order to improve the competitiveness of district heating services. There is continued support within the *Environment and Energy Efficiency Operational Programme* (EEEOP) for energy development and conversion of district heating networks to renewables. The scheme is directed at district heating producers and suppliers, and supports activities such as heat insulation of district heating pipes and improving control systems (NEEAP, 2015).

To support energy-efficient CHP, a feed-in tariff (FIT) was introduced for cogenerated fossil fuel-based power in 2002. The FIT system was removed in 2011, to focus support on renewable energy production. CHP is, however, supported by another regulation. Under Hungary's Electricity Act, electricity from renewable energy sources and from CHP production has priority access to the power grid over other electricity production, including imports. Furthermore, there is an obligation for utilities to buy surplus energy from households that generate their own heat and power in small CHP units (CODE2, 2014). New building standards are also designed to support efficiency co-generation by introducing primary energy requirements that benefit heat produced in efficient CHP generation (IEA, 2017b).

## Assessment

Overall, the 2020 energy intensity targets set in the NEEAP could be more ambitious considering recent trends in energy consumption. In addition, several energy efficiency measures, such as the National Energy Efficiency Advisory Network, are not subject to regular monitoring and evaluation. Consequently, it is difficult to evaluate their costs and benefits, including their wider multiple benefits. There is a need for improved data collection and analysis with regular monitoring to verify progress against targets, ensuring that these measures are improved and that the most cost-effective measures are implemented.

### Industry

The energy auditing requirements established by the European Union's EED are the main policy tool for achieving energy efficiency in the industry sector. Many large energy consumers already submit a compulsory annual report on the energy they use for statistical purposes under the *National Statistical Data Collection Program* (NEEAP, 2015). In accordance with the EU EED, energy auditing should be a requirement for all large enterprises.

Energy audits are seen as a first step that should be followed by implementing energy efficiency measures that are identified as economically feasible. The auditing process should be carried out by certified auditors; the government needs to implement a system for certifying and approving energy auditors to fulfil the EED requirements. Furthermore, Hungary should develop programmes to encourage small- and medium-sized enterprises to perform energy audits. The results of these audits should be monitored closely to assess the effectiveness of the system. Furthermore, a mandatory energy management system could complement the energy audits as a way to reach the intended energy savings.

### Transport

The transport sector has significantly increased its energy consumption over a 20-year period. Despite an increase in the use of biofuels, the sector is still highly dependent on oil products. Energy savings can be achieved by improving the fuel efficiency of vehicles or through structural changes in the transport network.

The existing vehicle fleet is relatively old, and replacing the oldest cars for newer and more energy-efficient ones, including electric vehicles, could enable energy savings in the road transport sector. Structural changes can deliver greater energy savings by means of improved public transport or the promotion of solutions that encourage lower transport activity.

With its electro-mobility programme, the government intends to facilitate more electric vehicles by means of a number of legislative measures, including reviewing and amending the Electricity Act, introducing green licence plates for hybrid and electric vehicles, permitting the use of bus lanes, as well as introducing parking and road toll incentives. The government will also formulate an authority protocol for the installation of electric vehicle chargers, in line with EU legislation (Ministry of National Economy, 2015).

In order to increase energy efficiency in the transport sector, Hungary has launched a number of initiatives such as the electro-mobility programme, the development of bicycle lanes and the improvement of rail and public transport. As a result of these measures, energy use in transport is projected to shrink by 10 terawatt-hours (TWh) in 2020 and to increase by 4 TWh in 2030. Measures such as a differentiated registration tax, a scrappage premium to get rid of old and inefficient cars, and energy taxation on fuels should be considered.

## Residential and commercial

The residential sector has seen significant energy efficiency improvements in its building stock in recent years. From 2012 to 2014, energy consumption declined by almost 30 PJ, compared to the energy savings target of 38.4 PJ by 2020 stated in the NABEPS. However, the artificially low energy price for household consumers is a potential threat. In 2013 and 2014, regulated energy prices were reduced by a cumulative total of 25%. The government should review regulations and subsidy policies to ensure that residential retail energy prices reflect the full cost of energy supply and delivery, including environmental costs. Adequate pricing will provide the correct signal to consumers and influence efficient behaviour.

There is a need to stimulate further energy savings in the existing building stock and introduce stricter energy efficiency standards for new buildings. The housing stock, which has 4.4 million apartments, offers a large potential for further energy efficiency improvements, particularly in prefabricated houses and older buildings.

The Green Economy Financing Scheme (GEFS) has several sub-programmes addressing energy efficiency in the residential sector. Budgets for different programmes have changed frequently, and predictable long-term programmes that encourage citizens and SMEs to make energy efficiency investments are missing. The new multi-annual programme financed by the European Regional Development Fund can contribute to greater long-term stability.

## District heating

District heating (DH) remains an important energy source in Hungary. The government recognises the role of district heating and in increasing energy efficiency and renewable energy use in the sector as a means of increasing energy efficiency in the country. Improved efficiency in buildings has, however, led to a decline in demand for heat, and DH struggles to compete with low natural gas prices.

With continued energy efficiency in the residential sector, heat demand will decline further. The customer base must therefore increase if district heat sales are to grow. For buildings using district heating, the investment needed for changing their heating system acts as a lock-in effect. In new buildings, however, DH companies need to compete with other heat sources for market shares. Current policy imposes a requirement for new buildings to connect to DH networks if it is deemed economically favourable in a cost-benefit analysis. This requires competitive prices for different heat sources on the market.

The natural gas market is regulated in a similar way as the DH market, with end-user prices for natural gas fixed at a level below market price. Low natural gas prices make DH and CHP a less competitive heating source in the residential sector. To compensate for this, the value-added tax paid by the end-user is reduced to 5% for DH, instead of the 27% applied to gas and electricity. Despite this tax reduction, functioning as an indirect incentive, natural gas has a large portion of the heating market.

A regulated price system should reflect the cost for producers and suppliers, and include a margin that allows for profits, also when costs are reduced through improved efficiency. Hungary’s system results in imperfect administrative end-user prices, which leads to a complex and non-transparent market.

There are opportunities to increase the amount of co-generation in DH supply, and to replace old CHP plants with more efficient ones. Furthermore, waste-grade heat from industries can be utilised as a cheap and efficient energy source in DH networks. There is also an opportunity for increasing waste incineration to supply DH systems. This will be considered in the new Waste Management Strategy, which should be aligned with the *District Heating Development Action Plan.*

## Recommendations

***The government of Hungary should:***

**General**

- Develop and apply methods for measuring and verifying the effectiveness of energy efficiency policies.

**Industry**

- Ensure that energy auditing in large companies is fulfilled in accordance with the EU Energy Efficiency Directive requirements and complemented with programmes for encouraging energy efficiency measures in small and medium-sized enterprises.

**Residential and commercial**

- Improve sustainability of the funding for energy efficiency measures in the residential sector and set more stringent requirements for energy efficiency in public buildings.
- Ensure that the goals of the National Building Energy Performance Strategy are supported by policies and measures.

**Transport**

- Implement stronger measures to increase energy efficiency in the transport sector. Implement the electro-mobility programme and complement it with further support for more efficient public transport systems.

**District heating**

- Apply market-based pricing mechanisms to end-user prices and remove the district heating supplier subsidy scheme to increase economic efficiency in the market. Ensure that efficient district heating can be cost-competitive compared to natural gas heating systems for the end-consumer by deregulation of the natural gas price.
- Make the *District Heating Development Action Plan* consistent with the new Waste Management Strategy and co-ordinate each so that potential new waste incineration plants use highly efficient combined heat and power technology and are connected to a district heating network.

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# 4. Electricity

## Key data

(2015)

**Total electricity generation:** 30.3 TWh, -15.1% since 2005

**Electricity generation mix:** nuclear: 52.2%, coal 19.5%, natural gas 16.8%, biofuels and waste 7.6%, wind 2.3%, hydro 0.8%, solar 0.6%, oil 0.3%

**Installed capacity:** 8.6 GW

**Peak load:** 6.5 GW

**Electricity consumption:** industry 41.2%, residential 29.0%, commercial and other services 23.6%, other energy 3.1%, transport 3.1%

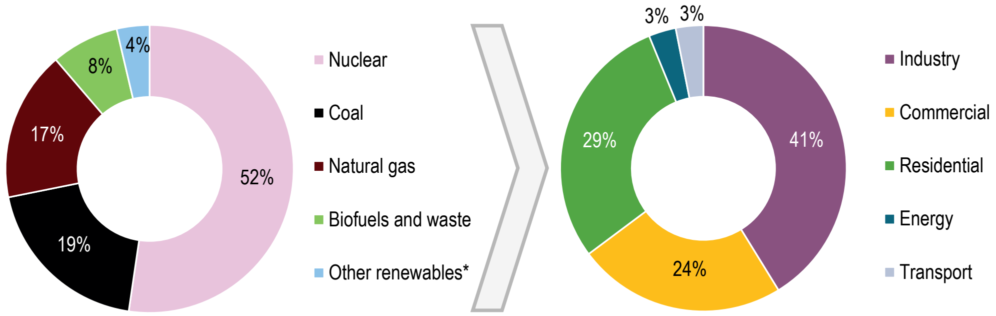
## Overview

Nuclear power accounts for over half the total electricity generation in Hungary and there are plans for new nuclear capacity to be built. Another third is produced from natural gas, the share of which has fallen significantly in the last decade, and coal. Electricity from renewable sources has increased as a result of growth in biomass and wind power although this increase has slowed in recent years. While total domestic production has declined, electricity demand has remained stable. This has led to a large increase in imports from neighbouring countries. Net electricity imports account for approximately one-third of final consumption. Electricity accounts for 16% of total final energy consumption and industry is the largest consumer, followed by the residential and commercial sectors. Household electricity prices are regulated below cost and as a result are among the lowest in Europe, while industry prices are more aligned with prices in the region.

## Supply and demand

Hungary's electricity consumption has increased steadily since the 1970s, with the exception of short declines during periods of economic downturn. Electricity consumption grew by 5% during the period from 2005 and 2015, despite a decline in 2009. Domestic power production was growing until 2008 but has since declined by 24%. Reduced production has been compensated for by increased imports.

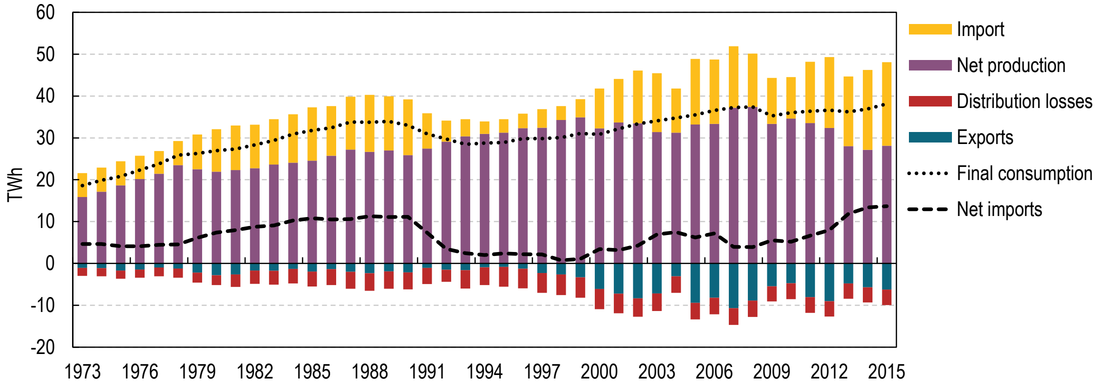
## Figure 4.1 Electricity generation by source and consumption by sector, 2015




**Other renewables* includes wind, hydro and solar.

Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*; IEA (2016), *Electricity Information 2016*, www.iea.org/statistics/.

## Figure 4.2 Electricity production, import, export, and final consumption, 1973-2015




Sources: IEA (2016a), *Electricity Information 2016*, www.iea.org/statistics/.

### Electricity generation

Hungary's electricity generation has been dominated by nuclear energy since the construction of the Paks nuclear power plant in the 1980s. Total installed nuclear capacity is 2.0 gigawatt (GW), providing an annual electricity production of over 15 terawatt-hours (15.8 TWh in 2015) with a load factor of around 90% (IEA, 2016b). Nuclear power accounted for 52.2% of total electricity production in 2015 and a new nuclear plant at the Paks site is planned to replace the ageing nuclear fleet in the future.

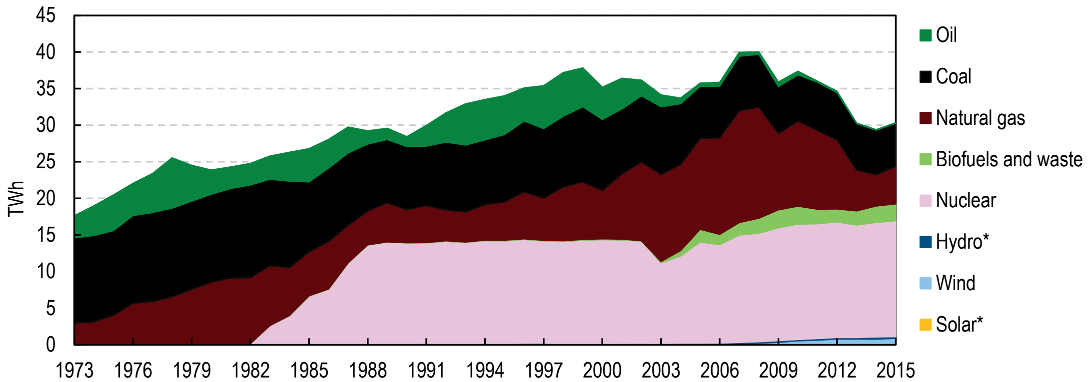
Coal is the second-largest energy source in electricity generation accounting for a fifth of total production in 2015. The use of coal has been declining over several decades and fell by 17% in the ten years from 2005 to 2015. The largest coal power plant is the almost 50-year-old Mátrai Erőmű lignite plant.[1]

Natural gas accounts for 16.8% of electricity production and its use has varied significantly over the last two decades. With peak levels of over 15 TWh in 2007 and 2008, natural gas accounted for more electricity production than nuclear power, but has since declined to around 5 TWh per year since 2013. Several large combined-cycle gas

[1]. The Mátrai Erőmű power plant has a total built-in capacity of 966 megawatts, which includes 884 MW lignite, 66 MW gas-fired and 16 MW solar generation.

turbine (CCGT) plants provide a total installed gas power capacity of 2.2 GW, which is larger than the installed nuclear capacity. Decreased electricity generation from natural gas thus indicates under-utilised capacity, which is typical for Europe at present. Oil has historically been a large source of electricity generation, with shares over 10% of total production until 2001, but has declined to almost nothing since.

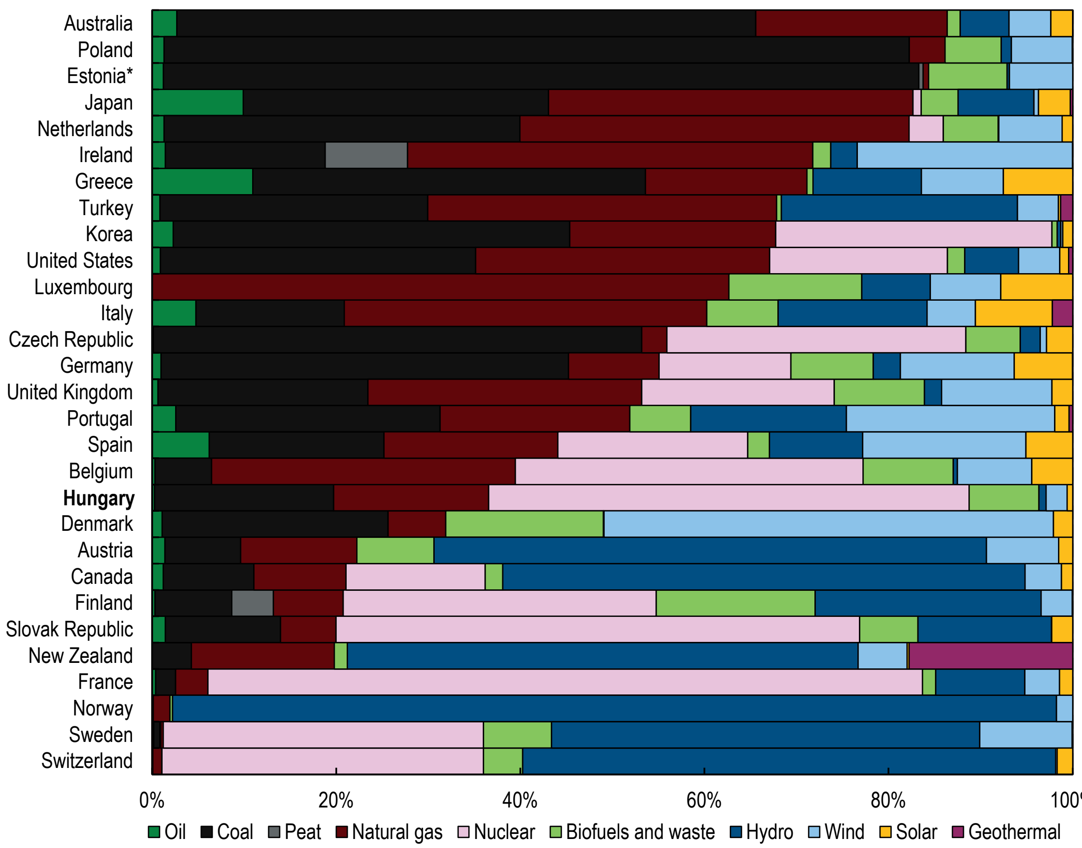
## Figure 4.3 Electricity generation by source, 1973-2015




* Negligible.

Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## Figure 4.4 Electricity generation by source in IEA member countries, 2015




*Estonia's coal represents oil shale.

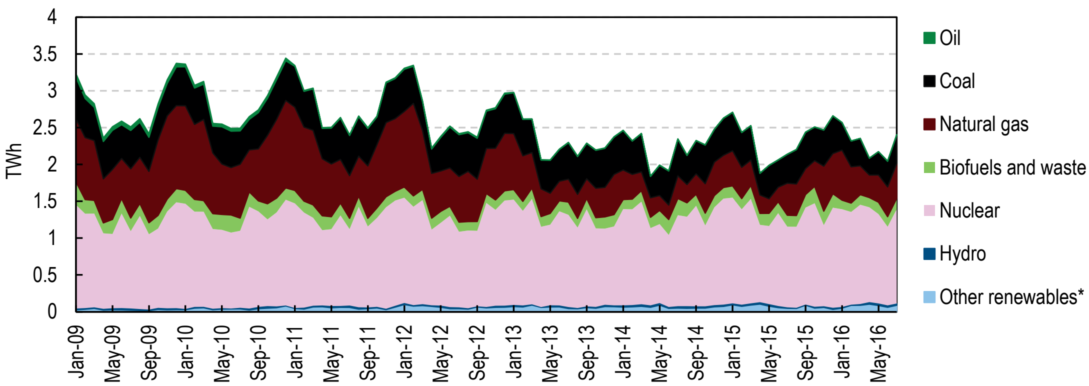
Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

Renewable energy sources accounted for 11% of total electricity generation in 2015. Biofuels and waste is the largest renewable energy source, accounting for two-thirds of total renewable electricity, followed by wind power with 20%. Generation from biofuels increased from 0.2 TWh in 2003 to 2.5 TWh in 2009 and has remained around 2 TWh since. Wind power increased rapidly from insignificant levels in 2003 to 0.8 TWh in 2012, with a ten-year average annual growth rate of 115%. In recent years, wind power capacity has not increased and electricity production from wind declined by 10% from 2012 to 2015. There is also a small share of hydropower in electricity generation (0.8% of total generation) and a small but growing share of solar power (0.6%).

Hungary's share of nuclear power in electricity production is the third-highest among IEA member countries (see Figure 4.4). This enables a relatively low dependence on other fuels despite the third-lowest share of renewable energy sources in the electricity production mix.

Electricity generation varies throughout the year as a result of seasonal temperature variations. Production increases during wintertime to meet higher demand although this trend changed in 2015, when the summer peak exceeded the winter peak. Natural gas power is the most flexible source, adjusting for variations in demand (see Figure 4.5).

**Figure 4.5 Monthly electricity generation by source, January 2009 to July 2016**




**Other renewables* includes wind and solar.

Notes: Production from other renewables has been estimated on the basis of annual data since January 2013. Production from oil has been estimated from annual data since January 2013.

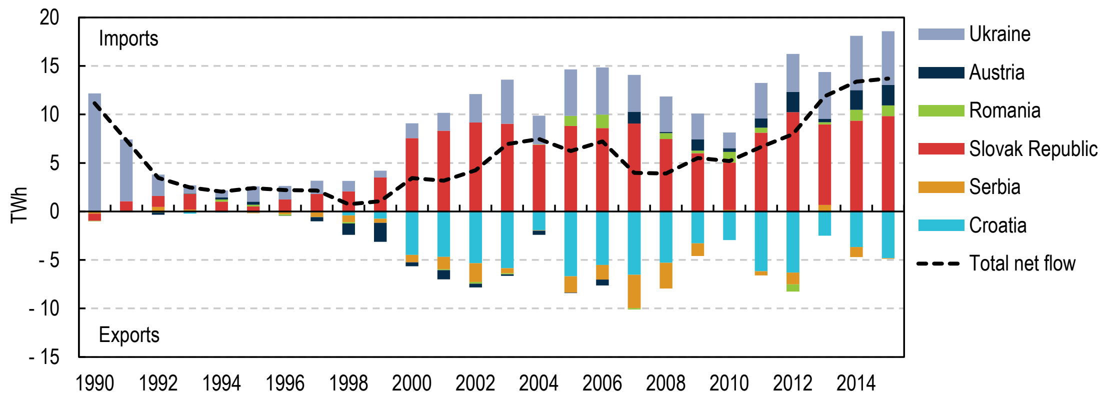
Sources: IEA (2016b), *Monthly Electricity Statistics 2016*, www.iea.org/statistics/.

## Imports and exports

Hungary's power system is well connected to most neighbouring countries. Imports compete with domestic power production and the country has become more dependent on electricity imports in recent years, while domestic production has declined. Net electricity imports were 13.7 TWh in 2015, accounting for 36% of total final consumption (see Figure 4.2).

The Slovak Republic is the largest electricity exporter to Hungary, providing 49% of total net imports in 2014, followed by Ukraine with 29% (see Figure 4.6). Imports come mainly from regions north-east of Hungary, while exports are made to regions in the south-west. Croatia accounted for 78% of Hungary's total exports in 2014, followed by Serbia with 22%.

**Figure 4.6 Electricity imports and exports by country, 1990-2015**

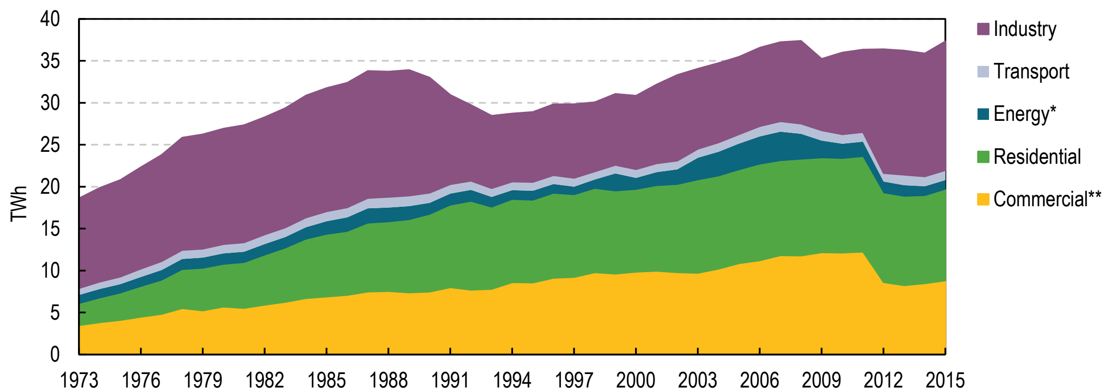



Source: IEA (2016a), *Electricity Information 2016*, www.iea.org/statistics/.

## Electricity consumption

Electricity demand has been stable in recent years after increasing from 1993 to 2008. Total consumption was 37.3 TWh in 2015, an increase by 5% in the ten years from 2005.

**Figure 4.7 Electricity consumption by sector, 1973-2015**




* *Energy* includes energy own-use and the transformation sector.

** *Commercial* includes commercial and public services, agriculture, fishing and forestry.

Note: The break in 2012, where electricity consumption increases in the industry sector and decreases in the commercial sector, is a result of changed methodology for reporting electricity demand in Hungary.

Source: IEA (2016a), *Electricity Information 2016*, www.iea.org/statistics/.

The industry sector accounted for the largest share of total electricity demand with consumption of 15.4 TWh in 2015. Consumption increased by 66% from 2005 to 2015, though a large part of this growth was a result of changes in the data methodology.[2] The largest electricity-consuming industries were the chemical and petrochemical sector (22% of total industry consumption), machinery (17%), and food and tobacco (14%).

The residential sector is the second-largest electricity consumer, accounting for 10.8 TWh, almost a third of total electricity demand in 2015. Consumption has declined

[2]. From 2013 data, the Hungarian government started to use a new methodology to calculate supply and demand of electricity and heat. This leads to breaks between 2011 and 2012, seen as a shift from the commercial sector to the industry sector.

by 2% since 2005, after increasing for several decades. The commercial and public services sector consumed 8.8 TWh of electricity in 2015, a decline by 19% from 2005 (mostly a result of the changed statistical methodology). Small shares of electricity are consumed in the energy and transport sectors. Consumption in the energy sector dropped by 64% from 2005 to 2015 while electricity use in the transport sector increased by 6% over the same period.

## Market structure

The Ministry of National Development is the competent authority and decision-making body responsible for all policies relating to the electricity sector. The Hungarian Energy and Public Utility Regulatory Authority (HEA) is the body charged with the supervision of sectors deemed to be of strategic importance, including the electricity sector. HEA's responsibilities include licensing, supervision, price regulation and network tariffing in the electricity, natural gas and district heating sectors, as well as in water supply. It is also responsible for the pricing of public waste management services.

At the end of 2015, total installed generating capacity of the system was 8 558 megawatts (MW). The four reactors of the Paks nuclear power plant accounted for 2 000 MW of capacity. MAVIR, the state-owned transmission system operator (TSO), manages the transmission network while six distribution system operators (DSOs), owned by foreign investors, are responsible for the regional distribution networks. Network access fees are determined by the regulator. In Hungary, the mandatory requirements for the unbundling of natural monopoly activities (transmission and distribution system operation) from other, competitive electricity sector activities (production, trade, and universal services) are contained in the Electricity Act and the Implementation Decree of the Electricity Act.

In 2006, the country switched from the previous independent system operator (ISO) model to the Independent Transmission Operator (ITO) model. In this case, the ITO operates as an independent subsidiary within the vertically integrated company, the state-owned MVM Hungarian Electricity Ltd Since market opening in 2003, the retail electricity market is characterised by its dual structure: a universal service segment and a competitive market segment. Consumers entitled to universal service are supplied predominantly by former public utility service providers who now possess universal service provider licences. Universal service providers are obliged to supply electricity to, and conclude contracts with, the consumers entitled to universal service. Consumers not entitled to universal service must purchase energy on the competitive market (for example, small and medium-sized non-household consumers and larger customers). MVM continues to be the dominant player in the retail market with 80% market share. Universal service providers purchased one-fifth of their electricity supply from sources other than MVM in 2015 and they are not required to purchase renewable feed-in production.

In the six distribution zones of Hungary, three companies operate as universal service provider: E.ON Energy Service Provider, DÉMÁSZ (which was purchased from the EDF Group by ENKSZ First National Public Utility Services Ltd at the beginning of 2017), and the RWE-owned ELMŰ-ÉMÁSZ Energy Service Provider. A further 88 companies have a licence for supplying electricity to end-consumers and 83 traders are eligible only for wholesale activities. MVM Group, the former monopolist, remains the dominant player in the wholesale electricity market.

## Generation

At the end of 2015, the total installed generating capacity was 8 558 MW, of which 7 730 MW were large power plants, 458 MW was renewable capacity and the remainder was capacity in plants below 50 MW. Domestic generation output in 2015 was 30 063 GWh, of which 52% was nuclear, 20% lignite, 10% renewables, and 17% natural gas. The system is also heavily dependent on imports, which were 13 687 GWh in 2015 representing 31.3% of total gross electricity consumption and 36% of total final consumption in 2015.

**Table 4.1 Total and projected installed generating capacity, 2015 to 2030**

| Power plants | Total installed capacity [MW] | | | |
|---|---|---|---|---|
| | 2015 | 2020 | 2025 | 2030 |
| Power plants above 50 MW | 7 006 | 5 646 | 5 226 | 4 392 |
| Small power plants (under 50 MW) and renewables | 1 552 | 1 302 | 814 | 495 |
| Total | 8 558 | 6 948 | 6 040 | 4 887 |

Source: MAVIR (2016), *Data of the Hungarian Electricity System.*

The largest generating company by capacity is state-owned MVM with 2 766 MW of installed capacity, followed by RWE (966 MW), Tisza Erőmű Kft (900 MW) and MET Power AG (794 MW).[3] The three largest generators combined account for 4 632 MW or 54.7% of capacity and 20.7 TWh or 50% of electricity consumption in 2015 (HEA, 2016). Using the Herfindahl-Hirschmanl index as a measure of concentration, 1 468 by market share of capacity and 1 578 by market share of generation output; the Hungarian generation market is a moderately concentrated market.[4]

## Wholesale market

The structure of the domestic electricity market emerged in 1995, when the majority of large power plants and the public utility service providers were privatised (together with the distribution networks). Today, the dominant domestic power plants sell most of their production within the framework of medium-term contracts with the former public utility wholesale trader (MVM). About one-fifth of the power plant output is sold directly on the competitive market under short-term (typically one year) contracts. The power plant contracts of MVM typically have a term of five to eight years.

MVM in turn sells about half the electricity purchased from domestic power plants under framework contracts, so-called electricity supply contracts, to the universal service providers who supply the consumers entitled to universal service (household and small-scale consumers, public institutions). MVM sells its remaining half of the power plants output to traders through bilateral contracts or public capacity auctions. A significant proportion of primary trader procurement is resold within the trade sector in the form of secondary trading before being sold to consumers or being sold as export.

3. Tisza Erőmű Kft did not generate in 2015 as its licence was suspended by the HEA.

4. A Herfindahl-Hirschman Index (HHI) of less than 1 000 represents a relatively un-concentrated market while an HHI between 1 000 and 1 800 represents a moderately concentrated market. Markets having an HHI greater than 1 800 are considered to be highly concentrated.

The sale of electricity generated from renewable sources or waste falls within a special sales category. MAVIR, the transmission system operator, is obliged to purchase this type of electricity from producers within the framework of the feed-in tariff (FIT) system (at the price provided in the relevant legislation, for the amount of electricity and over the term specified in the licence issued by HEA). MAVIR sells the electricity purchased from producers within the framework of the FIT system on the organised electricity market.

## Hungarian Power Exchange

The Hungarian Power Exchange Company (HUPX), owned by MAVIR, is the licensed operator of the Hungarian power exchange. The HUPX commenced operations in July 2010 with the launch of a day-ahead market, and ten members. At present, the exchange offers three markets: an intraday market with 31 members, a day-ahead market with 60 members and a physical futures market with 26 members. On 10 December 2015, the energy regulator appointed HUPX as the nominated electricity market operator (NEMO).[5]

In 2016, most electricity trades took place by means of bilateral agreements. By way of comparison, 17.7 TWh of spot electricity and forward products worth 6.8 TWh were sold in 2016; note that the trading volume was approximately 277 TWh. Nonetheless, the spot trading volume handled by HUPX constitutes a relatively high proportion of total domestic consumption: in 2015, it exceeded 37% of gross domestic consumption of 43.9 TWh (HEA, 2016). In 2016, the average monthly turnover on the HUPX day-ahead market was 1.48 TWh. HUPX achieved its record monthly trading volume in December 2016, with the volume of traded electricity being 1 653 GWh. The total volume traded on the day-ahead market in 2016 was approximately 17.7 TWh, which is 18% more than in 2015. This increase is partly the result of the coupling of the Czech, Slovak Republic, Hungarian and Romanian markets (4M market coupling) implemented in November 2014, and of the five new exchange members.[6]

The implementation of 4M market coupling has led to a gradual convergence of market prices in the region and more effective use of interconnector capacities. There are plans to couple the 4M and the MRC (multi-regional coupling) regions, as well as the North-Western European (NWE) and Central-Eastern European (CEE) price coupling regions. Hungary is also preparing to join the cross-border intra-day (XBID) project, which will enable continuous cross-zonal trading. It will increase the overall efficiency of intraday trading on the single cross-zonal intraday market across Europe. The government is also looking at an interim solution for intraday market coupling within the 4M region.

Despite this progress, the continued dominant position of state-owned MVM Group Ltd is a cause for concern. The company still controls at least half the Hungarian power plant fleet and for this reason it has been obliged as a remedy by the regulator to sell part of its electricity generation in long-term virtual power producer auctions to other market players.

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[5]. Pursuant to Article 4(1) of Regulation (EU)2015/1222, each EU member state electrically connected to a bidding zone in another member state shall ensure that one or more nominated electricity market operators (NEMOs) are designated by 14 December 2015 to perform the single day-ahead and/or intraday coupling.

[6]. Market coupling uses so-called implicit auctions in which market participants do not receive allocations of cross-border capacity themselves but just bid for energy on their power exchange. The exchanges then use the available cross-border transmission capacity to minimise the price difference between two or more areas.

## Transmission

MAVIR (*Magyar Villamosenergia-ipari Átviteli Rendszerirányító Zártkörűen Működő Részvénytársaság*) the Hungarian independent transmission operator company is responsible for the operation of the electricity system, including reserve capacities of generation and transmission. On 1 January 2016, the total length of the electricity transmission network was 4 856 kilometres of power lines (268 km of 750 kilovolts lines; 2 978 km of 400 kV lines; 1 394 km of 220 kV lines: and 216 km of 132 kV lines), 31 substations and 84 transformers.

The transmission network is interconnected via cross-border lines, with transmission networks of neighbouring countries thus enabling a synchronous operation with the interconnected power systems of the rest of continental Europe. Annual transmission losses are in the range of 40 MW to 60 MW per year or about 1% of the system load.

### *Cross-border transmission*

The Hungarian electricity transmission grid is a relatively well-developed network, connecting main generation and consumption centres and providing external connections. The existing interconnection capacities by neighbouring country are:

- Slovak Republic: 2 x 400 kV; 2 x 1 385 megawatts
- Ukraine: 1 x 750 kV, 1 x 400 kV, 2 x 220 kV; 2 598 MW + 693 MW + 2 x244 MVA
- Romania: 2 x 400 kV; 1 385 MW + 1 109 MW
- Serbia: 1 x 400 kV; 1 109 MW
- Croatia: 2 x 400 kV (double circuit each); 2 double circuit x 1 385 MW
- Austria: 2 x 400 kV, 2 x 220 kV; 2 x 1 385 MW + 2 x 228 MW

Planned cross-border capacity extensions in the coming years:

- Slovak Republic: 2 x 400 kV lines and a 400 kV line by 2020
- Slovenia: a new 400 kV interconnection with Slovenia (the necessary investments are completed on the Hungarian side and now serve as an additional interconnection with Croatia)

Major developments foreseen in the next five years include the new 400 kV cross-border lines between Hungary and Slovak Republic and between Hungary and Slovenia. The interconnections between Hungary and Slovak Republic have been added to the list of EU projects of common interest (PCIs) and in the 2014 Ten-Year Network Development Plan (TYNDP) of the European Network of Transmission System Operators for Electricity (ENTSO-E).

The Electricity Act obliges the TSO to submit a national network development plan every year. The plan must be approved by the regulator HEA and published on MAVIR's website. The last plan was approved in 2016. The ENTSO-E has established the next 10-year development plan (TYNDP 2016) based on the TSO's and on the Central East European region's plans.

The main objective of the new projects is to improve the security of the system and to increase cross-border capacities in order to eliminate congestion on the Hungary-Slovak

Republic interconnections, and to establish an interconnection with Slovenia. In all three countries, the planned developments will facilitate north to south power flows within the Central Eastern European region, generated from renewable sources. In addition to the interconnections, the planned transmission infrastructure developments in the relevant countries are necessary for full utilisation of the increased cross-border capacity provided by the new interconnectors.

### *Capacity allocation*

There is congestion on the interconnections between Hungary and its neighbours. To allocate the available transmission capacities to market participants, the TSOs use transmission capacity auctions. Explicit capacity auctions are organised on an annual, monthly and daily basis and, on some borders, intraday allocation exists as well. From 2016, long-term capacity auctions are organised on the basis of harmonised auction rules (with the exception of the Hungarian-Ukrainian border).

Congestion management is based on ENTSO-E policies and procedures, and performed in network operation planning and real-time operation. Regional co-ordination is performed within the framework of TSC (TSO security co-operation).[7]

### *Network access*

According to the Hungarian Electricity Law, access to the electricity transmission network is available to all market participants. Connection charges are based on the lowest capitalised values of the necessary investments:

- 100% of the total costs for conventional energy producers
- 50% to 70% of the total costs for renewable energy producers
- 70% of the total costs for consumers.

Typically, consumers are allowed to connect to the transmission network only over a 132-kV voltage level. At or below this level, only distribution system operators (DSOs) may connect to the transmission network.

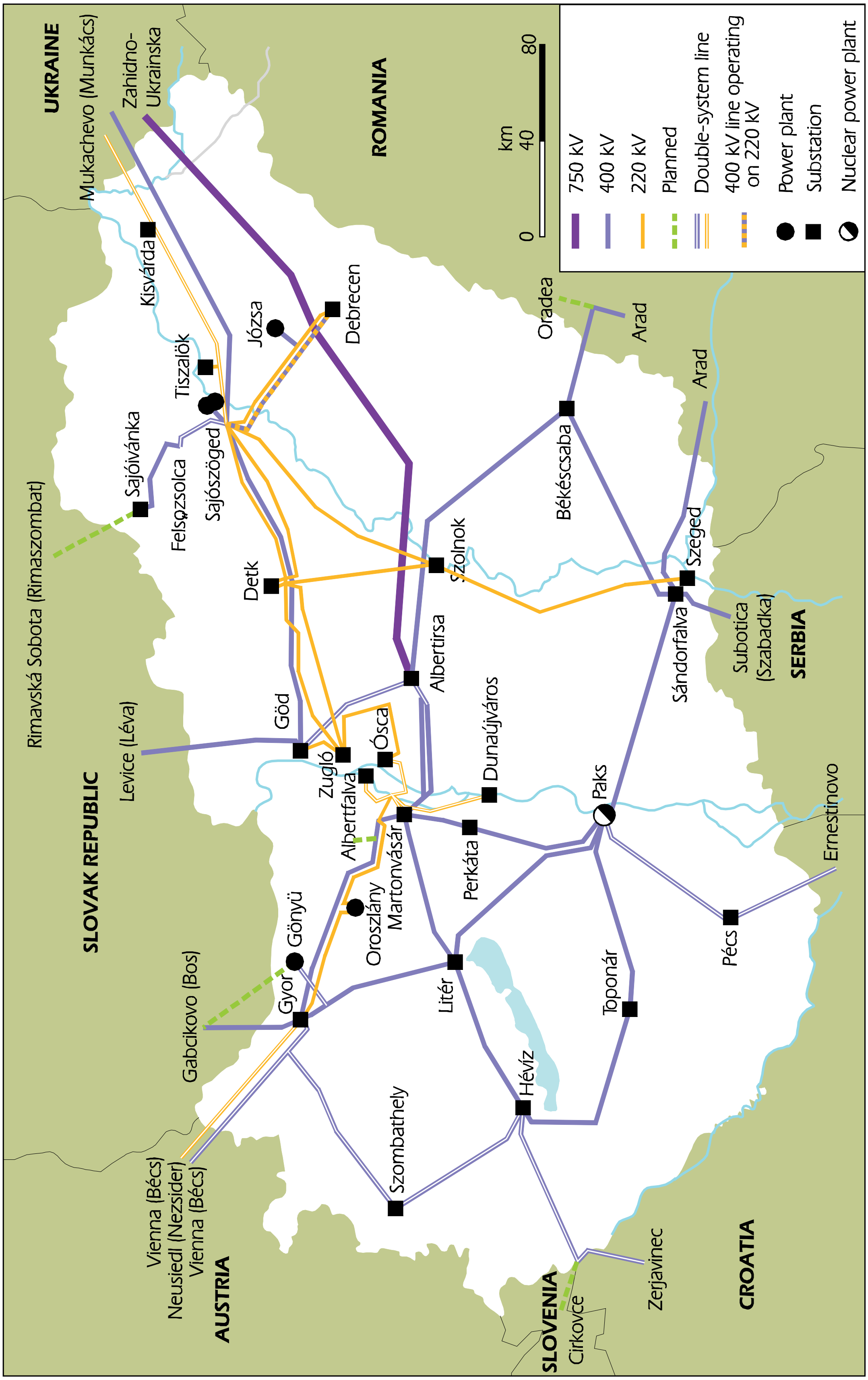
## Distribution

Six DSOs, owned by three utilities, have a licence for distribution activities from the regulator HEA. The three utilities are ENKSZ (one DSO licence), E.ON (three DSO licences) and RWE (two DSO licences). The terms of access and access tariffs (connection fees) to the distribution networks and connection provisions are determined by HEA.

The regulator also determines the rules related to the allocation of costs occurring in relation with connection of any new entity on the distribution network and the costs of investments necessary to connect. The decree on grid connection tariffs is obligatory to be implemented by the TSO and DSOs. Average distribution network losses in 2015 were 8.39% of net electricity fed into the distribution network.

[7]. TSC is made up of the TSOs of ten countries: Austria (APG), Croatia (HOPS d.o.o.), Czech Republic (ČEPS), Denmark (Energinet.dk), Germany (50Hertz, Amprion, TenneT Germany, and TransnetBW), Hungary (MAVIR), Poland (PSE), Slovenia (ELES), Switzerland (Swissgrid) and the Netherlands (TenneT Netherlands).

## Figure 4.8 Electricity infrastructure




This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

PART II. SECTOR ANALYSIS

### *Smart grids*

In accordance with EU Directives 2009/72/EC and 2009/73/EC, the EU member states are required to ensure the introduction of smart metering systems. The introduction of such systems, however, depends on an economic assessment of all costs incurred and benefits obtained by market participants and on the cost efficiency of each smart metering model as well as the potential schedule for their installation.

The HEA oversaw a Smart Metering Working Committee in 2015, which involved all stakeholders. The DSOs in turn implemented smart metering pilot projects in 2013 and 2014, which were completed by the end of 2014. The main focus of the smart grid pilot projects was to establish functions for the electricity and gas networks by creating and testing measurement solutions, data collection and other smart grid applications.

The final meeting of the Smart Metering Working Committee was held on 19 February 2015. According to the EU directives, EU member states should encourage the modernisation of distribution networks, such as by means of the introduction of smart grids that should be built in a way that encourages decentralised generation and energy efficiency. Once more, however, the introduction of smart metering systems and smart grids also depends on an assessment of the costs and benefits accruing to all market participants.

A European Commission decision allocated a EUR 20.9 million fund (originated from the $CO_2$ emission quota allocation) for centralised smart metering. A Pilot Project managed by MAVIR, or a 100% subsidiary company, targeted a model based on a centralised metering operator concept. The project provides data for economical assessment according to EU Directive 2009/73/EC. The pilot project is being implemented by a subsidiary company of MAVIR pursuant to the provisions of Government Regulation No. 26/2016, involving measurements in the field of electricity, gas, water utilities and district heating.

### *Demand-side policies*

It is possible for customers to participate in the MAVIR tenders for ancillary services on the same terms and conditions as generators. MAVIR has tried to involve more consumers by organising forums and some consumers already have participated in the tendering process. However, only one consumer has regularly participated in the tendering process.

## Electricity security

By the end of 2015, total installed capacity was 8 558 MW. The expectation of the TSO is that, owing to retirements, only 4 887 MW of this capacity will remain in operation by 2030. In 2015, the peak load in summer was 6 457 MW and in winter 6 447 MW; for the first time the summer peak exceeded the winter peak, which was the result of an unusually hot summer and mild winter. MAVIR is expecting the system's maximum daily gross load to increase to 7 000 MW in 2020 and 7 700 MW in 2030.

The regulator HEA considers that current power plant capacity reserves are sufficient. It has evaluated the operational security of the electricity transmission system over the winter period, until May-June each year for the next decade. A 2014 report submitted by

MAVIR to the HEA met the criteria specified by the regulator. The three-year average values of the system loss index and the average downtime of transmission line connections exceeded both the minimum quality requirement and the expected level of operational security.[8, 9]

Hungary's regional integration with its neighbours gave the country access to capacity in other markets. Expected retirements of power plants in the coming years resulting from lack of competitiveness or an advanced age increase the threat of insufficient domestic generating capacity and continued import dependence. A working group including the Ministry of National Development, HEA, and the transmission system operator MAVIR was established to examine future generation needs and reserve capacity. Nonetheless, the strategy on the future power plant fleet is unclear as is the source for the necessary investments.

Investments in new interconnector projects will facilitate greater international electricity trade. By expanding its interconnection capacity, Hungary is aiming to improve system security and security of supply. Nevertheless, an increasing ratio of imports is a reason for concern and this may reflect inefficiencies in the domestic electricity market. A new 400 kV interconnector with Slovenia, which is already completed on the Hungarian side, may lead to increasing exports from Hungary.

## Retail market, prices and taxes

Price regulations in the Universal Service Provider sector have provided Hungary's households with the lowest electricity prices in the region (see Figure 4.9). Household prices are approximately EURcent 11.45/kWh compared to an EU average of EURcent 21.05/kWh. The government's intention is to pass on any additional costs in the electricity sector to bigger customers and industry rather than to households. Electricity prices in the industry sector are closer to the EU average levels (EURcent 10.47/kWh compared to an EU average of EURcent 11.56/kWh).

Electricity prices increased in the period from 2000 to 2008 but have since fallen throughout the region for both industry and households (see Figure 4.10). The price decline has been sharpest in Hungary, leading to low prices compared to neighbouring countries, especially in the household sector.

In the competitive market segment, the prices of electricity are determined by the market, while consumers entitled to universal service can purchase electricity (and natural gas) at a regulated (capped) price. With the introduction of a universal service, the government aims to protect the interests of consumers who are less well-off (mainly household consumers).

According to the relevant Hungarian legislation, universal services shall be provided under mandatory, fair, clearly comparable and transparent pricing mechanisms. Universal service prices are determined by the Minister of National Development by decree, on the basis of a recommendation by the regulator HEA. HEA may submit its recommendations to the minister with respect to the prices.

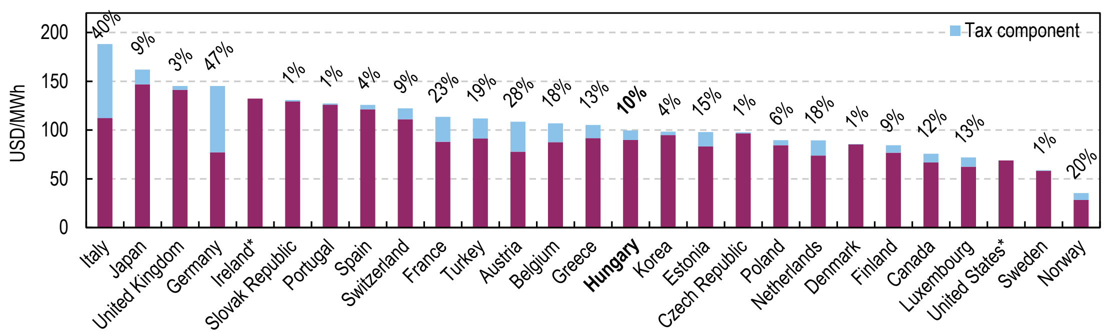
[8]. Electricity not supplied.
[9]. Non-availability index.

The price for universal services shall be determined on the basis of comparative analyses and prevailing market prices. It shall be sufficient to cover the justified and reasonable operating expenses of efficient authorised operators, insofar as such costs correspond to those of an authorised operator, with a view to enforcing the lowest-cost principle and to encourage the authorised operators affected to intensify their efficiency and to improve the quality of their services.

Universal service prices are determined by the Minister of National Development by decree. HEA may submit its recommendations to the minister with respect to the prices. In its role as regulator, the HEA conducts price supervision and cost, and asset reviews. As part of its price supervision function, the HEA verifies whether the licensees apply the tariffs set by the minister and the regulator. As part of the cost and asset review process, the HEA determines the network businesses' revenue requirement, which serves as the basis for establishing regulated prices.

## Figure 4.9 Electricity prices in IEA member countries, 2015

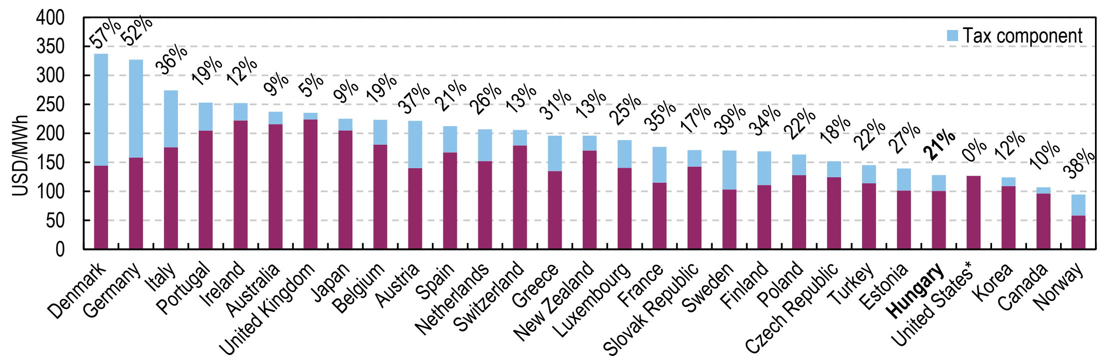
*Industry*




* Tax information not available.

Note: Data from 2015 not available for Australia and New Zealand.

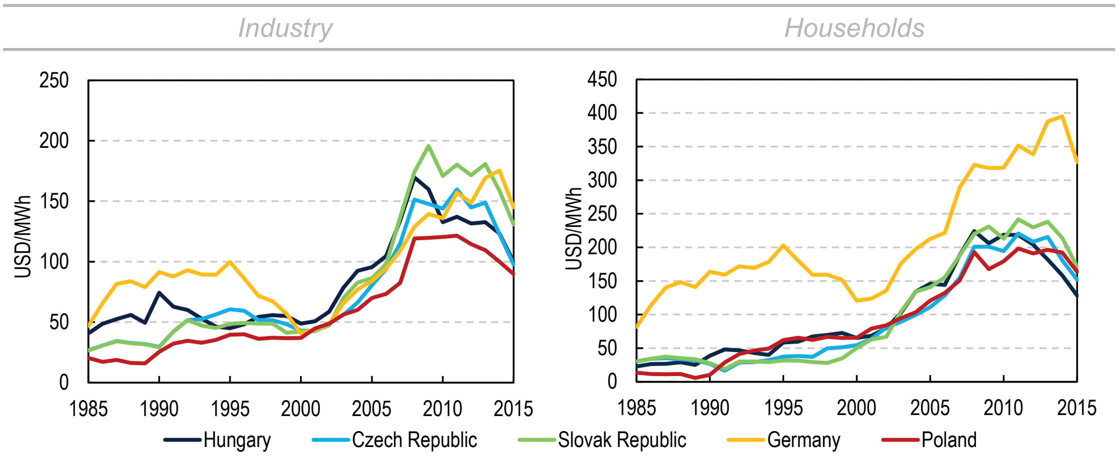
*Household*




* Tax information not available.

Source: IEA (2016c), *Energy Prices and Taxes 2016*, www.iea.org/statistics/.

**Figure 4.10 Electricity prices in Hungary and in other selected IEA member countries, 1985-2015**




Note: Industry data not available for Hungary and the Czech Republic 1980-84, and Poland 1980.
Source: IEA (2016c), *Energy Prices and Taxes 2016*, www.iea.org/statistics/.

Before 2012, utility costs represented a significant proportion of Hungarian families' expenditures and a serious economic strain for many of them. Utility costs were particularly high in comparison with regional and EU average costs. To address this situation, the government decided to reduce utility costs in December 2012. The outcome of legislative amendments, as proposed by HEA, was that end-user prices decreased by 10% for residential consumers availing of universal services of natural gas, electricity and district heating from 1 January 2013 (first utility cost cut). This was followed on 1 November 2013 by a second cut, which further reduced the price of natural gas, electricity and district heating by 11.1%. In early February 2014, parliament approved a third series of cuts to household energy and utility bills. This time, the price of natural gas fell by 6.5% from April 2014; the price of electricity fell by 5.7% from September 2014, and district heating prices decreased by 3.3% from 1 October 2014.

The consequence of these laws is that the regulated end-user electricity prices in Hungary are not cost-reflective, which results in financial losses in the regulated business segment of energy utilities. A cost reflective tariff is one which reflects the true cost of serving the customer, and includes the costs of electricity generation, distribution and retailing, as well as any charges or levies. In the case of Hungary, however, sector-specific levies and taxes are not allowed to be fully passed through in the final regulated prices paid by consumers. With below-cost regulated prices, the government has reduced incentives for customers to invest in energy saving and reduced the incentives for utilities to invest in their business. Furthermore, any losses incurred by the utilities must be recovered from elsewhere, including from the tax base.

In September 2015, the Agency for the Cooperation of Energy Regulators (ACER) published a study of competitiveness of retail electricity and gas markets in EU member states and Norway. The outcome of the study ranked Hungary the 22nd most competitive electricity retail market among the 29 countries ranked (IPA, 2015).

## Assessment

In 2015, Hungary had a total installed capacity of 8 558 MW. The expectation of MAVIR, the TSO, is that, owing to retirements, by 2030 only 4 887 MW of these will remain in operation. In 2015, the peak load in summer was 6 457 MW and in winter 6 447 MW. MAVIR is expecting this to increase to 7 000 MW in 2020 and to 7 700 MW in 2030. A large share of electricity consumption is satisfied by imports and the import-export balance was at 13 687 GWh in 2015. The largest volume of imports came from Slovak Republic (9 817 GWh) followed by Ukraine (5 550 GWh). In terms of capacity, the most important power plant is the Paks nuclear power station with an installed capacity of 2.0 GW, followed by the nearly 50-year-old Mátrai Erőmű lignite plant and several large combined-cycle gas turbine (CCGT) plants.

Hungary has successfully coupled its day-ahead electricity market with markets in Slovak Republic and the Czech Republic in 2012. This trilateral coupling was extended to Romania in November 2014 (4M market coupling) and has led to a gradual convergence of market prices in the region and more effective use of interconnector capacities. The country is seeking to further increase its electricity exchanges with neighbouring countries and other European partners. There are plans to couple the 4M and the MRC regions (multi-regional coupling, which connects most EU power markets) either with net transfer capacity-based calculation as an interim solution or with the whole region in one single step, with flow-based market coupling to implement the envisaged European day-ahead target model. Hungary is also preparing to join the cross-border intraday (XBID) project, which aims to create one integrated European intraday market, and therefore participating in the XBID accession stream. This will analyse the possibility of establishing local implementation projects on Hungarian borders, focusing first on the 4M countries. Accelerating regional market integration with neighbouring countries was an important recommendation contained in the 2011 in-depth review.

New interconnector projects with Slovak Republic and Slovenia will further facilitate international electricity trade and will also improve system security and security of supply. The increasing ratio of imports which may reflect inefficiencies in the electricity market is a reason for concern. A new 400 kV interconnector with Slovenia, which is already completed on the Hungarian side, may lead to increasing exports from Hungary, create new business opportunities for Hungarian generators and relieve the strong import dependence as a result of higher wholesale electricity prices.

Increased trading volumes and the number of market participants on the HUPX day-ahead and intraday markets is a positive sign for the liquidity of the wholesale electricity market. Nonetheless, the continued dominance of state-owned MVM Group Ltd remains a cause for concern. The Group controls at least half the power plant fleet and for this reason it has been obliged, as a remedy, by the regulator to sell a part of its electricity generation in long-term virtual power producer (VPP) auctions to other market players. It continues to serve roughly 28% of the non-regulated wholesale market.

Regulated customer prices (for households, public institutions and SMEs) have recently been reduced by the government, apparently in an arbitrary way. In the case of household consumers, end-user prices were fixed by the Act on the Reduction of Household Expenses (Overhead Charges Act). The tariffs for energy (in the case of universal service providers) are determined by the Minister of National Development while network tariffs for all consumers are determined by the regulator HEA.

Electricity is supplied at regulated prices by three universal service providers (USPs) owned by RWE, E.ON and ENKSZ. This market segment appears to be unprofitable and existing regulated tariffs are set at a level that fails to recover the full costs. The IEA understands that a number of the USP licences will expire at the end of 2017 and are unlikely to be renewed by the present holders. Roughly 80% of the electricity supplied to the USPs is sourced through the MVM Group, which is also likely to incur losses from this business activity (cross-subsidy). The situation in the regulated retail market conflicts with the message contained in the 2011 IEA review that end-user prices need to reflect costs and that the burden of high energy prices borne by low-income households should be addressed by using targeted social measures. The increased price convergence resulting from the 4M market coupling and the currently favourable wholesale electricity prices as a result of low global energy prices present an ideal opportunity to start the process of implementing cost-reflective retail prices.

As a result of the tariff reductions, electricity prices for households in Hungary are now among the lowest in Europe (EURcent 11.45/kWh compared to EURcent 21.05/kWh EU average) whereas electricity prices in the industry sector are far closer to EU average levels (EURcent 10.47/kWh compared to EURcent 11.56/kWh EU average). Retail prices of electricity should fully reflect all costs, including all supply, network, taxes and levy elements. In the case of Hungary, however, sector-specific levies and taxes are not fully passed through in the final regulated prices paid by household consumers at present.

While the reduction in household prices provides a financial boost for consumers in the short term, the economic implications of the price reductions will cause increased difficulties over the medium term and raise questions as to their effectiveness. The present configuration of the energy market, which is characterised by low natural gas and electricity prices for households, but conversely, by relatively high prices for business and industry, will reduce national competitiveness and investment incentives over the medium term. Furthermore, state-owned utilities are likely to end up carrying a very large cost in return for offering low retail prices. Should global energy prices rise this cost will increase once more. This will place the suppliers in a very difficult financial position and there is a danger that they may eventually have to be bailed out by the government (OECD, 2016).

Instead, when considering the consequences of market intervention, the government should look to examples elsewhere, and focus on the development of solutions based on the experience of other countries (for example Spain and Portugal when dealing with their tariff deficits). Furthermore, the government should seek to gradually introduce market-based energy prices by phasing out access to the universal service and returning the responsibility for regulating prices to HEA until such time as retail pricing is determined by the market. These steps should be complemented by targeted support measure for low-income households via the government social welfare system. The regulator can use transparent competition-friendly pricing principles to determine end-user prices during this transition phase. Once more, there are numerous examples across IEA member countries as to how this transition to market-based retail prices can be done. Public service obligations, if necessary, should be met through explicit and transparent compensation to providers and subject to the oversight of the European Commission.

Meanwhile, the regulator HEA considers the current power plant capacity reserves sufficient because of the excellent regional integration of the country. This allows the country access to capacity in neighbouring countries. Nonetheless, expected retirements of power plants over the next decade, because of either their lack of competitiveness or their advanced age, give rise to the possibility of insufficient domestic generating capacity and continued import dependence. A working group with members of the Ministry of National Development, HEA and MAVIR has been set up to examine future generation needs, including reserve capacity. Nonetheless, the strategy on the future power plant fleet is unclear as is the source for the necessary investments.

## Recommendations

***The government of Hungary should:***

- Develop a clear and transparent programme for the implementation of full retail market liberalisation in the electricity sector, including the elimination of administratively determined end-user prices. Protection measures targeted on vulnerable customers and less well-off households should form part of social policy rather than energy policy.
- Assess possible regulatory barriers to market-based power plant investments and examine and address the reasons for the relatively low competitiveness of the electricity generation sector.
- Develop a clear strategy to secure a sufficient level of generating capacity in a competitive power sector, which ensures generation adequacy and security of supply.

### References

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# 5. Renewable energy

## Key data
(2015)

**Total supply:** 3.2 Mtoe (12.7% of TPES) and 3.4 TWh (11.3% of electricity generation)

**IEA average:** 9.9% of TPES and 23.6% of electricity generation

**Biofuels and waste:** 2.9 Mtoe (11.7% of TPES) and 2.3 TWh (7.6% of electricity generation)

**Geothermal:** 0.1 Mtoe (0.4% of TPES)

**Solar:** 0.07 Mtoe (0.3% of TPES) and 0.19 TWh (0.6% of electricity generation)

**Wind:** 0.06 Mtoe (0.2% of TPES) and 0.7 TWh (2.3% of electricity generation)

**Hydro:** 0.02 Mtoe (0.1% of TPES) and 0.2 TWh (0.8% of electricity generation)

**Exchange rate (2015):** HUF 1 = USD 0.00358 or EUR 0.00323; USD 1= EUR 0.901

## Overview

The share of renewable energy in Hungary's energy system has increased significantly in the last decade, but the growth has levelled off in recent years. Increased use of biomass for heat and power production has been the main driver of growth in renewables. The EU Renewable Energy Directive (2009/28/EC23) mandated Hungary to have 13% renewable energy in gross final consumption[1] of energy by 2020, and the country has set a higher national target on 14.65%. In 2016, Hungary replaced its feed-in tariff system with a new renewable energy support scheme to help meet its 2020 targets.

## Supply and demand

Biofuels dominate renewable energy supply in Hungary, both in terms of total primary energy supply (TPES) and electricity generation. The largest shares of biofuels are fuelling heat and power production or used directly by households for heating purposes. Despite a large increase in the last decade, Hungary's share of renewables in energy supply is low compared to the average among IEA member countries.

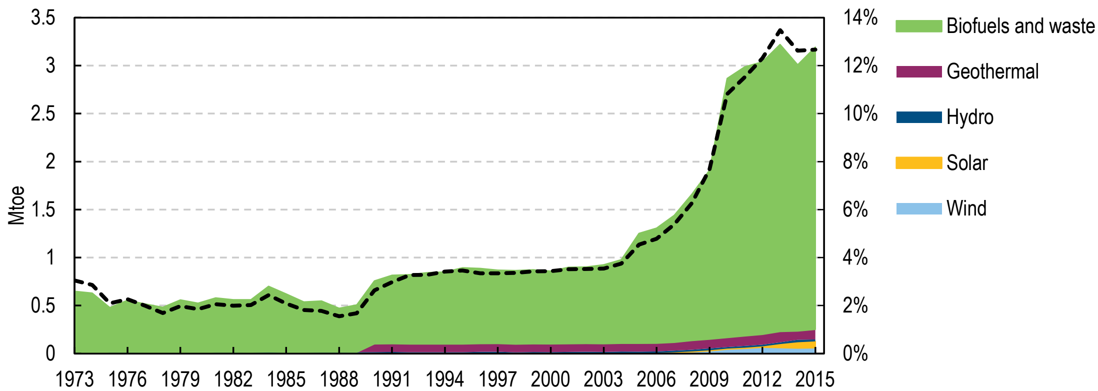
[1]. Defined as renewable energy commodities in TFC plus electricity and heat generated from renewable energy sources, as a share of total TFC.

## Renewable energy in TPES

Renewable energy in TPES grew rapidly from 2005 to 2010,[2] and has since remained stable around 3 Mtoe annually. As a result of increased total energy supply, the share of renewables in TPES declined slightly in 2015 from a 13.5% peak in 2013 (see Figure 5.1).

Biofuels accounted for 92% of renewable energy in Hungary's TPES in 2015, followed by geothermal (3%), solar (2%), wind (2%) and hydro (1%).[3] Significant shares of biofuels and geothermal energy are used by the residential and commercial sectors, while wind, solar and hydro energy are directly converted to electricity.

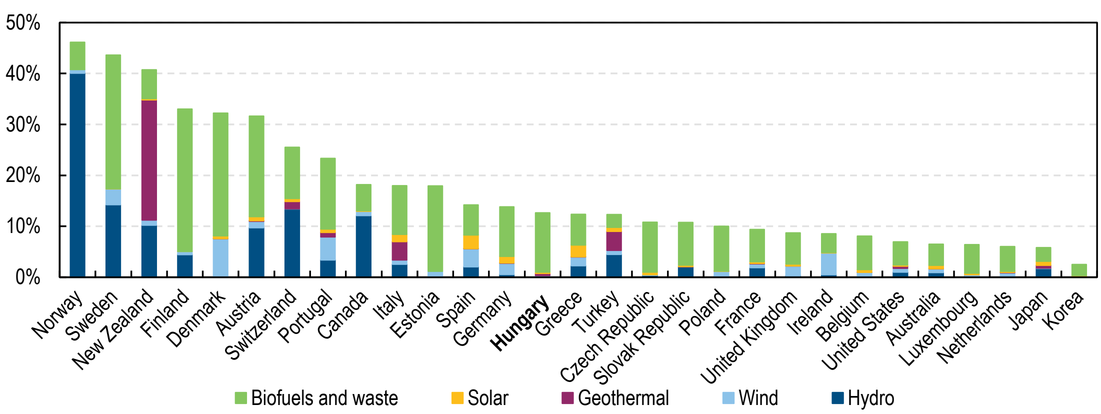
### Figure 5.1 Renewable energy as a percentage of TPES, 1973-2015




Notes: Changes in data collection methodology resulted in a significantly larger share biomass in household final consumption (and thus also in TPES) from 2010. Biofuels and waste includes a small share of non-renewable waste.

Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

### Figure 5.2 Renewable energy as a share of TPES in IEA member countries, 2015




Notes: Biofuels and waste may include shares of non-renewable waste. Data are provisional.

Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

[2]. This rapid growth was partly a result of the new methodology for collecting data on biofuel consumptiuon in the residential sector.

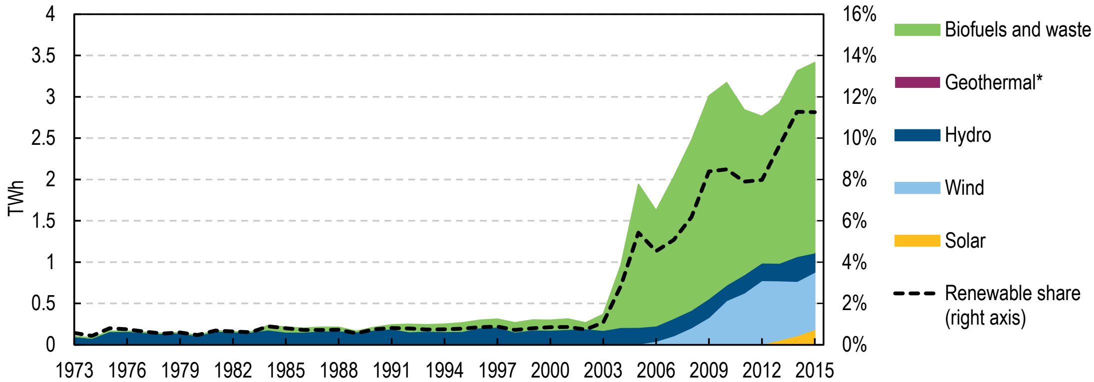
[3]. Conversion losses are included in TPES data. This will give a relatively high figure for biofuels used in heat and power generation compared to hydro, wind and solar, which are counted as the electricity produced without conversion factor. Geothermal energy has a conversion factor similar to biofuels.

## Electricity from renewable energy

Electricity generated from renewable energy sources increased by 76% from 2005 to 2015. The main source of this growth was electricity produced from biofuel, heat and power plants, which more than tripled in the five years from 2004 to 2009. This also makes up most of the growth in renewable energy in Hungary's TPES. Electricity production from biofuels and waste peaked at 2.5 terawatt-hours (TWh) in 2009 and has since declined by 6%.

Wind power has also increased, from negligible levels in 2005 to a peak at 0.8 TWh in 2012. Since the peak level, wind power production has not increased as no new wind capacity has been installed (see Table 5.1). Solar power has been the fastest growing source of renewable electricity in recent years, increasing from very low levels in 2012 to 0.19 TWh in 2015. Installed solar capacity more than doubled annually between 2009 and 2014, but production is low compared to electricity from biomass and wind power. Hungary also has low but stable production of hydropower.

### Figure 5.3 Renewable energy as a percentage of electricity generation, 1973-2015

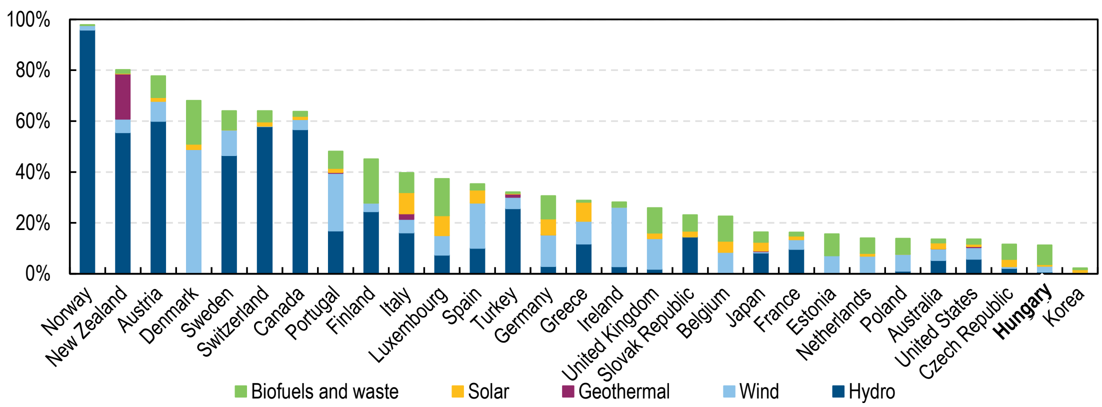



*Negligible.

Notes: Biofuels and waste in electricity production includes minor shares of non-renewable municipal waste. 2015 data are provisional.

Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

### Figure 5.4 Electricity generation from renewable sources as a percentage of all generation in Hungary and in IEA member countries, 2015




Notes: Biofuels and waste may include shares of non-renewable waste. Data are provisional.

Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

Despite growth in the last decade, Hungary has the second-lowest share of renewables in electricity generation among IEA member countries, ahead of only Korea (see Figure 5.4). This is a result of low shares of hydro, wind and solar power. The share of biofuels is on a median level among IEA countries.

## Table 5.1 Renewable electricity generating capacity, 1990-2015 (MW)

| Technology | 1990 | 1995 | 2000 | 2005 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| Hydro | 48 | 48 | 48 | 49 | 53 | 55 | 56 | 57 | 57 | 57 |
| Solar PV | 0 | 0 | 0 | 0 | 2 | 4 | 12 | 35 | 77 | 168 |
| Wind | 0 | 0 | 0 | 17 | 293 | 331 | 325 | 329 | 329 | 329 |
| Waste* | 24 | 25 | 25 | 26 | 44 | 47 | 45 | 45 | 47 | 59 |
| Solid biofuels | 0 | 5 | 5 | 337 | 469 | 436 | 202 | 247 | 467 | 422 |
| Biogases | 0 | 0 | 1 | 6 | 24 | 45 | 53 | 63 | 63 | 69 |
| **Total capacity** | **72** | **78** | **79** | **435** | **885** | **918** | **693** | **776** | **1 040** | **1 104** |

*Includes municipal waste and industrial waste.

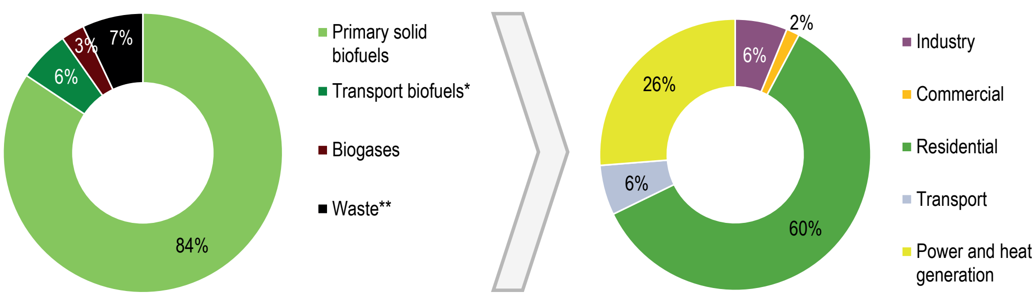
Note: PV = photovoltaic.

Source: IEA (2016), *Renewables Information*, www.iea.org/statistics/.

## Biofuels and waste

Biofuels and waste is the largest renewable energy source in Hungary. The vast majority is solid biofuels which are mostly used in household boilers in the residential sector or combusted for heat and power production in large energy transformation plants (see Figure 5.5). Biofuels and waste make up 7.6% of electricity production and 11% of heat production in Hungary. Furthermore, biofuels account for 4.2% of energy used in transport, of which approximately two-thirds are biodiesel and one third is bio-gasoline. Waste is used as fuel in a waste incineration plant located in Budapest, which is the only energy-from-waste facility in the country.

## Figure 5.5 Supply and consumption of biofuels and waste, 2015




**Transport* biofuels is made up of bio-gasoline and biodiesel.

***Waste* is made up of industrial waste, renewable municipal waste and non-renewable municipal waste.

Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## Institutions

The **Ministry of National Development** is responsible for energy and climate policy within the government. It was established following the general election in 2010. It is also responsible for managing state-owned assets, including in the energy sector.

The **Hungarian Energy and Public Utility Regulatory Authority (HEA)**, the energy sector regulator, performs standard national energy statistics-related tasks and complies with the data reporting obligations to various national and international bodies and organisations. As part of the National Statistical Data Collection Programme, HEA liaises with roughly 8 000 data suppliers.

## Policies and measures

### National plans

Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources lays down a 20% target for the overall share of energy from renewable sources and a 10% target in transport for the European Union as a whole. Pursuant to this directive, member states' targets vary according to the different situations and national possibilities of increasing renewable energy production. Therefore, a mandatory target of a 13% share of renewable energy in gross final energy consumption by Hungary by 2020 was established. The mandatory target of a 10% share in the transport sector is also in place.

Hungary's *National Renewable Energy Action Plan* (NREAP) was submitted to the European Commission in December 2010 and is under review in 2017. The 2010 plan projected a national target, in excess of the mandatory target, of a 14.65% share of renewable energy in gross final energy consumption and the fulfilment of a target of a 10% share in transport in by 2020.

The *Energy and Climate Awareness Raising Action Plan* (Government Decision 1602/2015) proposes to spread awareness of energy and climate. It identifies a series of governmental measures achievable within a short time, the majority by 2020, which are capable of significantly contributing to changing attitudes about climate change and energy efficiency. It concerns primarily the following five themes: *i)* energy efficiency and energy conservation; *ii)* renewable energy use; *iii)* transport energy savings and emissions reduction; *iv)* resource-efficient and low-carbon-intensity of economic and social structures; *v)* housing.

### Renewables targets and progress

Every two years, EU countries must report on their progress towards the EU's 2020 renewable energy goals. In the case of Hungary, the most recent progress report was published in May 2016.

### Table 5.2 National overall target for the share of renewable energy in gross final consumption of energy, 2005 and 2020

| | |
|---|---|
| A. Share of energy from renewable sources in gross final consumption of energy in 2005 (**%**) | 4.3% |
| B. Target of energy from renewable sources in gross final consumption of energy in 2020 (**%**) | 14.65% |
| C. Expected total adjusted energy consumption in 2020 **(ktoe)** | 19 644 |
| D. Expected amount of energy from renewable sources corresponding to the 2020 target (calculated as B × C) **(ktoe)** | 2 879 |

Note: ktoe = kilotonne of oil-equivalent.

Source: MND (2010), *Hungary's Renewable Energy Utilisation Action Plan*.

### Table 5.3 National 2020 target and estimated trajectory of renewable energy in heating and cooling, electricity and transport

| | 2005 | 2010 | 2014 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|
| Heating and cooling (%) | 5.99 | 11.05 | 12.40 | 11.80 | 13.70 | 15.70 | 17.40 | 18.90 |
| Electricity (%) | 4.42 | 7.10 | 7.28 | 7.10 | 8.60 | 10.20 | 10.70 | 10.90 |
| Transport (%) | 0.41 | 5.44 | 6.93 | 5.80 | 6.40 | 7.30 | 8.00 | 10.00 |
| Overall share of renewable energy (%) | 4.47 | 8.59 | 9.51 | 9.30 | 10.70 | 12.30 | 13.40 | 14.65 |

Source: MND (2010), *Hungary's Renewable Energy Utilisation Action Plan*.

## Renewable energy support system

To date, in seeking to achieve its targets, Hungary has developed a feed-in tariff (FIT) scheme, known as KÁT. First introduced in 2003, KÁT stimulated renewable energy development through the purchase of electricity at above market rates. The volume of electricity for which the KÁT rate is paid, as well as the duration, is limited by the regulator on the basis of the project payback period. Around 70% of KÁT support went to combined heat and power (CHP) plants and most of the remaining 30% went to biomass and wind plants. The feed-in tariff for CHP was abolished in 2011. The government has been working on reforming the KÁT to ease the burden on electricity prices and better focus financial support.

The KÁT is differentiated in the case of electricity generated from renewable energy sources and wastes, and feed-in tariffs are differentiated according to nominal electrical capacity, the date of acquisition of the right (before or after 1 January 2008), time of delivery (peak, off-peak and trough periods) and, in some cases, on technology (solar and wind are not time-differentiated). The present feed-in tariff rates are published on the website of the regulator (HEA). The FIT is adjusted in line with the Hungarian consumer price index of the previous year for those renewables generators who were licensed before 1 January 2008. For waste-to-energy producers and those renewables producers who were licensed after 1 January 2008, the price is indexed yearly with the consumer price index of the previous year reduced by one percentage point.

The FIT operates on the basis of a feed-in tariff balancing group, which has been functioning since January 2008. Under the Electricity Act, all generators selling electricity eligible for the KÁT form a separate balancing group, for which the transmission system operator (TSO) is responsible. The TSO receives all electricity supplied through the feed-in tariff system, operates the balancing group, balances out deviations from the schedule, and allocates, sells and accounts for all volumes of electricity received in the KÁT system. MAVIR, the TSO, pays the feed-in tariff to each producer for the volume of electricity supplied to the balancing group.

A producer of renewable electricity is entitled and obliged to join the KÁT balancing group if it fulfils all other legal requirements. MAVIR, as the entity responsible for the balancing group, concludes a balancing group membership contract with the producer. Since April 2016, the full volume of electricity received through the feed-in tariff system is sold by MAVIR on the organised power exchange (HUPX).

The additional costs of electricity received through the feed-in tariff system (the difference between the value of the FIT and the market value) are allocated to the market in proportion to their respective electricity sales that are not subject to universal service.

**Table 5.4 Total contribution (installed capacity, gross electricity generation) from each renewable energy technology, 2014**

| Energy source | Average feed-in tariff (HUF/kWh) | Capacity (MW) | Output (GWh) |
|---|---|---|---|
| Hydro (average) | 22.06 | 57 | 228.3 |
| Solar PV | 32.49 | 77 | 56.0 |
| Onshore wind | 34.36 | 329 | 704.2 |
| Solid biomass | 34.20 | 467 | 1 702.0 |
| Biogas | 33.65 | 63 | 283.8 |
| **Total** | | **993** | **2 974.3** |

Source: MND (2016), "Report on the Use of Renewable Energy Sources in Hungary in 2013 and 2014".

### *The METÁR system*

In 2017, a new operational support system, METÁR, was introduced for renewables-based electricity generation. The necessary legislative amendments were adopted by parliament in June and December 2016. The KÁT system continues to operate for existing plants following the introduction of METÁR; however, only new entrants will be eligible for the METÁR support mechanism.

The purpose of the new mechanism is to facilitate the integration of renewable electricity producers into the market, as well as to support the fulfilment of Hungary's 2020 renewable energy targets. Under METÁR, renewable electricity generators, with the exception of non-wind power plants under 0.5 megawatts (MW) and those already receiving a FIT, shall sell electricity on the market. Different market premiums will apply depending on the capacity of the power plants:

- In case of smaller power plants of less than 0.5 MW capacity (excluding wind energy) and demonstration projects, the electricity produced shall be purchased by MAVIR, the TSO, and sold by the TSO on the electricity wholesale market (HUPX). The purpose of this measure is to shield small producers from some of the market sales, clearing and price risks. These producers, therefore, remain in the same position as before.

- In case of power plants of medium capacity (between 0.5 MW and 1 MW), an administrative premium, at a level similar to the KÁT, will be paid to producers without any competitive bidding procedure (no tenders).
- In case of larger power plants (over 1 MW) and wind farms, premium support shall be granted only via competitive tendering procedures (except for demonstration projects). Although METÁR started on 1 January 2017, the details of the tendering scheme are unclear and are under negotiation with the European Commission (March 2016).

Following approval from the EU Commission, METÁR will also introduce a brown premium for depreciated biomass and biogas power producers. The purpose of this measure is to avoid the shutdown of these plants or the switch to fossil fuels in depreciated plants. In order to prevent illegal logging and to protect forests, METÁR contains strong guarantees regarding the usage of wood as fuel for electricity generation.

### *The guarantee-of-origin system*

The former verification of origin system was abolished by an amendment of the Electricity Act effective from 22 June 2013 and was superseded by the introduction of a guarantee of origin (GO). The detailed rules on GOs are set out in Government Decree 309/2013 (GO Decree) and are applicable from 1 January 2014. Under the Electricity Act, the volume of electricity produced from renewable energy sources or highly efficient co-generation may only be certified by the seller to the consumer in the form of a guarantee of origin.

GOs may be issued for volumes of electricity produced from renewable sources, or from highly efficient co-generation, provided that the relevant power plant has been already received a qualification resolution by the regulator HEA pursuant to the GO Decree. The standard volume included in a guarantee of origin is 1 megawatt-hour (MWh). GOs are tradable official certificates, which consumers/suppliers can use to certify the origin of the electricity they consume/supply.

In accordance with the GO Decree, HEA operates a registry of GOs using an electronic management system. In order to access the management system, the producer and/or the buyer of the guarantee of origin need to open a holding account with the regulator. In 2015, 13 holding accounts were opened, increasing the total number of account holders to 20 by the end of the year. In 2016, nine new holding accounts were opened bringing the total number of account holders to 29 by the end of the year. GOs are issued by HEA through the management system, upon request by the account holder, for volumes of electricity generated by a power plant classified under the GO Decree.

In 2016, a total of 6 810 GOs were registered with respect to electricity generated in Hungary. A further 343 131 GOs were recognised by the regulator upon request of the account holders with respect to electricity generated abroad. Accordingly, the certificates traded in Hungary originate primarily from abroad.

The purpose of GOs is to certify to consumers the (renewable or high-efficiency co-generation) origin of the electricity. In 2015, the renewable origin of 369 207 MWh of electricity was certified to consumers using guarantees of origin. No GOs for high efficiency co-generation have been issued or recognised by the regulator to date.

## Other funding mechanisms

The purpose of the EU Environment and Energy Efficiency Operational Programme (EEEOP) is to support sustainable growth and contribute to achieving the EU 2020 targets for smart, sustainable and inclusive growth. Among other things, it provides funding to improve energy efficiency and promote the use of renewable energy sources. Accordingly, Hungary is eligible for support from EU resources for development purposes. From 2014 to 2020, more than HUF 768.5 billion (EUR 2.5 billion) was allocated to operational programmes supporting developments in energy.

Eligible activities include the use of renewable energy sources (primarily solar panels, installation of solar panels, biomass, geothermal energy, heat pumps), heating and cooling of official buildings, modernisation of domestic water-heating systems and lighting systems to reduce energy use (maintenance-type investments are not permitted).

The Kyoto Protocol of the UN Framework Convention on Climate Change (UNFCCC) introduced trade in greenhouse gas (GHG) emission allowances of which Hungary has a substantial quota surplus. Revenue accumulated from the sale of these allowances is used for climate protection purposes, including the promotion of renewable energy within the framework of the Green Investment Scheme (GIS). The scheme supports the renovation of approximately 145 000 buildings as well as extensive renovations. GIS supports the development of renewable energy as part of the investment in energy-saving measures.

The Economic Development and innovation Operational Programme (EDIOP) is intended to support economic development but it also supports energy-related building refurbishments that include the use of renewable energy. The programme provides approximately HUF 233 billion (EUR 748 million) for this purpose.

The Rural Development Programme (RDP), co-financed by the European Agricultural Fund for Rural Development (EAFRD), provides support for renewable energy development projects in the agricultural sector. The programme supports the establishment of plantations of ligneous energy crops (such as poplar and willow for biomass production) with a fast-growing cycle, the establishment of non-food low-capacity plants for the production of raw alcohol and raw oil of vegetable origin, and the establishment of perennial herbaceous energy crop plantations for biomass production.

The Hungarian Energy Efficiency Credit Fund (EECF) offers low-interest loans to support the implementation of energy efficiency projects and the use of renewable energy sources. Access to preferential loans is open to enterprises and local governments but also to the public. One of the goals of the EECF is to substitute traditional energy sources with renewables and waste energy. Over 1 013 projects have applied for low-interest loans and the majority of projects were implemented in the industrial sector. The loans may be obtained simultaneously with other, non-refundable support. In recent years, the number of successful projects has dropped from 60 to between five and ten each year. The government is examining the scheme in order to ensure its efficiency and economic feasibility into the future.

## Renewable energy and electricity

Hungary's renewable energy generation is dominated by biomass, followed by onshore wind and small volumes of solar PV, biogas and hydropower. The NREAP foresees very little growth in renewable electricity between 2010 and 2020: approximately 17 MW of hydropower, 57 MW of geothermal and 740 MW of wind power (subject to the controllability of the electricity system). Further investments in wind power may be possible subject to technological advances in storage and the flexibility of the electricity system. Biomass use is expected to increase significantly but its use will be in the heating sector in the first instance. The theoretical potential of solar PV and heat pumps in Hungary is strong but, again, the bulk of use will be in the heating sector.

In the case of wind power, in 2016 the Hungarian government issued a series of new regulations with the aim of limiting the installation of new wind turbines in the country. While the amendment to the Energy Act does not explicitly ban wind farms, it bans wind turbines within a 12-kilometre radius of populated areas. Furthermore, the installation of wind turbines on agricultural land is restricted to those areas which have been out of cultivation for at least three years. Additionally, only 2 MW wind turbines, that is those with older technology, are allowed and at a height of no more than 100 metres. In October 2016, the President referred the amendment of the Electricity Act back to parliament for review. A slightly amended version of the regulation was passed by parliament in December 2016 on the assumption that Hungary would be able to reach the goals outlined in the Paris Agreement on Climate Change without investing in additional wind power.

### Grid access

The Act on Electric Energy gives priority grid connection and access to electricity generated from renewable energy sources. In addition, it imposes restrictions on electricity imports to the benefit of renewable energy. The costs for the connection of renewable energy plants and the expansion of the grid are borne either by the plant operator or by the grid operator, depending on certain criteria.

Despite this, insufficient grid capacity, high connection costs and a very difficult permitting process represent significant barriers to renewables expansion. According to the industry, grid connection takes an average of 45 months to secure and an estimated 10.6% of total project costs are spent on obtaining it. This is further complicated by the fact that a large number of authorities are involved in the permitting process and many applications are denied at present. A bureaucratic overhaul will be required if Hungary's renewables market is to meet its potential.

## Heating and cooling

The main use of renewable energy is in the heating sector. The EEEOP encourages the development of new, renewable energy sources based on district heat production facilities, enhancing the energy efficiency and replacing the old and obsolete production units by converting them to renewable energy use. Integration of new production units into the district heating system is also supported. Approximately, HUF 45.7 billion has been set aside for this part of the programme. The main beneficiaries are district heating service providers, district heating companies and business associations.

## Transport sector

Regulations for the use of biofuels have existed in Hungary since 2005. Until 2009, the country provided incentives for the use of biofuels by means of tax relief. Excise duties on bioethanol and biodiesel for blending with transport fuels, as well as on their ethyl tertiary butyl ether (ETBE) bioethanol component, were recoverable. In 2009, the tax relief on biofuels mixed with gasoline and diesel was abolished and was replaced with a biofuel blending obligation (to fuel suppliers) which was 3.1% in gasoline and 4.4% in diesel between 2011 and 2013. For the period 2014 to 2018, the biofuel blending obligation was increased by 4.9%; however this regulation still relates to both gasoline and diesel together.

Consultations are currently in progress between the Ministry of National Development and industry stakeholders about a new blending obligation for the period 2019-20. Since 2011, the ratified blending obligation can only be fulfilled by using biofuel that is certified to have been produced in a sustainable way.

According to the most recent available data from Hungary, the country produced 305.19 kilotonnes of oil-equivalent (ktoe) of biofuels in 2013 (179.8 ktoe of bioethanol/bio-ETBE and 125.39 ktoe of biodiesel), in contrast to the country's final biofuel consumption of 136.82 ktoe (31.13 ktoe of bio-gasoline and 105.69 ktoe of biodiesel) (MND, 2016). At the current rate of progress, the country is unlikely to meet its EU target of 10% in 2020.

The Jedlik Ányos Plan (1487/2015, Government Decision on legislative tasks related to the Jedlik Ányos Plan) aims to promote electro-mobility. The main measures in the plan include planning and preparation tasks between several ministries and regulatory co-operation, for example *i)* planning the deployment of charging infrastructure; *ii*) developing the measurements and accounting system for electricity used to charge vehicles; *iii)* ensuring the operation of household charging appliances; and *iv)* establishing direct and indirect-tax incentives.

## Assessment

Since 2005, the share of renewable energy sources in the Hungarian energy mix (measured as TPES) has grown from 4.5% to 12.7% in 2015, primarily owing to abundant biofuel and biomass production. In its *National Renewable Energy Action Plan*, submitted to the European Commission on the basis of the Renewable Energy Directive (2009/28/EC), Hungary pledged to increase the share of renewables to 14.65% of gross final energy consumption by 2020. Beyond this general target, three different sub-targets have been specified, namely the share of renewables in electricity generation (10.9% by 2020), the share of renewables in transport (10%) and the share of renewables in heating and cooling (18.9%).

Although the share of renewables in the energy mix in 2015 was higher than the 2013-14 indicative RES target (6.9%), the increase in the annual renewable share showed signs of slowing down. This was largely the result of reaching the limits of biomass, especially in heat and electricity generation, as biomass is the source of more than 90% of total renewable energy production. Other forms of renewables, such as solar, geothermal or wind remained marginal but solar has been the fastest-growing source of renewable electricity in the past few years. Renewable energy policies of the country should therefore focus on energy sources other than biomass otherwise it risks missing its 2020 renewable energy target.

The Hungarian government acknowledges that solar, geothermal and other renewable energy sources could significantly contribute to the attainment of the 2020 renewable energy targets, and renewables play an important role in the most probable Nuclear-Coal-Green Scenario set out in the National Energy Strategy 2030. In the case of solar electricity generation, measurable growth has been observed in the last two or three years, primarily owing to increasing deployment of rooftop PV. However, an environmental tax (recycle fee) has been levied on solar panels, which is high by international comparison. Geothermal energy, for which Hungary has strong geological endowment, remains underdeveloped as only a few investors have demonstrated interest in exploiting the resource to date.

Current renewable policies in Hungary do not favour wind energy, as new wind farms face significant regulatory obstacles. For example, wind farms should be installed a large distance from settlements and residences; the wind turbine shaft should not exceed a given height; and capacity shall not exceed 2 MW, and so forth. These preconditions are difficult to comply with taking into account Hungary's geographical situation and the physical characteristics of available wind turbines on the market.

Under the previous renewable support system (KÁT), electricity plants from 50 kW upwards could sell their electricity to the TSO MAVIR and benefit from the feed-in tariff system. Household-size power plants (less than 50 kW) were not entitled to join the KÁT system but they could sell their electricity to the local distribution system operator (DSO), which was obliged to purchase the electricity at the end-user electricity price. The KÁT system has been closed to new entries but existing contracts still remain valid until their expiration date.

The new support system for electricity generation from renewable sources (METÁR) is a fundamental reform of the feed-in tariff system. For renewable generation, capacities less than 0.5 MW will continue enjoying the mandatory offtake regime. For generating capacities between 0.5 MW and 1 MW, a premium will be paid above the reference price. The length of the support period will be determined by the regulator HEA. For larger capacities (over 1 MW) and wind installations, a competitive bidding procedure will be implemented. For biomass and biogas generating capacities, a so-called brown premium will be introduced, in order to keep biomass firing competitive vis-á-vis fossil fuels. The new METÁR system provides operating aid for renewable sources and fulfils the requirements of EU state aid guidelines.

The source of the operating aid will be a renewable surcharge to be paid by final non-household customers, as households are entitled to participate in the universal service provision and pay regulated electricity prices. Although preliminary calculations reckon with only a modest increase in end-user prices for the business sector, if the impact is underestimated and electricity prices experience higher increases, it may negatively impact the competitiveness of the industry.

Nonetheless, METÁR represents progress following several years of reform delays in the renewables support scheme. The new support system came into operation on 1 January 2017 although some elements of the system await EU Commission approval.

However, there are many details that remain to be clarified. For example, there is no information on network development plans enabling the feed-in of increasing renewable generation, though during the preparation of the national network development plans, concrete connection of new generation (including renewable energy sources) is taken into account on the basis of the relevant declarations of generators. Distribution system operators and the transmission system operator (MAVIR) should present such plans to clarify the situation.

Under the Environmental and Energy Efficiency Operational Programme of the European Commission, significant financial sources are available for investments in renewable capacities. Funds are also available for increasing the role of renewables in district heating in the period 2014-20; however, it is not clear yet how these funds will be used. In the case of the share of renewables in transport, the attainment of the 2020 target is principally ensured through biofuel blending in motor fuels: however, the relatively old age of the Hungarian car fleet makes it technically difficult to further increase the share of biofuels. Hungary is, however, promoting electro-mobility and alternative fuels infrastructure, which will contribute to the enhancement of the share of renewables in the transport sector.

## Recommendations

***The government of Hungary should:***

- ☐ Focus incentives on renewable energy sources such as solar, wind and geothermal rather than biomass and biogas. Available funds for renewable investment support should be used effectively and special attention should be paid to the district heating sector.
- ☐ The new METÁR renewable support system entered into force on 1 January 2017. Further details on the tendering of renewable capacities should be published as soon as possible and funding of the support mechanism should be transparently allocated.
- ☐ The national regulatory authority, the electricity distribution system operators and the transmission system operator should develop and implement a long-term plan for the efficient integration of greater shares of variable renewable generation.

### References

IEA (International Energy Agency) (2017), *World Energy Balances - 2017 Preliminary edition,* IEA/OECD, Paris, www.iea.org/statistics/.

IEA (2016), *Renewables Information*, OECD/IEA, Paris, www.iea.org/statistics/.

MND (Ministry of National Development)) (2016), "Report on the use of renewable energy sources in Hungary in 2013 and 2014", MND, Budapest.

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# 6. Nuclear

## Key data
(2015)

**Number of reactors:** 4 reactors at the Paks nuclear power plant, operated by MVM Paks Nuclear Power Plant Ltd

**Installed capacity:** 2 GW (4 reactors of 500 MW)

**Electricity generation:** 15.8 TWh, +14% since 2005

**Share of nuclear:** 17.3% of TPES, 52.2% of electricity generation, 36.0% of total electricity supply (including net imports)

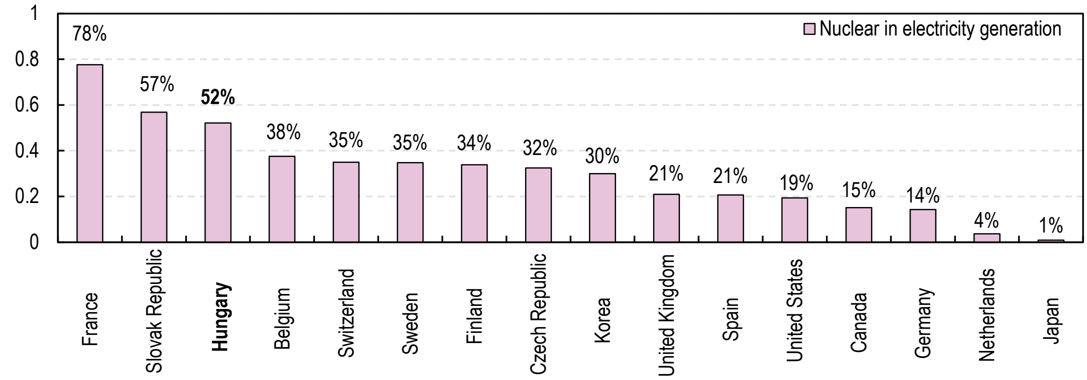
## Overview

Nuclear energy has been a major source of electricity generation in Hungary ever since the start of the Paks nuclear power plant (NPP) in the 1980s. Electricity from nuclear power is considered a way to improve security of supply and at the same time reduce carbon emissions. The National Energy Strategy 2030 (NES 2030) states that nuclear energy is an important part of the domestic energy sector and the economy. It provides more than half (52%) of domestically generated electricity and will continue to do so into the foreseeable future. The share of nuclear in the electricity mix can be ensured through the lifetime extension of the four units located at the Paks 1 site (already implemented for three units), by sustaining a high capacity utilisation, by managing nuclear waste responsibly and by constructing two additional units at the Paks site.

The construction of new units at the Paks site would be the largest investment in the Hungarian energy sector for several decades, and is therefore considered a flagship project by the government, under direct responsibility of the Prime Minister's Office. Once the new units start operation, the output of the plant needs to be integrated into the electricity market, contributing in a competitive way to the Nuclear-Coal-Green Scenario, which is envisaged in NES 2030.

The existing Paks NPP has four pressurised water reactors (PWR) with a production capacity of 500 megawatt-hours electrical ($MW_e$) each. In 2015, the share of nuclear power in electricity generation is the third-highest among IEA member countries, after France and the Slovak Republic (Figure 6.1). In terms of total electricity consumption, which includes the relatively high net imports of electricity to Hungary, the share of nuclear is roughly one-third.

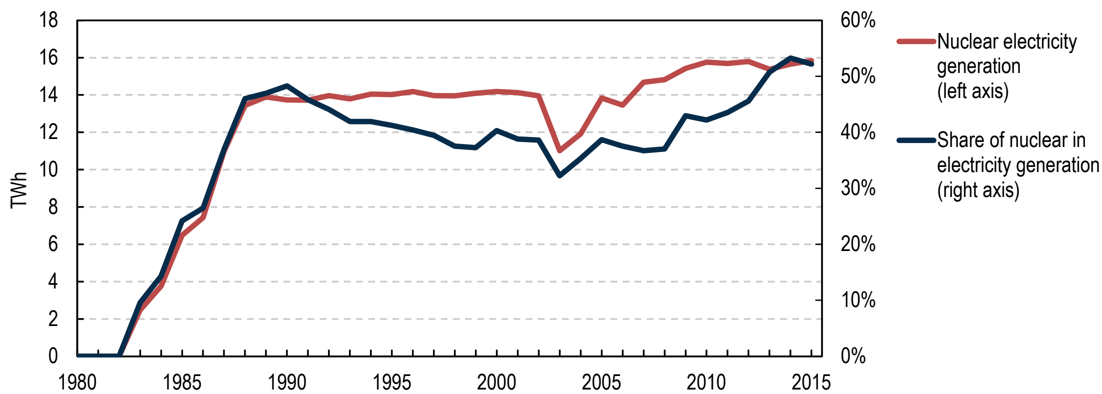
**Figure 6.1 Share of nuclear power in electricity generation in IEA member countries, 2015**




Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

The four Paks units were put into operation in 1982, 1984, 1986 and 1987. The reactors were originally designed for a capacity of 440 $MW_e$, but have been upgraded in several phases since. Electricity generation has been around 14 terawatt-hours (TWh) per year from 1988, with the exception of 2003 and 2004 when production declined below 12 TWh as a result of a major incident in unit 2 (Figure 6.2). In 2009, the most recent upgrade was completed, resulting in an increased capacity of approximately 500 MW for each reactor and a total electricity generation of nearly 16 TWh per year. The plant operated at a capacity factor of around 91.4% in 2016.

**Figure 6.2 Nuclear power in electricity generation, 1980-2015**




Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## Institutions and regulation

The Act CXVI of 1996 on Atomic Energy (Act on Atomic Energy) provides for the independence of the nuclear safety authority both organisationally (legal supervision) and financially. Nuclear safety and security are supervised by the Hungarian Atomic Energy Authority (HAEA), an independent government office, working under the legal supervision of the government. HAEA is overseen by the minister responsible for nuclear energy nominated by the Prime Minister, in this case the Minister of National Development. The Director-General of HAEA is nominated by the Prime Minister and the two deputies by the Minister of National Development. These three positions have no time limits (until revocation). HAEA reports annually to the parliament. In 2015, the Hungarian Parliament adopted a new act to strengthen the nuclear licensing and financial environment, including more staffing and remuneration of HAEA. The HAEA has the power to take regulatory decisions concerning nuclear safety, security and safeguards in line with the requirements and the recommendations of the European Union and the International Atomic Energy Agency.

The Public Limited Company for Radioactive Waste Management (PURAM), established in 1998, is the body responsible for the management of radioactive waste in Hungary. It is 100% state-owned, and was established by the Director General of HAEA on behalf of the government. In accordance with the Act on Atomic Energy, PURAM is responsible for the design and execution of radioactive waste management in a safe manner. Its tasks include the final disposal of radioactive waste, the interim storage of spent fuels, closure of the nuclear fuel cycle and the decommissioning of nuclear installations.

## Nuclear strategy

Hungary's nuclear strategy is based on the uprate and lifetime extension of the existing units. At the same time it plans the construction of the new units on the same site. Its aim is to maintain nuclear capacity over the long term, when the existing Paks units will be shut down. Other parts of the strategy are to achieve a responsible management of nuclear waste and a decommissioning process.

### Power uprating of the Paks units

The power output of the four existing units has been uprated in two phases ending in 2009, from the original 440 $MW_e$ gross to 500 $MW_e$. In 2016, a further upgrade of the turbines of unit 2, including the replacement of all eight high-pressure turbines, allowed an additional increase in power output of 5 $MW_e$ per unit. In 2015, the HAEA also authorised a 15-month operation cycle with slightly higher enrichment. This will have some positive economic and safety-related impacts for the units concerned.

### International peer reviews of the existing Paks units

The existing NPP regularly gets international peer reviews from the International Atomic Energy Agency (IAEA), the Operational Safety Review Team (OSART) and the World Association of Nuclear Operators (WANO).

### Lifetime extension of the Paks units

Four VVER 440-213 Russian-design units started operation in 1982, 1984, 1986 and 1987, with a standard operational design lifetime of 30 years. The lifetime extension process for an additional 20 years was initiated as early as 2000 through a feasibility study. In 2005, the Hungarian parliament supported the 20-year lifetime extension principle. The extension programme was submitted in 2008 for review by the HAEA, which approved the lifetime extension of units 1, 2 and 3 in 2012, 2014 and 2016. In December 2016, a request was submitted to the HAEA to grant a lifetime-extension licence for unit 4. The decision is expected in 2017. The estimated costs for the upgrading and extension are estimated at around EUR 50 million per unit, excluding the costs related to dedicated post-Fukushima measures resulting from the stress tests.

## New build at the Paks site

The existing four Paks units are planned to close in sequence between 2032 and 2037, after 50 years of operation. To ensure the timely replacement by new nuclear units, in 2009 the parliament authorised the start of preparatory works for the new Paks units. In January 2014, Hungary signed an Inter-Governmental Agreement with the Russian Federation (hereafter, “Russia”) for the construction and technical support of two units of 1 200 $MW_e$ at the Paks site. The units are expected to start operation in 2025 and 2026. In March 2014, Hungary and Russia signed a financial agreement providing for a EUR 10 billion credit line from Russia to cover 80% of the capital expenditure for the construction of the two units. The Hungarian government will finance the remaining 20%.

The agreements have been approved by parliament in two consecutive parliamentary terms. The loan is to be repaid over 21 years of operation (after commissioning of the units), with interest rates increasing in increments over time from 4% initially in the first period to 5% in the last period. Based on public information, the overnight construction cost is estimated at USD 6 215/kilowatts electrical ($kW_e$) installed, leading to a levelised cost of electricity of EUR 55/MWh (IEA/NEA, 2015).

Under intergovernmental agreements, three contractual implementation agreements were signed in December 2014 between MVM Paks II Ltd on the Hungarian side and JSC NIAEP on the Russian side: the engineering, procurement and construction (EPC) agreement, the fuel supply agreement, and the operation and maintenance support agreement. Under the terms of the EPC, the Paks II project has a fixed price, fixed deadlines, turnkey contract, for which the Russian party bears the full contractual responsibility until the start of commercial operation.

The MVM Paks II Ltd is in direct state-ownership and the shareholder’s rights and obligations are exercised by the Prime Minister’s Office. In 2014, it has been fully separated from the incumbent MVM Group which includes the joint stock company MVM Paks NPP Ltd, established in 1992, which is operating the existing Paks units. A Government Commissioner to oversee the Paks II project has also been nominated.

Authorisation for site investigation and evaluation for MVM Paks II Ltd was granted by the HAEA in 2014. Execution of the site investigation programme started in 2015. A site licence application was submitted in October 2016, which is currently being evaluated by HAEA. The environmental licensing procedure started in 2014. A number of information forums were held in Paks and the surrounding areas, and nine international hearings in seven neighbouring countries were concluded in November 2015. The Hungarian Environmental Authority issued the environmental permit in 2016, which was appealed by a number of non-governmental organisations. A second-degree permit review is currently in progress. Following this, the site and construction licences should be provided in 2017 by HAEA, allowing construction to start in 2018. In 2015, the European Commission gave a positive opinion on the Paks II project under the Euratom Article 41 Investment Declaration procedure. The Euratom Supply Agency also analysed the impact of the Paks II fuel supply contract. After negotiations, ensuring that the aspects of security of supply for Euratom were respected, the contract was signed in April 2015.

In November 2015, the European Commission opened a formal investigation to analyse compliance with the EU State Aid Rules. In the course of this procedure, the “standstill clause” of the EU law (no financial spending is allowed, not even an obligatory financial commitment in connection with the project implementation) was applied until the case was decided. Furthermore, the European Commission opened an infringement procedure in relation with the Public Procurement Rules. The later proceedings were ended by the European Commission on 17 November 2016 without comment; while the former process ended on 6 March 2017.

## Nuclear safety

Following post-Fukushima EU stress tests, the HAEA developed a *National Action Plan* compiling the actions decided during the self-assessment and international reviews. The action plan was positively evaluated during the European Nuclear Safety Regulators Group (ENSREG) peer review organised by the European Commission. In 2016, HAEA reviewed the implementation of the action plan, so as to be able to report under the IAEA Convention on Nuclear Safety. The situation is as follows:

- Twenty-eight tasks out of 51 have been implemented within the deadline.
- Nine further tasks were reported fulfilled by the operator, but not yet closed by HAEA.
- In the case of 10 tasks, the deadline has not yet expired and can still be reached.
- Delays are anticipated for four tasks, but all tasks are to be terminated by the end of 2018.

HAEA deemed the situation satisfactory, a position that was endorsed by the ENSREG review.

In 2014, the Hungarian nuclear licensing regulatory framework was revisited and modernised to integrate the regulatory framework for nuclear safety, radiation and physical protection regarding the peaceful use of nuclear energy under the same unique authority. In 2015, the Hungarian Parliament adopted a new act creating a better licensing and financial environment, including increased staffing and remuneration of HAEA and providing more time (nearly fourfold) for HAEA to evaluate the licensing documentation. An additional 80 staff were recruited by HAEA, doubling the workforce. Between 30 and 40 more staff will be recruited in the coming years.

The HAEA can call on the expertise of Technical Safety/Support Organisations as necessary. These have the responsibility to ensure the independence of the experts they provide in support to HAEA.

## Nuclear fuel cycle, including uranium production

Hungary currently has no nuclear fuel production infrastructure (uranium mining, refining, conversion, and enrichment or fuel fabrication facilities) and no reprocessing facilities. Nuclear fuel for the four existing units is purchased exclusively from Russia and a strategic reserve of two years of fuel supply is maintained at the NPP. For the new units, a fuel purchase contract for the first ten years has been signed with Rosatom.

Between 1956 and 1997, uranium was mined at the underground Mecsek mine by the state-owned (until 1992) Mecsek Ore Mining Company, producing a total of just over 21 000 tonnes of uranium (tU). Until an ore-processing plant became operational at the site in 1963, all ore was shipped to the Sillimae metallurgy plant in Estonia. After 1963, uranium concentrates produced at the processing plant were shipped to the former Soviet Union. The mine was closed in 1997 because of poor market conditions.

Closure and large-scale site remediation activities at the Mecsek uranium production centre were carried out between 1998 and 2008. Remediation mainly consisted of: removing several hundred thousand tonnes of contaminated soil from various areas around the site to an on-site disposal facility; clearing tailings ponds and waste rock piles through the placement of protective earthen covers; abandoning and closing underground mine workings as well as extracting and treating groundwater. Although the large-scale remediation programme was completed by the end of 2008, long-term care activities – such as groundwater remediation, environmental monitoring and maintenance of the engineered disposal systems and remediated sites − will have to continue for several decades to come. Because of the flooding of the abandoned underground mining openings, in the next years the enlargement of the water management system and the mine water treatment plant is crucial. The planning and implementation works started in 2014.

With generally increasing prices since 2003 and prospects of rising demand, uranium exploration and mine development activities were restarted in many countries, including Hungary. In 2009, Australian-based Wildhorse Energy signed a co-operation agreement with Mecsek-Öko and MECSEKÉRC, Hungarian state-owned companies that are currently responsible for uranium mining, exploration and rehabilitation activities. The intent of this agreement was to work towards the resumption of uranium mining in the Mecsek Hills. However, in 2014 these uranium mining activities were suspended and Wildhorse Energy withdrew from the project.

## Nuclear waste and decommissioning

In accordance with the Council Directive 2011/70/Euratom adopted on 19 July 2011, the Hungarian government has elaborated its National Policy and National Programme on spent fuel and radioactive waste management. The National Policy on radioactive management was approved by the parliament in April 2015 and is in line with the relevant international recommendations, EU requirements, as well as national laws and regulatory procedures on spent fuel and radioactive waste. The National Programme – as a roadmap – contains the practical and specific technical solutions for carrying out the goals and principles laid out in the National Policy. The National Programme's strategic environmental assessment was completed in August 2016. In Hungary, PURAM is the body responsible for radioactive waste management (NEA, 2016).

Low- and intermediate-level radioactive waste generated during the operation and decommissioning of the existing Paks units will be disposed of in the Bátaapáti National Radioactive Waste Repository (NRWR). The facility was commissioned in two phases. In 2008, the surface buildings were put into operation providing technological storage capacity for the NPP-origin waste. In the second phase of the construction, the first two disposal galleries were commissioned in 2012.

Until 1998, spent nuclear fuel from the existing Paks units was sent back to Russia for reprocessing. Since 1997, an interim spent-fuel dry storage facility is in operation next to the Paks site. The facility is expanded by steps as necessary with the continued long-term operation of the plant. Spent nuclear fuel is currently not considered as a waste in Hungary.

In parallel with the process of expanding the Interim Spent Fuel Storage Facility, the preparation of the future decision on the back end of the fuel cycle is of prime importance. The parliament approved the national policy on spent fuel and radioactive waste management in 2015, according to which a decision is expected by mid-2040, based on technical, safety and socio-economic assessments.

While the final back-end option has not yet been selected, the annual payment of the Paks power plant to the Central Nuclear Financial Fund is determined by assuming direct geological disposal of spent nuclear fuel (without reprocessing) as the reference scenario. Hungary has run a geological investigation programme for many years aiming at a site selection for an underground research laboratory by 2030, leading to the construction of a deep geological repository by 2055 and the start of operation in 2064.

Decommissioning and radioactive waste management activities are financed by the entities operating the facilities and generating the waste (polluter-pays-principle). In 1998, the Act on Atomic Energy established the Central Nuclear Financial Fund to finance these activities. Payments to the Fund are coming from tax-like instalments made by the waste generators. The Fund is managed by the Ministry of National Development and is to be used only for the purposes specified in the Act. Hence, the government is bound by law to use the Fund only for waste management activities defined in the Act.

The Fund is authorised to finance only tasks pertaining to the final disposal of radioactive waste, interim storage of spent nuclear fuel, back-end fuel cycle processes (disposal of either spent fuel or high-level waste after reprocessing), and decommissioning of nuclear facilities. The larger contributor to the Fund is the Paks NPP. Annual payments are made during the operational lifetime of the plants. At the end of 2015, EUR 820 million has been accumulated in the Fund. Expenditures from the Fund in 2015 to finance ongoing radioactive waste and spent fuel management amounted to EUR 47 million.

## International agreements

In 2013, Hungary signed two memoranda of understanding in the field of energy co-operation. One between the Ministry of National Development of Hungary and the Ministry of Energy and Mineral Resources of the Hashemite Kingdom of Jordan, and another between the Ministry of Economy, Trade and Industry of Japan and the Ministry of National Development of Hungary.

In September 2013, Hungary and Vietnam signed an intergovernmental agreement on training, research, regulatory and technical co-operation in the peaceful uses of nuclear energy. In October 2013 an agreement was signed between the government of Hungary and the government of the Republic of Korea for co-operation in the peaceful uses of nuclear energy.

In 2014, Hungary signed an intergovernmental agreement with Russia concerning co-operation in the peaceful use of atomic energy. In the same year, an Agreement was signed between the government of Hungary and the government of the Republic of Serbia for the early exchange of information in the event of radiological emergency.

In 2015, Hungary signed several co-operation agreements in the field of the peaceful uses of nuclear energy in the area of education and training as well as of research and development. In February 2015, the respective ministries of Hungary and Turkey signed a memorandum of understanding on education, training, research and development in the nuclear industry. Similarly, in May 2015, the respective ministries of Hungary and the People's Republic of China signed a memorandum of understanding on nuclear energy co-operation, including education and training, research and development (R&D) and knowledge exchange. In December 2015, an intergovernmental agreement for co-operation on the peaceful uses of atomic energy between Hungary and Saudi Arabia was signed (NEA, 2016). In February 2016, the respective ministries of Hungary and the Hashemite Kingdom of Jordan signed a memorandum of understanding on co-operation in the peaceful uses of nuclear energy.

## R&D and human resources

The research reactor of the Energy Research Centre of the Hungarian Academy of Sciences (Budapest research reactor) and the training reactor of the Institute of Nuclear Technology of the Budapest University of Technology and Economics (BME NTI, training reactor) serve important research and educational purposes.

The Budapest research reactor went critical in 1959 (with an initial 2 MW of thermal power). The first upgrading took place in 1967 when the power was increased from 2 MW to 5 MW, using a new type of fuel and a beryllium reflector. Between 1986 and 1992 a full reconstruction was carried out. After the conversion (a thermal power upgrade to 10 MW), the new reactor was granted a 30-year operating licence, which is valid until 2023. The training reactor operated by BME NTI was started up in 1971 and the expected operating time is not yet defined. The parts and components of relevance to the service life are interchangeable or renewable. The renewal of the operating licence of the facility will be initiated with the regulatory body by the licence holder during the next Periodical Safety Review scheduled for 2017. On the basis of the results of the Periodical Safety Review, the competent authority extends the operating licence of the training reactor with 10 years until 2027.

The Budapest research reactor is in the phase of being converted from HEU (highly-enriched uranium) to LEU (low-enriched uranium). The first step of the repatriation process to Russia initiated and financially supported by the US Department of Energy was completed in 2008 in the frame of IAEA's RER/4/028 programme; all fuel used before 2005 was repatriated. The second step took place during October and November 2013, following which Hungary became HEU-free. The core now operates with low-enriched (19.75% 235 U) fuel elements.

## Assessment

Nuclear energy is a main contributor to electricity production and consumption in Hungary, with four reactors in operation at the Paks site since the 1980s (unit 1 commissioned in 1982, unit 4 commissioned in 1987). The reactors, of Soviet origin

(VVER 440 213 with pressure suppression pools), have a 30-year original design lifetime. Lifetime extension programmes are ongoing, with three already finalised, to allow the operation for an additional 20 years. The reported budget for this lifetime extension programmes is of the order of EUR 50 million per unit, not considering the post-Fukushima safety upgrades resulting from the stress tests. The lifetime extension programmes have been reviewed and approved by the HAEA, the atomic energy supervisory authority. It is important that they are further monitored and followed up over time, including through exchanges of information with operators and regulators for similar plants in other countries (such as Russian, the Slovak Republic, the Czech Republic) but also through lifetime extension methodologies applied to other types of nuclear plants.

The timeframe proposed for the construction of the new units at the Paks site makes sense in view of the replacement of the existing Paks units when they are shut down, with the aim to keep an important nuclear contribution to the Hungarian energy mix over time. The new units would come on line before the shut-down of the existing units, leading to a temporary increase in nuclear capacity for some years, compensating imports of electricity for a while. Because this project is central in the NES 2030, it is important to ensure its success and therefore to comply with all necessary international rules and procedures of application, in particular at EU level.

The construction programme for the new units is organised as a stand-alone project and a legal entity directly under the responsibility of the Prime Minister's Office, demonstrating the national strategic importance of the project. In recent years, a number of measures have been taken to reinforce the independence and capacity of the nuclear safety authority HAEA. This is of particular importance considering the additional work load and responsibilities brought about by the evaluation and implementation of the post-Fukushima safety upgrades, the lifetime extension programmes, and the first measures related to the design and construction of new units.

An Integrated Regulatory Review Service (IRRS, an IAEA review mission of the safety authority and connecting co-authorities) was completed in 2015. Among a set of 32 recommendations and 10 suggestions, the matters of independence and capacity (manpower and financial resources) have been highlighted as elements deserving attention.

Decommissioning and radioactive waste management activities are financed by the entities operating the nuclear facilities and generating the wastes, as per the polluter pays principle. In 1998, the Act on Atomic Energy established the Central Nuclear Financial Fund to finance these activities. Annual payments are made during the operational life of the plants. The Fund is managed by the Ministry of National Development and strictly segregated. The lifetime extension of the Paks units will allow a further stretch of contributions to the Fund. During that time the yearly payments need to be regularly re-evaluated and adapted, on the basis of improved and refined calculations of the costs associated with decommissioning and long-term waste management, reflecting better knowledge of processes.

It is important to clearly separate the financing of "actual waste management activities during the operational lifetime of the plants", which should be considered as "operational costs", from the securing of funding for the "long-term waste management activities after the plants are definitely shut down", and which can be considered as legacy costs to be financed by the dedicated fund.

## Recommendations

***The government of Hungary should:***

- Ensure that, at the end of the construction phase, the operation of the plant is properly integrated into the functioning of the electricity market.
- Ensure the full independence of the Atomic Energy Authority. This is particularly important as the implementation of the construction project of the new unit is run by the Prime Minister's Office, while the Authority is overseen by a Minister (of National Development) who is directly appointed by the Prime Minister, and headed by a director general nominated by the Prime Minister and a deputy director general nominated by the Minister of National Development.
- Pursue the activities necessary to solve the long-term management of spent nuclear fuel and waste: investigate and clarify the options for the back-end of the fuel cycle, which is linked with the investigation of geological disposal options and sites (including for the timely development of an underground laboratory).
- In line with the above, regularly review the cost estimation for decommissioning and spent fuel and waste management, including for the diverse fuel-cycle back-end and geological disposal options under investigation. Ensure, accordingly, that the adequate provision and proper management of the segregated Fund will be able to pay for all costs at the appropriate time.

### References

IEA (International Energy Agency) (2017*), World Energy Balances - 2017 Preliminary edition,* OECD/IEA, Paris. www.iea.org/statistics/.

IEA/NEA (Nuclear Energy Agency) (2015), *Projected Costs of Generating Electricity 2015 Edition*, OECD/IEA/NEA, Paris.

NEA (2016), *Nuclear Energy Data 2016*, OECD/NEA, Paris.

# 7. Oil

## Key data

(2015)

**Crude oil* production:** 0.86 Mt, -39% since 2005

**Crude oil* net import:** 6.52 Mt, +4% since 2005

**Oil products net export:** 3 kt

**Share of oil:** 28.4% of TPES and 0.2% of electricity generation

**Consumption by sector:** 6.9 Mtoe (transport 57.0%, industry 31.4%, commercial and public services, including agriculture and fishing 5.7%, other energy industries 4.6%, residential 0.9%, heat and power generation 0.4%)

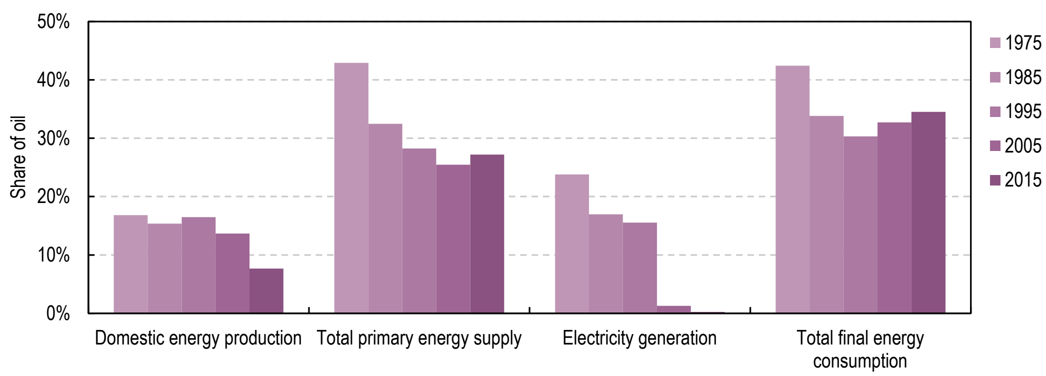
**Exchange rate (2015):** HUF 1 = USD 0.00358 or EUR 0.00323; USD 1= EUR 0.901

**Including natural gas liquids and refinery feedstocks.*

## Overview

Oil is the second-largest primary energy source after natural gas, representing 28.4% of Hungary's total primary energy supply (TPES) in 2015. Oil use has declined since the 1970s, especially in the power sector, but its share in TPES and final consumption increased slightly in the last decade as a result of the falling share of natural gas. Production of crude oil has been on a steady decline since the 1990s and it contributed 11% to total domestic supply in 2015. The remaining crude oil supply is imported, mainly from the Russian Federation (hereafter, "Russia"). By sector, transport is the main consumer of oil and diesel, notably dominant in heavy vehicles.

**Figure 7.1 Oil share in different energy supplies, 1975-2015**



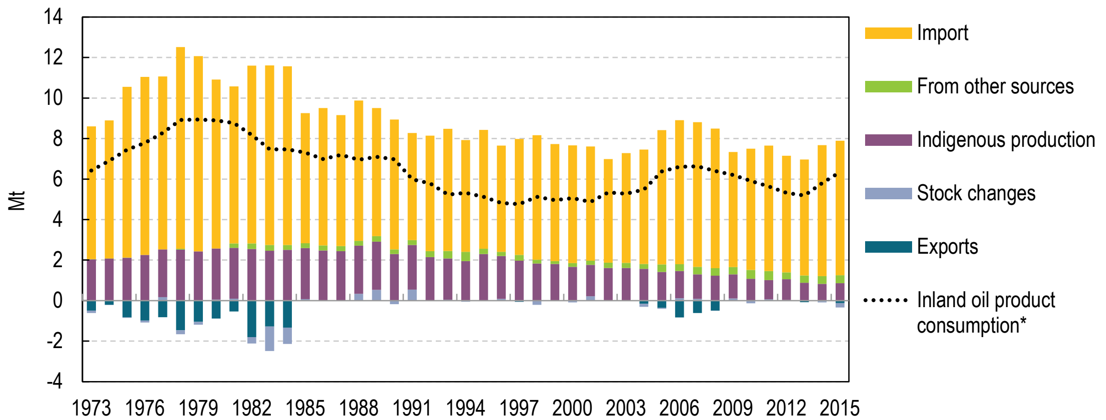

Note: 2015 values are provisional.

Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## Supply and demand

Oil intake in refineries was 7.6 million tonnes (Mt) in 2015, of which domestic production accounted for 0.9 Mt. Production has been declining since peak levels of around 2.5 Mt in the early 1980s. Consumption of oil products has also declined from a peak in 1978 at 11.8 Mt, and has varied between 5.9 Mt and 7.5 Mt in the last two decades. By consuming sector, oil consumption has changed significantly since the early 1990s, but has remained relatively stable in the last decade.

**Figure 7.2 Crude oil supply by source and oil product consumption, 1973-2015**




* Final consumption of all oil products, excluding the use in energy transformation.

Note: Columns include crude oil, natural gas liquids and refinery feedstock.

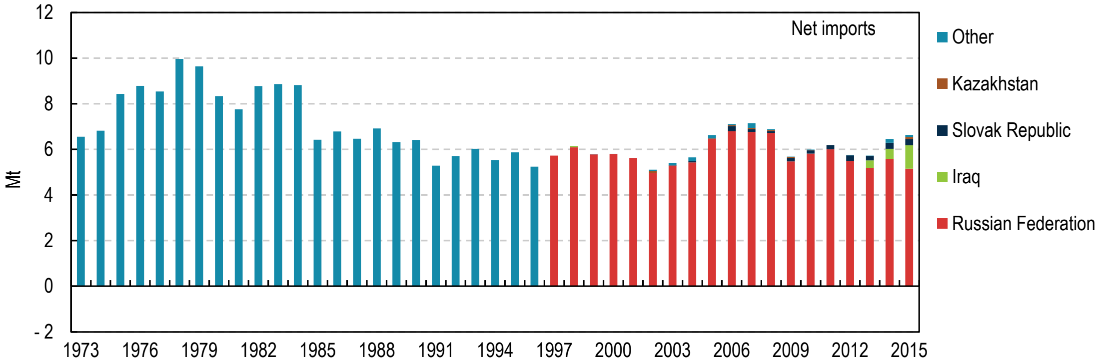
Source: IEA (2016a), *Oil Information 2016*, www.iea.org/statistics/.

### Supply

Hungary is a net importer of crude oil, mainly from Russia, which accounted for 78% of total imports in 2015. The dependence on Russian oil (Russia exports blended crude oil) has been reduced from the 95% Hungary imported in 2012. Iraq is the main alternative, providing 15% of total crude oil imports in 2015, followed by the Slovak Republic at 4%. Over the five-year period 2004-09 Hungary also exported some oil to its neighbour countries such as Croatia, the Slovak Republic and Slovenia. In recent years, however, export volumes have been insignificant.

A number of measures have been introduced to arrest declining domestic production. One example is the development of a tendering system for granting exploration and mining licences for oil and gas in which companies bid on royalty rate and contract fee. This allows further adaptation of exploration projects to market conditions. The country also provides extensive geological and seismic data through online databases of interested parties. A well-educated workforce and an attractive royalty regime are other important factors. The government has also established a reduced royalty rate for unconventional hydrocarbons, reserves of which could support additional production of oil and gas. Three successful bidding rounds have taken place that attracted foreign investors to the sector. Further investment is expected in 2017.

**Figure 7.3 Crude oil net imports by country of origin, 1990-2015**



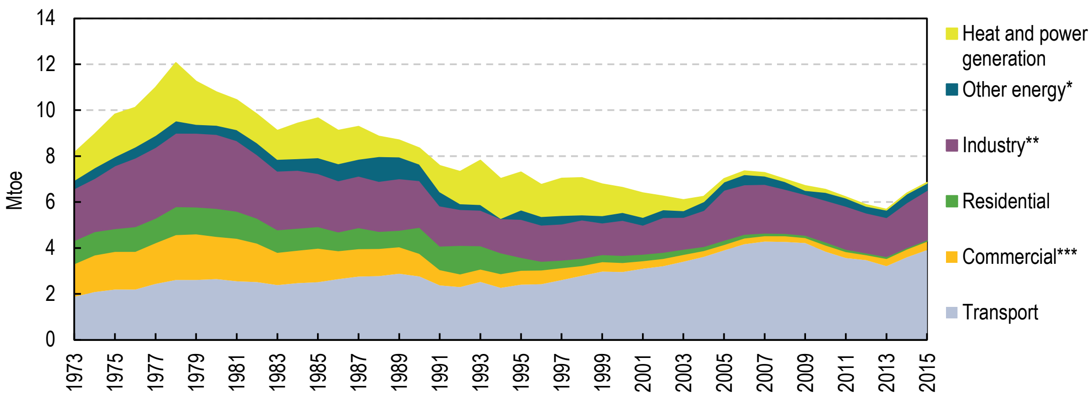

Note: Until 1996, no country-specific import data are available.

Source: IEA (2016a), *Oil Information 2016*, www.iea.org/statistics/.

## Demand

Oil demand averaged 138.7 thousand barrels per day (kb/d) in 2014 and it is expected to remain flat until 2020 at least. Consumption has shifted over a few decades from a mix of sectors towards dominance in the transport and industry sectors. The collective use in transport and industry accounted for 88% of total oil consumption in 2015. Consumption in the transport sector declined by 25% between 2007 and 2013 following the global recession, but recovered to 3.9 Mtoe in 2015, the same level as in 2005. Industry consumption was 2.2 Mtoe in 2015, a slight decline compared to 2005.[1]

**Figure 7.4 Oil consumption by sector, 1973-2015**




**Other energy* includes coke ovens, other refining and energy own-use.

***Industry* includes non-energy use.

****Commercial* includes commercial and public services, agriculture/forestry and fishing.

Note: TPES by consuming sector for crude oil (plus refinery feedstock, natural gas liquids, additives and other hydrocarbons) and oil products.

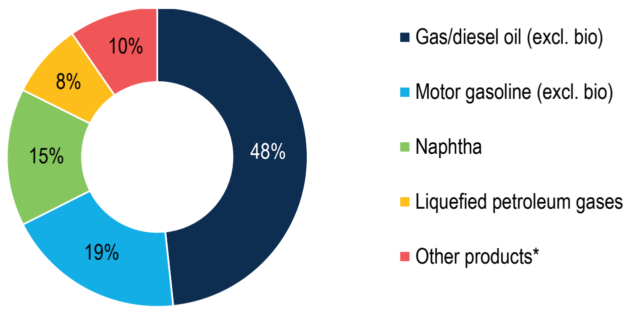
Source: IEA (2017a), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

[1]. The industry consumption here includes oil for non-energy purpose (used as feedstock in industry processes), which accounts for almost two-thirds of industry consumption.

Oil consumption has fallen significantly over the long term in heat and power generation, as well as in the residential and commercial sectors. Heat and power has seen the largest decline both historically and recently, as oil-fired capacity was replaced by gas, with an 80% decrease from 2000 to 2015. The residential sector's oil consumption has fallen by two-thirds over the same period with greater use of district heating and natural gas. The commercial and service sector increased its consumption by 49% from 2005 to 2015, but it still represents only a small share of total oil consumption (Figure 7.4).[2]

Diesel is the most important oil product, accounting for 48% of total final consumption, followed by motor gasoline (19%) and naphtha (15%), which feeds Hungary´s large chemical and petrochemical industry. Over a ten-year period from 2005 to 2015, the profile of oil product demand has changed. Diesel and liquefied petroleum gas (LPG) demand have increased while kerosene and gasoline demand declined.

**Figure 7.5 Oil consumption by product, 2015**




Notes: Oil products in final consumption (not including consumption in energy transformation).
* *Other* includes bitumen, petroleum coke, lubricants, paraffin waxes and fuel oil.
Source: IEA (2016a), *Oil Information 2016*, www.iea.org/statistics/.

## Infrastructure

### Refining

There is one major refinery in Hungary, the Danube Refinery in Százhalombatta, with a capacity of 162 kb/d. There are also two smaller refineries in Tiszaújvaros (60 kb/d) and Zalaegerszeg (10 kb/d) which do not process crude oil at present. All three refineries are owned by the Hungarian Oil and Gas Company (MOL). The Duna refinery is operated as a hub in co-ordination with the MOL-owned 122 kb/d refinery in Bratislava (Slovak Republic) and a significant amount of intermediate products are exchanged between the two. According to the government, the critical minimum supply for the refinery is 77 kb/d, possibly less in a "stop and go" operation mode.

As elsewhere in Europe, the region is struggling with refining overcapacity. The Mediterranean market and Central Europe are oversupplied by refined products (especially LPG, JET, gasoline and to an increasing extent by diesel). As a consequence, in 2014, the Danube refinery ran at a reduced operating rate. The country's refined product output averaged 172.4 kb/d (the output figure is higher than the refinery's capacity as a result of the hub regime with the Bratislava refinery).

[2]. Including agriculture and forestry as the main oil-consuming part of the sector.

## Ports and pipelines

There is no oil port in Hungary, but there is the option to export and import refined products by barge from Komárom and Százhalombatta. A large proportion of product exports from the MOL refineries are transported by barge on the Danube River.

The Southern Friendship (Druzhba) pipeline system, originating in Russia and transiting Belarus and Ukraine, is Hungary's main crude oil supply channel. The section of the older Druzhba I pipeline (built in 1961) between Százhalombatta and Sahy has recently been fully renovated and increased its capacity from 70 kb/d (3.5 Mt/year) to 120 kb/day (6.0 Mt/ear). It enables supplies to Hungary from its northern border with the Slovak Republic. The Druzhba II (built in 1971) has a capacity of 160 kb/d (7.9 Mt/year) and supplies Hungary from its eastern border with Ukraine. The pipeline terminates at the Duna refinery at Százhalombatta (via the Tisza refinery). Domestic oil production is transported via an internal pipeline between Algyő, where oil is produced, and the Százhalombatta refinery.

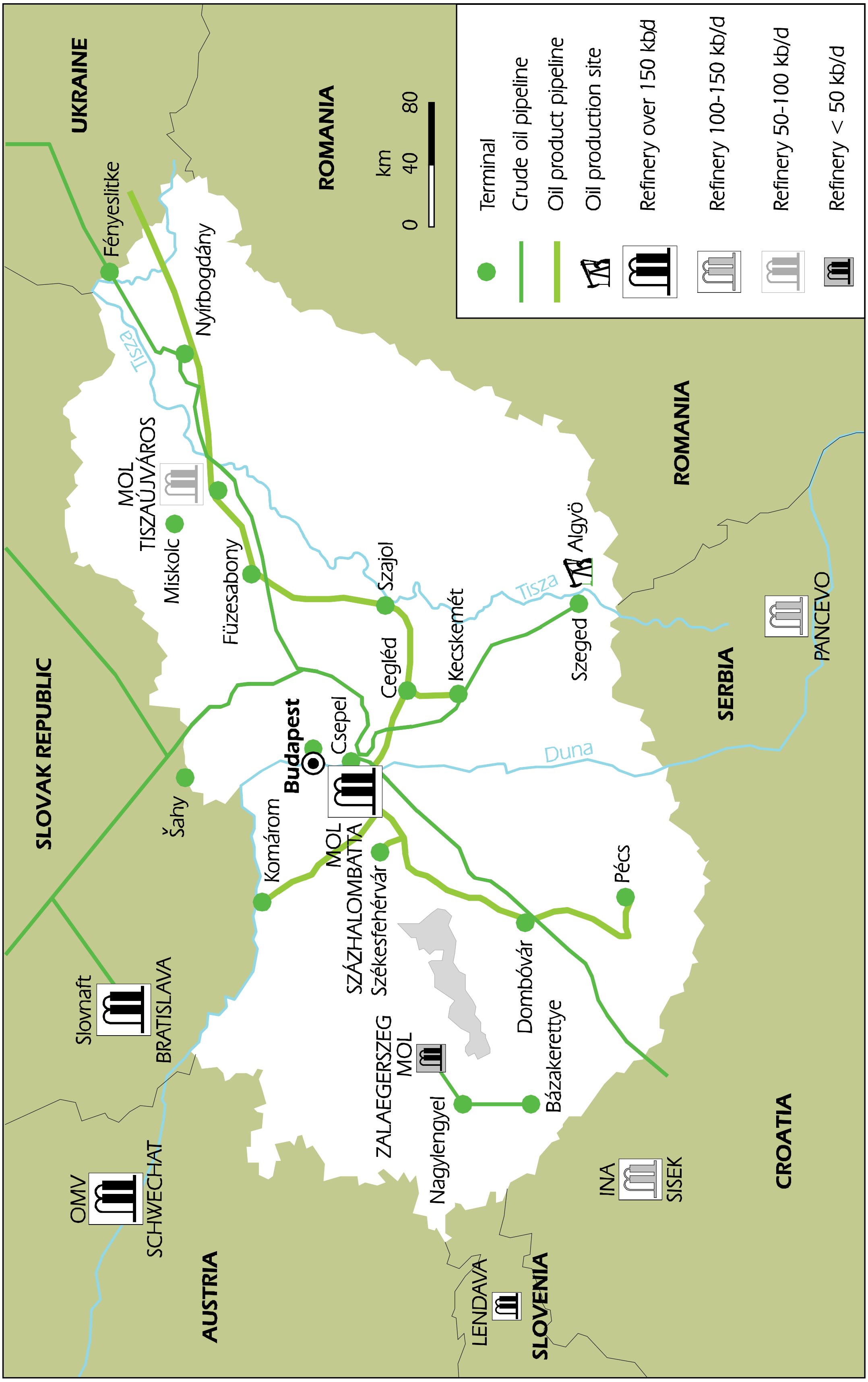
The Adria oil pipeline section between Sisek and Százhalombatta has also undergone recent renovation and increased its capacity from 200 kb/d (10 Mt/yr) to 280 kb/d (14 Mt/yr), roughly equal to the total processing capacity of the Bratislava and Duna refineries combined. This pipeline links the Duna refinery to the Croatian port of Omišalj. This pipeline was originally intended for the delivery of crude oil imports from the Middle East or Africa to Hungary but was mainly used for transporting Russian crude oil in the opposite direction, transiting to the Sisek refinery in Croatia. In recent years, its use for transporting cargoes from Omisalj (the pipeline's original purpose) has increased. MOL estimates that seaborne cargo arrives to the refinery via Adria pipeline between 15 and 20 days after discharge at the port.

Hungary is also linked to the Eastern oil product pipeline that transports product from Russia's refining centres via Ukraine. This enables MOL to purchase gasoil feedstock from Russia for further processing. There is no arrangement in place for purchasing other feedstock.

## Storage

Total storage capacity in Hungary is 3.1 million cubic metres (mcm), or 19.5 million barrels (mb) (2015): 1.1 mcm of this capacity is for crude oil storage and 1.9 mcm for product storage. There are two main operators, MOL and OPAL – the latter being a subsidiary of HUSA, the hydrocarbon stockpiling agency. OPAL operates 0.9 mcm of capacity, or 5.6 mb, at a ratio of 52% product storage to 48% crude. MOL's system has been downsized in recent years; there are now several closed facilities that can be brought back into operation relatively quickly.

## Figure 7.6  Oil infrastructure




This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

## Market structure

The Hungarian wholesale and retail oil markets are fully liberalised. The largest market player in Hungary is MOL, which is an integrated international oil and gas company. The company has also upstream and downstream interests in a number of other countries. It is active in all downstream activities, including refining, pipelines and retail. The wholesale market is dominated by MOL and OMV, the main regional refiners but there are other wholesalers such as Mabanaft and ENI. Importing and exporting refined products is possible by barge from Komárom and Százhalombatta.

Although the Hungarian state owns 24.75% of the company, MOL has a diversified shareholding structure in which other energy companies, banks and domestic and international investors hold stakes in the company. MOL owns three refineries in the country and its competitors are refineries in other countries in the region.

Shell is a major player in the retail market and owns 192 service stations. It is also a large player in the natural gas and petrochemicals sectors. The OMV Group, an Austrian-owned integrated oil company, is the second-largest player in the market and owns 173 service stations in Hungary. There are other wholesalers such as Mabanaft and ENI. There were 1 921 retail stations in June 2016: 862 are independently owned while the remaining 1 059 are owned by the major market participants.

There have been a number of mergers and acquisitions in the retail market over the last five years. For example, in 2014, Normbenz acquired the Lukoil stations in Hungary (and in Slovak Republic), but kept the Lukoil brand. In 2016, MOL acquired all ENI stations in Hungary, which officially became MOL property from 1 August 2016.

### Table 7.1 Ownership of retail stations (excluding independents), 2016

| | |
|---|---|
| ENI Hungária | 175* |
| Normbenz | 74 |
| Mabanaft | 39 |
| MPH Power | 42 |
| MOL | 364 |
| OMV | 173 |
| Shell | 192 |

* Taken over by MOL in August 2016.

Source: Hungary IDR submission to the IEA.

## Road transport

Following a decline in motor fuels consumption between 2009 and 2012, demand has started to grow again along with increased economic activity. The government projects gasoline demand will increase slightly in the near to mid-term, driven by higher levels of real income and a growing vehicle fleet, while diesel use is increasing with economic development. In the first eight months of 2016, gasoline demand increased by 2.7% and diesel demand by 4.2%. In the long run, gasoline use is likely to decrease as a result of energy efficiency improvements, the spread of alternative fuels and greater utilisation of public transport. Higher demand for diesel results from increased use by heavy-duty vehicles where possibilities for fuel substitution are few. These trends will require refineries to increase their flexibility. Domestic production of gasoline and diesel is slightly lower than demand and this imbalance will grow in the future in line with demand.

The Hungarian transport fleet accounted for 3.8 million vehicles at the end of 2015. The fleet structure is changing, with the ratio of gasoline-fuelled vehicles to diesel vehicles has declined from around 70% in 2010 to 63% in 2015. Statistics on new car sales, however, suggest a loss of interest in diesel cars, and sales have dropped from 50% in 2010 to 42% in 2015.

The number of cars per capita is the second-lowest in the European Union, 366 per thousand inhabitants compared to the EU average of 574 per thousand inhabitants but the car fleet in Hungary is outdated and more than half of all passenger cars are over ten-years old (ACEA, 2016). Fostering its renewal with lower-emission vehicles would result in an improvement in urban air quality, in less energy use and in an economic stimulus. Supporting measures implemented by other countries have had an influence on the age composition of passenger cars.

According to the Renewable Energy Directive, Hungary should meet at least 10% of final consumption of energy in transport from renewable sources by 2020. Moreover, the EU Indirect Land Use Directive limits to 7%, the contribution from biofuels and bio-liquids produced from cereal and other starch-rich crops, sugars and oil crops (first generation biofuels).[3] The legislation currently in place sets a mandatory blending of 4.9% in gasoline and diesel, although operators may comply with it as a pool with different ratios for each product as long as such threshold is achieved in the total energy generated from gasoline and diesel. Although the 2020 deadline is getting closer, it is not yet clear how the 10% target is to be achieved and how the challenges arising from the newly introduced 7% limit to first-generation biofuels are to be faced.

## Emergency preparedness

### Oil emergency response policy and emergency organisation

The use of publicly held stocks is central to Hungary's emergency response policy for both oil and gas. The Hungarian Hydrocarbon Stockpiling Association (HUSA) is entrusted with the public stockpiling of both oil and gas. HUSA was founded, and is operated and financed, by the oil and gas industry and is an independent non-profit company. It is financed by compulsory membership levies paid by its member companies. The government has special control rights over HUSA. Its public oil stocks are the equivalent of 105 days of net imports (in September 2016). When counted together with industry stocks, Hungary has total stock levels standing at 176 days, well beyond the IEA minimum stockholding obligation of 90 days of net imports. In an IEA co-ordinated response to a supply disruption, Hungary would respond with the release of

[3]. Directive (EU) 2015/1513 of the European Parliament and of the Council of 9 September 2015 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources.

public stocks. HUSA regularly conducts inspections of the operation of storage companies and facilities.

Act No. 23/2013 on the obligatory stockholding of imported oil and petroleum products forms the basis of the Hungarian oil emergency response policy. It outlines the requirements for HUSA and sets statutory powers for the Ministry of National Development to release stocks and order demand restraint measures by ministerial decree. The National Emergency Strategy Organisation (NESO) is chaired by the minister responsible for energy (i.e. the Minister of National Development) and its secretariat is staffed by ministry staff.

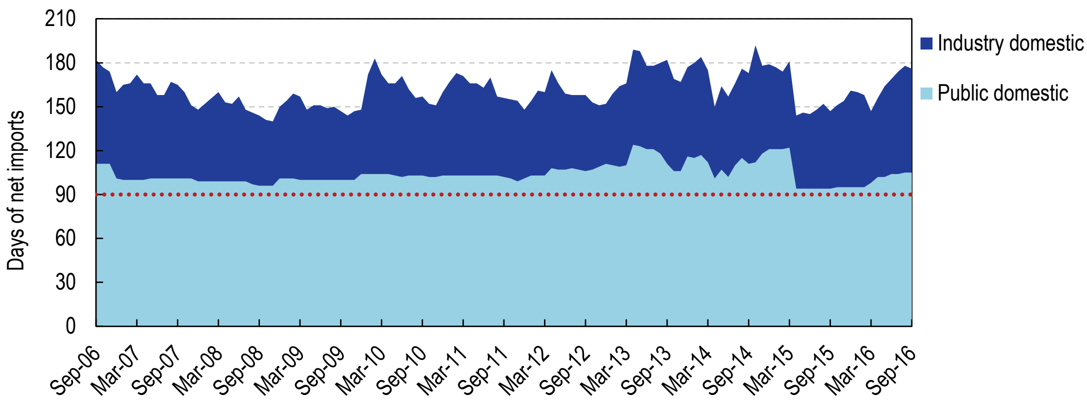
### *Emergency oil reserves*

In September 2016, Hungary held 17.8 million barrels of emergency stocks. Emergency reserves were composed of 52% refined products and 48% crude oil. All stocks were held within the country and were equal to 176 days of net imports (105 days held by the public and 71 days by industry).

Hungary does not impose a stockholding obligation on industry. All public emergency reserves are held by the stockholding agency HUSA, which is responsible for meeting the country's international obligations. At the end of September 2016, the composition of HUSA's stocks was: 4.5 mb of crude, 3.8 mb of middle distillates and 1.9 mb of motor gasoline.

All emergency stocks must be held in Hungary and must be available for withdrawal within 48 hours. All public emergency stocks are stored in separate depots owned or rented by HUSA, which has an online information system linked to the storage facilities. Stocks are not to be held under ticket contracts, but legislation enables cross-border stockholding on the basis of bilateral contracts. The Minister of National Economy is responsible for authorising the contracts. Hungary holds ticketed and physical stocks for several European Union member states and 2.3 mb of stocks for other countries under bilateral agreements, mostly as tickets (70%).

**Figure 7.7 Days of Hungary's net imports (September 2006–September 2016)**




Source: IEA (2016b), *Monthly Oil Statistics* (September 2016), www.iea.org/statistics/.

In the event of a supply disruption, the drawdown of stocks is ordered by the minister, on the basis of consultations with NESO members. As HUSA is a member of NESO, the drawdown process can be started immediately. After a declaration of an oil supply disruption, HUSA member companies have 48 hours to communicate their quota (i.e. the amount they have the right to purchase from the stockdraw), after which they lose their preferential access. The minister then has the right to choose how to allocate any unclaimed stocks, either by awarding pre-emptive purchase rights to selected consumers or by asking HUSA to call for tenders from its member companies.

The purchase price for the released stocks would be based on the market price with a premium and the law stipulates that it must be higher than the original acquisition price of the stocks. Physical deliveries are possible within 48 to 72 hours following a stockdraw decision.

### Oil demand restraint and other oil emergency response measures

Hungary has never resorted to demand restraint measures. The primary emergency measure considered by the government is a stockdraw. In the event of a crisis, however, the minister may take steps to restrict consumption in a decree issued jointly with the other ministers concerned in the regulation. Since 1979, Hungary has had rules and legislation giving the minister responsible for energy wide-ranging authority to impose demand restraint measures. If necessary, a parliamentary decision can also be prepared on NESO's behalf. Hungary distinguishes three levels of demand restraint: light-handed, medium-handed and heavy-handed measures.

The light-handed measures can be executed within a few days and would result in a 2% to 4% reduction in consumption. The medium-handed measures would take one to two weeks to implement and would result in a 4% to 8% reduction in consumption (including the aforementioned light-handed measures). The impact of the heavy-handed measures has not been quantified. As experience from the 2009 natural gas disruption shows, the government expects a good response from the population in a serious crisis.

There is very little potential for surging oil production in Hungary and no other possible measures such as fuel switching. By law, all power plants of 50 megawatts (MW) or more must organise a fuel stockpile of at least eight days of their consumption and an additional eight days of emergency stocks. Oil-fired electricity generating capacity in Hungary is close to zero at present.

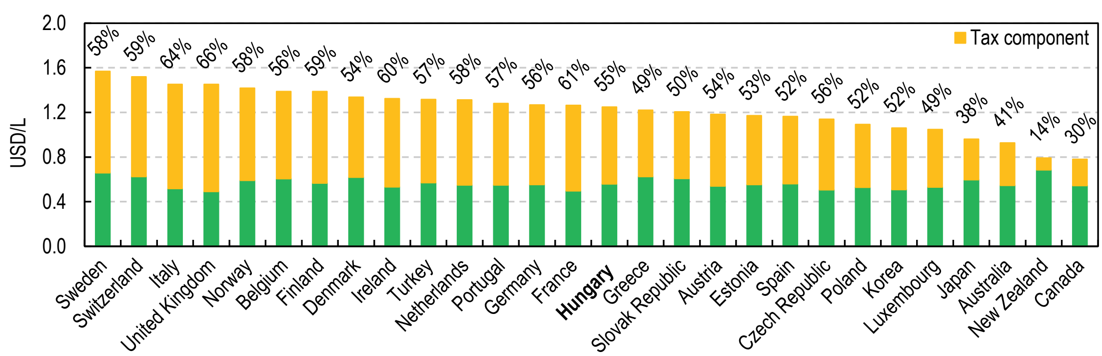
## Prices and taxes

Prices for diesel and gasoline are generally comparable to the prices in neighbouring countries. In Hungary they are slightly above prices in the Czech Republic and Poland, but below those in the Slovak Republic.

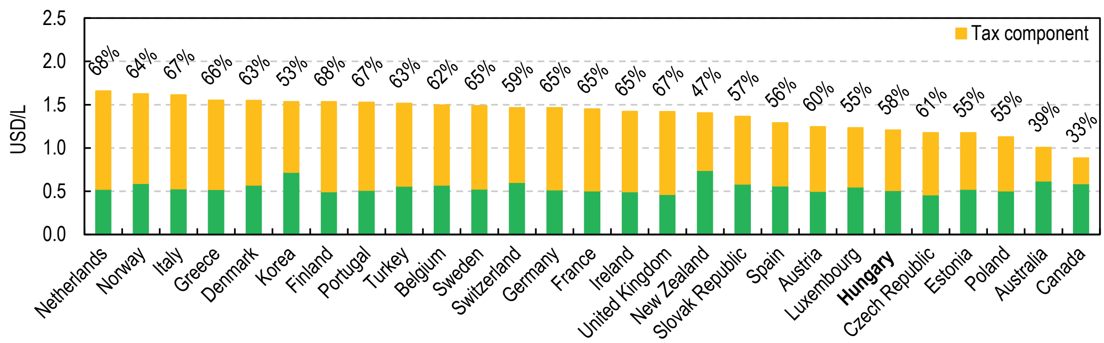
The market for petroleum products has been liberalised. Hungarian wholesale and retail oil products' prices are determined by global market fundamentals and expectations. The impact of government is marginal exercised by means of the level of excise duty, value-added tax and regulation of alternative fuels. As taxes and duties contribute to a large part in the end-user price, any change in their level has a significant effect. A new excise tax regulation for low crude quotation came into effect on 1 September 2016. It introduced an automatic excise tax increase if the price of crude oil drops below USD 50 per billion barrels (bbl) during a defined period. When the price exceeds USD 50, the excise duty will adjust automatically. The diesel tax rate for commercial purposes is determined at a minimum level, in conformity with the EU Energy Taxation Directive (2003/96/EC).

**Figure 7.8 Fuel prices in IEA member countries, fourth quarter 2016**

*Automotive diesel*




*Premium unleaded gasoline (95 RON)*




Note: Data not available for gasoline prices in Japan.
Source: IEA (2017b), *Energy Prices and Taxes*, OECD/IEA, Paris.

## Assessment

Oil´s share in TPES is second in importance to natural gas, representing 28.4%, the share of TPES being progressively declining since the 1970s. Oil demand averaged 138.7 kb/d in 2014 and is expected to remain flat until 2020 at least. By sector, transport is the main consumer of oil (56.7%), followed by industry (29.8%), transformation/energy (11%) and commercial/agriculture/other (6.2%).

Hungary is a net importer of crude oil mainly from Russia (approximately 82% in 2015), but its dependence dropped from 100% in 2012, when the country started importing from other sources, Iraq being the main alternative to date. Despite being a landlocked country without an oil port, Hungary has extensive supply infrastructure owing to the Druzhba/Friendship pipeline system from the east and the Adria pipeline from the Adriatic Coast to the south. The first one channels Russian crude oil to Hungary from its northern border with the Slovak Republic and eastern border with Ukraine via the Druzhba/Friendship II branch, while the recently upgraded old Druzhba/Friendship I branch now serves to connect the Hungarian and Slovak transmission systems, as well as MOL's Százhalombatta and Bratislava refineries.

The recent renovation of the Adria pipeline from the Omisaj port terminal in Croatia has allowed new oil sources to enter Hungary, largely from Iraq. An Inter-Governmental Agreement was signed with Croatia in 2011 regulating access to unutilised capacities in the event of a disruption but some legal modifications remain outstanding on the Croatian side. These matters should be resolved as soon as possible. A third means of importation is the Eastern product pipeline, which enables MOL to purchase gasoil from Russia for use as feedstock for further processing.

Domestic oil production is in decline but satisfies about 10% of demand at present. Steps have been taken to arrest this trend, however, such as the development of a tendering system for granting exploration and mining licences for oil and gas in which companies bid on royalty rate and contract fee, as well as production optimisation by MOL, the major producer. In 2015 MOL stopped and reversed the production decline at its Hungarian oilfields. This allows further adaptation of exploration projects to market conditions. The country also provides extensive geological and seismic data to interested parties. In this regard, a project to switch this information to modern and common international formats online is welcome. A well-educated workforce and an attractive royalty regime are other important influencing factors. Moreover, the government has established a reduced royalty for unconventional hydrocarbons, whose reserves could support additional production of oil and gas. Three successful bidding rounds have taken place and attracted new foreign players to the national arena while a fourth one is expected to commence shortly.

Following the global economic crisis, the profile of oil product demand changed: diesel and kerosene demand increased while LPG and gasoline demand declined. Diesel is the most important oil product accounting for 45% of sales, followed by motor gasoline (18% of demand), while naphtha is third (17%), which feeds Hungary´s large chemical and petrochemical industry. Almost no gasoil is used for heating purposes.

The ratio of gasoline and gasoil sales has switched from around 1:1-1:1.5 to 1:2 during the period since the last in-depth review: an increase in demand for diesel in the heavy-goods vehicle (HGV) sector is a key factor. The excise duty for diesel is lower than for gasoline in Hungary (HUF 120/litre for petrol, HUF 110/litre for diesel). A new law has introduced a quarterly variable amount to this excise tax amounting to HUF 10/litre for diesel and HUF 5.0/litre for gasoline, whenever the crude oil price is below USD 50/bbl. In view of the evolution of crude oil prices, it is unlikely that such modification of the excise tax will have an impact in the dieselisation process under way. The main purpose of this measure is to balance out potential effects of extremely low oil prices.

The number of cars per capita is the second-lowest in the European Union, 366 per thousand inhabitants, compared to the EU average of 574 per thousand inhabitants but this car fleet is outdated, more than half of the passenger cars are over 10 years old. Fostering its renewal with lower-emission cars would mean a significant improvement in the air quality of cities, more energy efficiency and an economic stimulus. The introduction of incentive mechanisms has had an influence on the age composition of the passenger car fleet in other countries. Hungary should also consider the introduction of measures such as a vehicle scrappage payment. The government has also adopted the Jedlik Ányos Plan in order to promote the expansion of electro-mobility with different economic and regulatory incentives.

According to the EU Renewable Energy Directive, Hungary should meet at least 10% of the final consumption of energy in transport from renewable sources by 2020. Moreover, the EU Indirect Land Use Directive limits to 7% the contribution from biofuels and bio-liquids produced from cereal and other starch-rich crops, sugars and oil crops (first-generation biofuels). The legislation currently in place sets a mandatory blending of 4.9% in gasoline and diesel, although operators may comply with it as a pool with different ratios for each product as long as such threshold is achieved in the total energy generated from gasoline and diesel. Although the 2020 deadline is getting closer, it is not yet clear how the 10% target is to be achieved and how the challenges arising from the newly introduced 7% limit to first-generation biofuels are to be faced.

The MOL Group is the largest player in the Hungarian oil market. It has operations all along the value chain, from upstream to downstream (refining and petrochemicals). Although the Hungarian state owns 25% of the company, it has a diversified shareholding structure in which other energy companies, banks and domestic and international investors participate. MOL has three refineries in Hungary, Duna (Danube), Tisza and Zala, although only Duna is fully operational while the other two are utilised as logistic hubs with some production of methyl tertiary butyl ether (MTBE) and bitumen. The Duna refinery is operated in co-ordination with MOL Group's other refinery in Bratislava in order to optimise their combined output. As in the entire European refining sector, the region is struggling with refining overcapacities.

There are numerous players in the retail market in Hungary; MOL is the largest one with 539 service stations thanks to the purchase of the ENI network, followed by international oil companies such as Shell (192) and OMV (173). In total, the main market players account for 1 059 branded service stations. Approximately 860 independent filling stations are also present in the market. The wholesale market is dominated by MOL and OMV, the main regional refiners, but there are other wholesalers such as Mabanaft and ENI. Importing and exporting refined products is possible by barge from Komárom and Százhalombatta. The total storage capacity in Hungary was 3.1 mcm in 2015 and there is around 1 350 km of domestic product pipelines to supply the main depots at Székesfehérvár, Pécs, Komárom, Szajol and Tiszaújváros.

Hungary is consistently compliant with the IEA and the EU emergency oil stock requirements. HUSA, the country´s stockholding agency, is responsible for meeting all its international obligations as no obligation is imposed on industry. Emergency reserves are composed of 48% crude and 52% refined products (diesel and gasoline only) and stored in dedicated tanks in commercial depots, some of them owned by OPAL, a HUSA subsidiary.

## Recommendations

***The government of Hungary should:***

- ☐ Introduce measures, such as environmental taxes or a well-designed vehicle scrappage scheme, to encourage the renewal of the car and light- and heavy-duty vehicle fleet, with a particular focus on the removal of older, less-efficient vehicles.

- Clarify its policy on biofuels to enable Hungary to comply with its 2020 target and to give market participants time to take their business decisions.
- Maintain its rigorous and consistent emergency stockholding regime.

## References

ACEA (European Automobile Manufacturers' Association) (2016), *Automobile Industry Pocket Guide 2016/2017*, ACEA, Brussels.

IEA (International Energy Agency) (2017a), *Energy Balances of OECD Countries 2016*, OECD/IEA, Paris.

IEA (2017b), *Energy Prices and Taxes*, OECD/IEA, Paris, www.iea.org/statistics/.

IEA (2016a), *Oil Information 2016*, OECD/IEA, Paris, www.iea.org/statistics/.

IEA (2016b), *Monthly Oil Statistics (September),* OECD/IEA, Paris.

# 8. Natural gas

## Key data
(2015)

**Natural gas production:** 1.8 bcm, -41% since 2005

**Natural gas imports and exports:** 6.8 bcm imported, 0.5 bcm exported

**Share of natural gas:** 29.7% of TPES and 16.8% of electricity generation

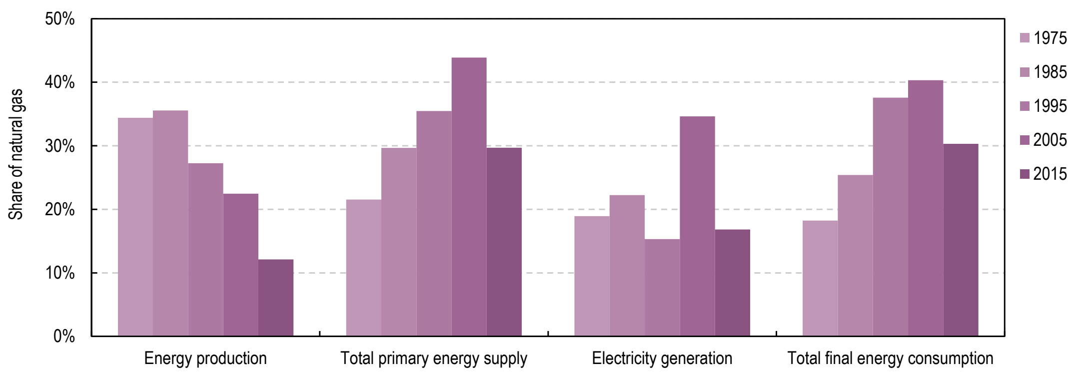
**Consumption by sector:** 7.5 Mtoe (residential 34.0%, industry 21.9%, heat and power generation 21.2%, commercial and public services, including agriculture and fishing 17.8%, other energy industries 4.7%, transport 0.4%)

**Exchange rate (2015):** HUF 1 = USD 0.00358 or EUR 0.00323; USD 1= EUR 0.901

## Overview

Natural gas is the largest primary energy source in Hungary, accounting for just less than one-third of both total supply and final consumption, although consumption has declined since 2005, notably in electricity generation. Domestic natural gas production has fallen steadily for three decades, from its peak of 7.5 billion cubic metres (bcm) in 1985 to current levels of less than 2 bcm per year. Domestic production meets around one-fifth of total consumption and most of the remainder is imported from the Russian Federation (hereafter, "Russia"). Natural gas networks reach a large part of the population and the residential sector is the largest consumer, accounting for one-third of total natural gas demand, mainly used for heating. Consumption has fallen in recent years in most sectors, including the residential sector, despite price interventions that have significantly lowered the natural gas price for households.

**Figure 8.1 Natural gas share in different energy supplies, 1975-2015.**




Note: 2015 values are estimates.

Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

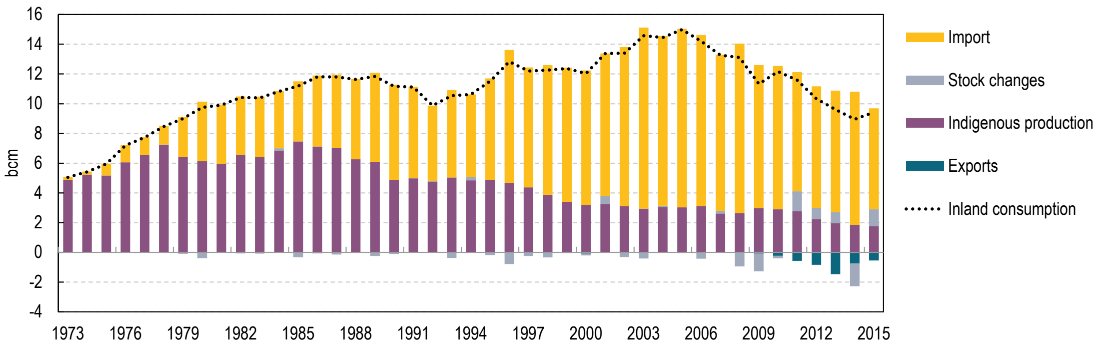
## Supply and demand

### Supply

Natural gas provided 7.5 million tonnes of oil-equivalent (Mtoe) or 9.0 bcm of Hungary's energy supply in 2015, equal to a share of 31% of TPES. This represents a decline of 39% from 2005, when natural gas supply peaked at 12.1 Mtoe or 15 bcm (IEA, 2017). The Hungarian forecasts this level to stagnate or slightly decrease over the next ten years. The realistic expectation is that players in the natural gas market have to be content with a total market of less than 10 bcm after 2020 and, in certain warmer years, the expected annual natural gas demand will be around 9 bcm, while the total end-user market is expected to amount to around 8.5 bcm.

Hungary has gone from being close to entirely self-sufficient in natural gas to becoming heavily import-dependent. Production decreased by 41% between 2005 and 2015, while production as a share of total consumption remained at around 20% to 25%, as total consumption also declined (see Figure 8.2). Natural gas production is projected to decrease further: from 1.8 bcm in 2015 to approximately 1 bcm in 2020.

**Figure 8.2 Natural gas supply by source and inland consumption, 1973-2015**

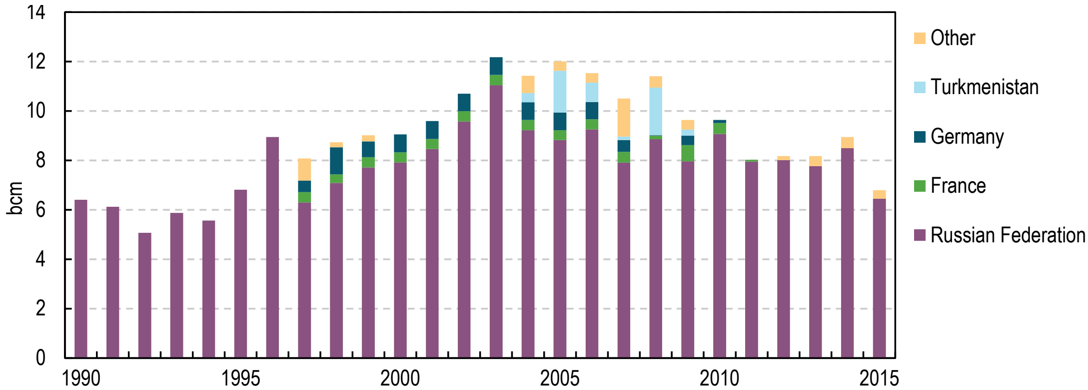



Note: 2015 values are provisional.

Source: IEA (2016a), *Natural Gas Information 2016*, www.iea.org/statistics/.

From the mid-1990s, a long-term gas supply contract with Russia, concluded in 1995 for a period of 20 years, played an important role in Hungary's security of gas supply. Currently, the long-term contract concluded between Panrusgas Gas Trading Plc and Hungarian Gas Trade Ltd belongs to the power company MVM Group. Import dependence is high, and 95% of total imports in 2015 came from Russia (see Figure 8.3). To improve diversity and security of supply Hungary has increased its gas interconnections with neighbouring countries. Imports from Russia will, however, continue to dominate in the short term following the extension of the long-term contract between the two countries until 2019. In the medium term, however, NES 2030 contains a number of proposals to diversify supply such as utilisation of the Slovak Republic-Hungary interconnector to access the German market or using the European pipeline network to access liquefied natural gas (LNG).

**Figure 8.3 Natural gas imports by country, 1990-2015**




Note: 2015 values are estimates.

Source: IEA (2016a), *Natural Gas Information 2016*, www.iea.org/statistics/.

### *Transit*

Hungary plays an important role in supporting natural gas market integration in Central Europe. The process of further diversifying supply sources and routes and expanding Hungary's role as a transit country includes the development of reverse flows on the Hungarian-Croatian border (which requires further infrastructure development on the Croatian side), effective reverse flow on the Hungarian-Romanian interconnector (which is under preparation and requires some construction on both the Hungarian and the Romanian sides), as well as future consideration of capacity upgrades for existing interconnectors.

The cross-border connection between Hungary and Romania was completed in 2010 and the first one with Croatia has been in operation since the beginning of 2011. Hungary has provided reverse-flow gas to Ukraine since April 2013. In May 2015, Hungary together with Bulgaria, Slovak Republic and Romania signed a co-operation agreement to connect gas transmission networks and make them suitable for the reverse-flow supplies. The Hungary-Slovak Republic gas interconnector is operational since July 2015.

Diversification options and necessary infrastructure development for the region are being discussed in the framework of the Central and South East Europe Gas Connectivity (CESEC) High-Level Group as well. Hungary takes an active part in the work of CESEC. At the margins of the September 2016 CESEC ministerial meeting hosted in Budapest, Hungary signed a joint statement together with Greece, Bulgaria and Romania on the realisation of the vertical corridor which aims to create a link between the southern gas corridor and Central and Eastern European countries by completing missing links and connecting existing pipelines in the four countries.

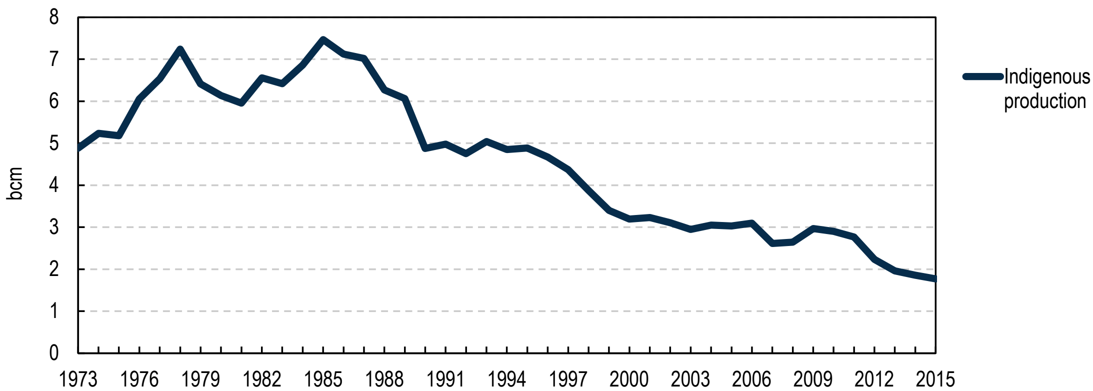
Transit volumes were 1.85 bcm in 2015. Transit is carried out from Ukraine towards Serbia and gas is delivered at the Hungarian-Serbian interconnection point at Kiskundorozsma. Serbia currently receives gas from Russia, with very low domestic production, and transit is via Ukraine and Hungary.

### *Production and reserves*

Hungary's natural gas production reached its peak in the 1970s and 1980s. Since then, production has been in continuous decline but it is still capable of satisfying 20% to 25% of domestic natural gas demand. In the mid-1990s, natural gas production exceeded 5 bcm but by 2015 it was less than 1.8 bcm. According to FGSZ, the natural gas transmission system operator, and estimates of producers, this amount will continue to decline and net domestic production is expected to fall below 1 bcm by 2020.

The Hungarian Office for Mining and Geology estimated the country's recoverable resources of natural gas at 1 639 bcm (74 bcm conventional gas and 1 565 bcm unconventional gas) in 2015. Several companies have shown an interest in the exploration of unconventional gas resources but, at current gas retail prices, the potential for economically viable extraction seems low.

**Figure 8.4 Natural gas production, 1973-2015**




Source: Ministry of National Development.

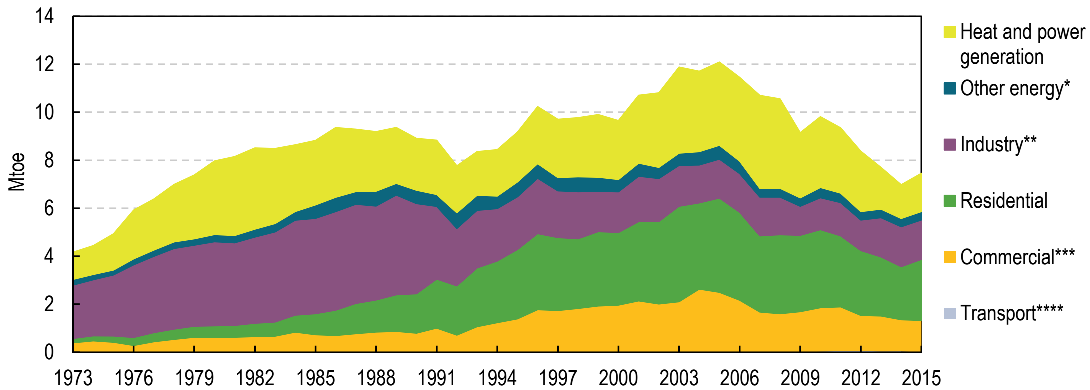
## Demand

Natural gas consumption has gone through several transitions, from being an industry feedstock and fuel in the 1970s and 1980s to mainly supplying heat and power production and residential sectors from the 1990s. In recent years, demand has declined in both heat and power generation and in the residential sectors, while industrial demand has recovered slightly. The overall trend, however, is a significant decline in natural gas consumption over the last decade.

The residential sector is the largest user, accounting for one-third of total demand in 2014 (consumption has declined by 37% in the decade from 2004). The downward trend can be explained by a combination of more energy-efficient buildings and a series of mild winters in recent years. Nonetheless, natural gas remains the most important energy source for households and it meets over half the total energy demand in the sector. Low household prices, which are determined by government, and gas infrastructure that reaches a large part of the country, contribute to the strong position of natural gas in the sector.

Industry sector consumption fell rapidly in the 1990s, but demand has recovered recently, increasing by 43% between 2009 and 2014. The three largest gas-consuming industry sectors (food and tobacco, chemicals and petrochemicals, and non-metallic minerals) account for over half total industry demand.

**Figure 8.5 Natural gas demand by sector, 1973-2014**




* *Other energy* includes coke ovens, other refining and energy own-use.

** *Industry* includes non-energy use.

*** *Commercial* includes commercial and public services, agriculture/forestry and fishing.

**** *Transport* share is negligible.

Note: TPES by consuming sector.

Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

Natural gas consumed in heat and power production decreased by 54% between 2005 and 2015. The share of natural gas in electricity generation was 17% in 2015, a significant drop from 38% in 2008, when it was the largest source of power production. The main reason behind the stagnating gas consumption is considered to be high gas prices combined with low electricity import prices which have resulted in the mothballing of gas-fired power plants. Gas-fired power plants provide more flexibility compared to nuclear and coal power plants, which are the other main power sources in Hungary. Natural gas is also the main energy source used in district heating, accounting for 69% of total heat production in 2015. The commercial sector, including agriculture, consumes 18% of total demand. Natural gas accounts for almost half the total energy supply in the commercial and public service sector. An overall decline in energy consumption in these sectors has led to a 38% drop in natural gas consumption from 2005 to 2015. Agriculture represents a minor share (1.5%) of total natural gas demand.

## Infrastructure

### Transmission

The gas transmission network consists of 5 873 kilometres (km) of high-pressure pipelines, seven compressor stations and around 400 gas delivery points. It delivers gas to regional gas distribution companies, power plants and large industrial consumers. There are five cross-border entry points: at Beregdaróc (UA>HU), Mosonmagyaróvár (AT>HU), Drávaszerdahely (CR-HU), Balassagyarmat (SK-HU) and Csanádpalota (RO-HU), and two transmission systems: the FGSZ Ltd System and the Hungarian Gas Transit Ltd (MGT) system.

FGSZ, owned by MOL and the holder of a transmission system operator licence is responsible for the operation of the natural gas system and the transmission network. FGSZ operates according to the independent transmission operator (ITO) model, which ensures compliance with the unbundling-related requirements of the European Union. The main principle of the model is that a company, if it is part a vertically integrated group of companies and is also engaged in transmission operations, it must separate this activity from production and commercial activities within the company group. Within the framework of the ITO model, FGSZ operates independently from both the parent and its subsidiary companies. MGT, Hungarian Gas Transit Ltd, is owned by the Hungarian government, is represented by the Ministry of Interior. It operates the Slovak Republic-Hungary interconnector gas pipeline transit system under the ownership-unbundling model. Its request for certification was submitted to the regulatory authority HEA in 2014. The HEA carried out the certification process and formally submitted the draft resolution on its decision, in accordance with the relevant EU legislation, to the European Commission on 22 December 2014, and in March 2015 a final decision on certification was issued.

## Ten-year network development plans

Within the European Network of Transmission System Operators for Gas (ENTSO-G), European TSOs co-operate on the development of EU-wide grid planning, by means of EU-wide ten-year network development plans (TYNDP), regional investment plans and national ten-year network development plans.[1] The principal aim of the TYNDP is to provide a consistent view of the pan-European gas infrastructure and signal potential gaps in future investment. In March 2015, ENTSO-G published the fourth edition of the EU-wide TYNDP (TYNDP 2015) covering the 2015-35 period.

TYNDP 2015 also plays a central role in the process of selecting projects of common interest (PCIs). These have been defined as projects that help create an integrated EU energy market and strengthen security of supply. The European Commission has drawn up a list of 248 PCIs. These projects may benefit from accelerated licensing procedures, improved regulatory conditions, and access to financial support totalling EUR 5.35 billion from the Connecting Europe Facility (CEF) between 2014 and 2020. The second list of PCIs was published in November 2015 in Commission Delegated Regulation (EU) 2016/89. The new list contains the following national projects:

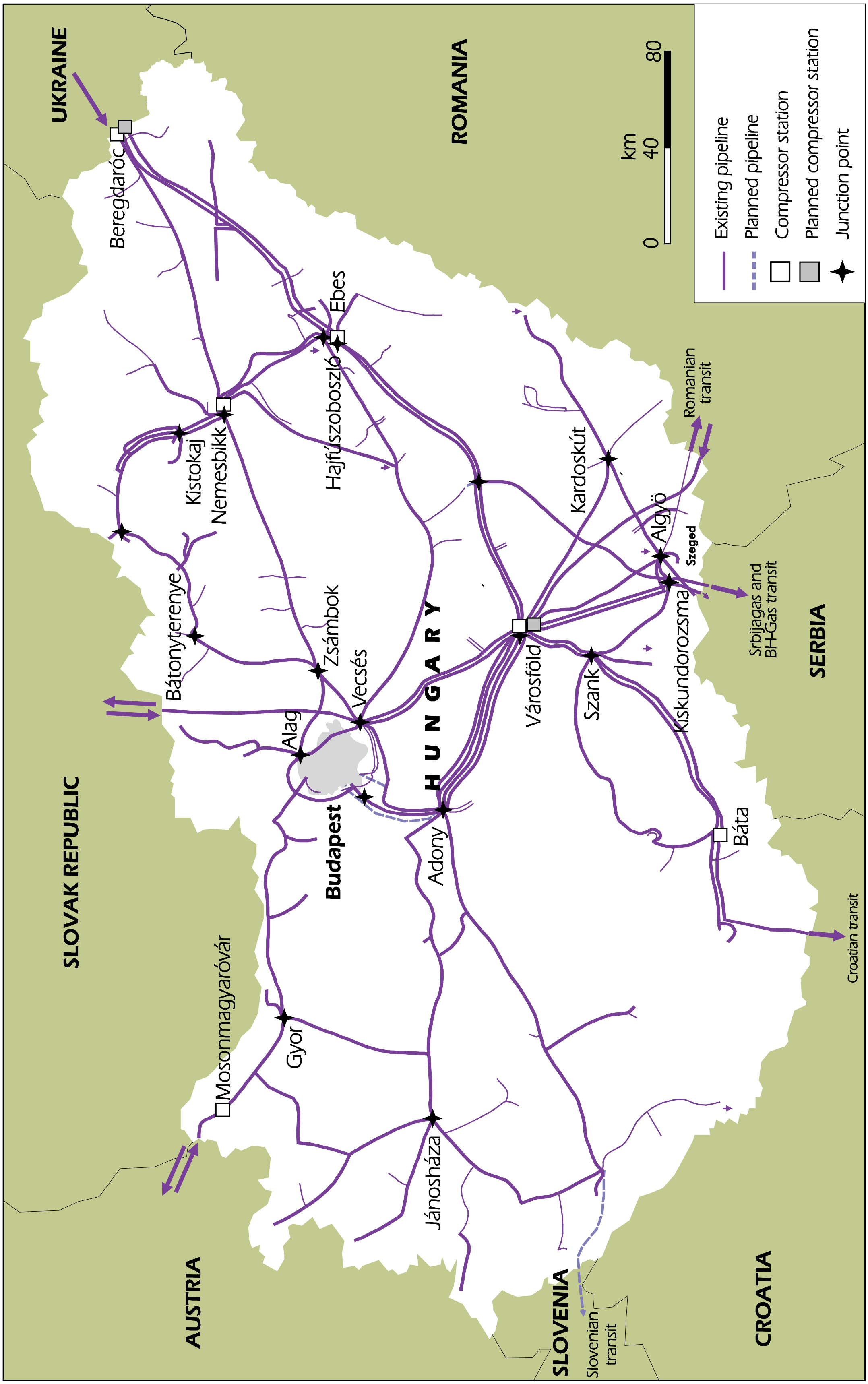
- Hungary-Slovenia interconnection
- Cluster-phased capacity increase on the Bulgaria-Romania-Hungary-Austria bidirectional transmission corridor (currently known as ROHUAT/BRUA) to enable 1.75 bcm/year in the first phase and 4.4 bcm/year in the second phase, including new resources from the Black Sea
- Infrastructure to bring new gas to the Central and South-Eastern European region with the aim of diversification (e.g. Eastring).

One Croatian PCI project, Krk LNG terminal and evacuation pipelines towards Hungary and beyond, is also important from Hungary's point of view.

The transmission operator FGSZ submitted its national ten-year network development plan to the HEA in December 2014 which was partly approved the plan or some provisions were conditionally approved in a decision dated 9 November 2015. The latest version of the national ten-year network development plan was submitted by FGSZ to HEA for approval in December 2016.

[1]. The role of ENTSO-G is to facilitate and enhance co-operation between national gas transmission system operators across Europe in order to ensure the development of a pan-European transmission system in line with European Union energy goals.

## Figure 8.6 Natural gas infrastructure




This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

### *Recent investments*

Following pipeline developments carried out in 2010 by FGSZ, import diversification possibilities increased, thereby improving security of supply. The pipelines to Romania, Croatia and Slovak Republic not only enabled gas trade to the neighbouring countries but are also part of the north-south gas corridor, which is considered a priority project by the European Commission since 2011. The concept of North-South gas interconnections in Central Eastern and South Eastern Europe aim at developing gas infrastructure for regional connections between and within the Baltic Sea region, the Adriatic and Aegean Seas, the Eastern Mediterranean Sea and the Black Sea, and for enhancing diversification and security of gas supply.

The most recent development, the Slovak Republic-Hungary cross-border pipeline with bi-directional gas flow, operated by MGT, started commercial operation in 2015. The Slovak Republic-Hungary interconnection is a bidirectional pipeline. Its capacity in the import direction is 12 mcm/day, while in the export direction it is 4.8 mcm/day.

Article 7 of EU Regulation 994/2010/EU concerning measures to safeguard security of gas supply stipulates the obligation to create bidirectional capacity for all cross-border natural gas pipelines within the European Union. The Austrian-Hungarian interconnector (HAG) pipeline, similarly to the Croatian-Hungarian interconnector, was constructed by Hungary with the original aim of enabling bi-directional flows. At the moment, transmission takes place from Austria to Hungary on the HAG pipeline. On the Croatian-Hungarian interconnector, transmission currently takes place from Hungary to Croatia: physical bidirectional gas flows on the pipeline, and consequently imports in the direction of Hungary, are not possible because of missing infrastructure on the Croatian side. Therefore, further infrastructure developments are necessary in order to enable effective bidirectional gas flows at these two interconnection points. These developments are planned to take place in the coming years.

Developments required to enable bidirectional transmission on the Romanian-Hungarian interconnector (construction of a compressor station) are being carried out by the Romanian TSO, Transgaz.

**Table 8.1 Maximum technical capacity of the natural gas system (mcm/day)**

| | |
|---|---|
| Domestic production | 7.8 |
| Import HAG (West) | 14.4 |
| Import Beregdaróc (East) | 71.3 |
| Import Csanádpalota (South East) | 4.8 |
| Import Drávaszerdahely (South West) | 19.2 |
| Import Balassagyarmat (North) | 12.0 |

Source: Ministry of National Development, Hungary IDR submission to the IEA.

### *Network access and tariffs*

Fees payable for regulated natural gas transmission services (basic services) are defined by the HEA. Besides the basic services, the TSO provides additional services (such as the supply of data) of which terms and conditions are described in the TSO's network code. These latter services are also defined in HEA's regulations. A capacity fee is paid after capacity is booked at entry and exit points. Volume fee and odourisation fees (payable only when odourised gas is delivered at the exit point), must be paid after the delivery of natural gas at the exit point.

The interconnection point between FGSZ and MGT networks (Vecsés) is not part of capacity booking and no fee is defined for transporting gas between the Hungarian TSO systems.

## Storage

### *Commercial stocks*

Gas storage is crucial because of the high dependence of Hungary's electricity sector on gas-fired power plants and because of the high volumes of relatively inflexible residential demand. Hungary has five commercial storage facilities with a total working capacity of 5.13 billion cubic metres (bcm) and a maximum withdrawal capacity of 58.6 mcm/day. All of them allow third-party access. Four of the five facilities are operated by Hungarian Gas Storage Ltd (HGS, formerly E.ON Gas Storage Ltd) and one is operated by MMBF Natural Gas Storage Ltd. At present, both natural gas storage operator licensees hold licences for the storage of commercial and strategic natural gas reserves. The system is able to provide two-thirds of the domestic daily peak demand from commercial storage facilities.

The Hungarian Network Code for Gas contains the guidelines for basic storage services, including capacity booking rules. HGS publishes its available capacities each January on a first-come first-served basis. At the beginning of the storage year, the amount of HGS's free capacity is announced and sold via capacity auctions. Allocated capacities can be nominated and additional peak capacities can be booked on an information technology platform. HGS also offers a wide range of optional products which can be booked via an auction process. MMBF's commercial storage capacities are completely sold for the long term, until April 2020.

**Table 8.2 Natural gas storage facilities**

| Storage facility | Working gas (mcm) | Injection rate (mcm/day) | Withdrawal rate (mcm/day) |
|---|---|---|---|
| **Hungarian Gas Storage Ltd** | | | |
| Hajdúszoboszló | 1 640 | 10.3 | 19.8 |
| Kardoskút | 280 | 2.15 | 2.9 |
| Pusztaederics | 340 | 2.5 | 2.9 |
| Zsana | 2 170 | 17 | 28 |
| **Natural Gas Storage Plc (MMBF Zrt.)** | | | |
| Szoreg-1 strategic stocks | 1 200 | 10 | 20 |
| Szoreg-1 commercial stocks | 700 | 2.7 | 5 |
| Total capacity | 6 330 | | |

Source: Ministry of National Development, Hungary IDR submission to the IEA.

The gas storage service is made available on a regulated third-party access basis. Storage operators are allowed to offer capacity but the price is capped at the regulated level. They may apply lower prices without discrimination; if one customer receives a discount, the same discount should be offered to others. Strategic storage is not subject to price regulation. The price of firm capacity may be calculated by using tariff calculators, which can be found on the websites of the storage service operators.

### *Strategic stocks*

Act XXVI of 2006 on the strategic stockpiling of natural gas was adopted by the Hungarian parliament in March 2006 and provided for the construction of a 1.2 bcm underground storage site by 2010, with a withdrawal capacity of 20 mcm/day for a period of at least 30 days in case of the disruption of the single largest gas infrastructure under average winter conditions. The Gas Stockpiling Act appointed the Hungarian Hydrocarbon Stockpiling Agency (HUSA) as the responsible organisation to build and maintain the emergency gas stock. HUSA and MOL established MMBF Ltd to own and operate the storage facility which was completed in 2010. The gas stocks are owned by HUSA. In 2013, Hungarian Gas Storage Ltd was also granted a licence by the regulator HEA for strategic stockpiling of natural gas at one storage site (Hajdúszoboszló), however, the then Minister responsible for energy appointed MMBF Zrt, which previously performed this task, as the sole licensee for storing strategic gas stocks. HUSA has a “take-or-pay” storage contract with MMBF, according to which HUSA has to pay for the whole storage capacity of 1.2 bcm, regardless of the actual quantity of the stored gas.

The strategic stocks specified by the Act serve exclusively the security of supply of household and customers who cannot switch to other energy sources. Since 1 July 2015, actual strategic stock levels have been at 921 mcm. Decree 7/2017 of the Ministry of National Development (issued on 31 March 2017) raised the level of strategic stocks to 1.2 bcm from 31st October 2017. The decision to raise the level of strategic stocks was based on the favourable level of natural gas market prices as well as the positive impact of the higher stock levels on security of supply and on the physical functioning of the storage facility.

## Distribution

Approximately 3 000 communities out of 3 200 have access to natural gas by means of the distribution networks. This results in a 92.1% penetration of natural gas among settlements in the country. There are ten natural gas distribution system operator companies operating in the country:

- ÉGÁZ-DÉGÁZ Földgázelosztó Zrt (GDF SUEZ affiliate)
- E.ON Dél-dunántúli Gázhálózati Zrt (E.ON affiliate)
- E.ON Közép-dunántúli Gázhálózati Zrt (E.ON affiliate)
- FŐGÁZ Földgázelosztási Kft (MFB, Magyar Fejlesztési Bank Zrt majority shareholder)
- TIGÁZ-DSO Földgázelosztó Kft (ENI affiliate)
- Csepeli Erőmű Kft
- ISD POWER Energiatermelő és Szolgáltató Kft
- Magyar Gázszolgáltató Kft

- NATURAL GAS SERVICE Ipari és Szolgáltató Kft
- OERG Kft

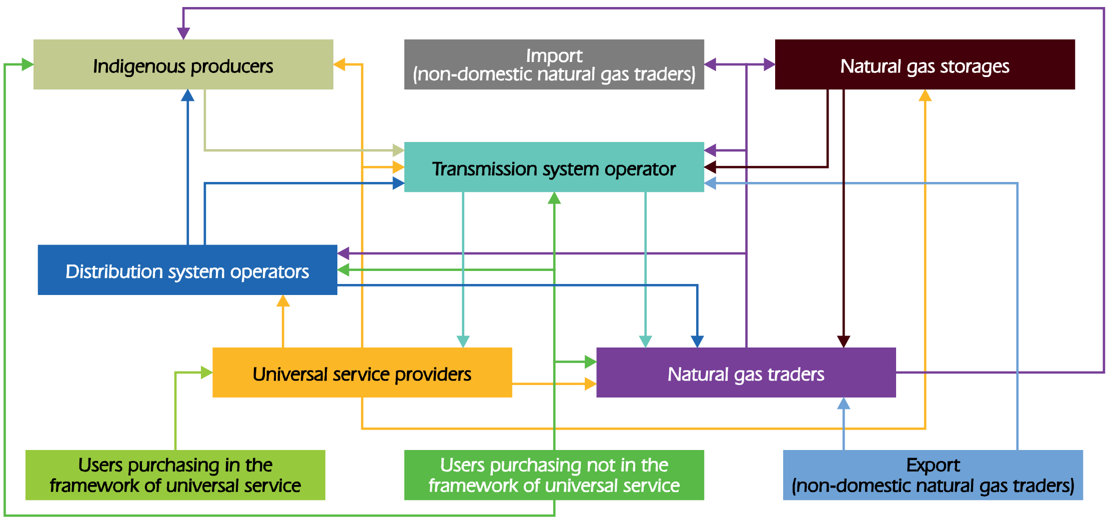
Among the ten natural gas distribution licensees operating in Hungary, there are five major regional companies with more than 100 000 consumers each. The five large companies completed legal unbundling procedures in 2007, and consequently they perform gas distribution and sales activities in separate companies.

## Market structure

### Structure of the gas market

Approximately 90 companies have a licence to trade gas in Hungary, but state-owned Hungarian Gas Trade Ltd (taken over by the MVM Group from EON in 2013) has a market share of over 60%. Hungarian Gas Trade Ltd has an obligation to supply gas at regulated prices to universal service providers (USP) upon request. FŐGÁZ Group, which is currently the sole retailer for households, as a USP purchases gas from the Hungarian Gas Trade Ltd. The volume of the USP market is almost 3.6 bcm a year or close to half the gas market in Hungary.

**Figure 8.7 Structure of the Hungarian natural gas market (physical flows)**




Source: HEA, Hungary IDR submission to the IEA

Gas traders on the Hungarian market can be put into three main categories:

- Gas trading licensees who are entitled to carry out activities on both the wholesale and retail markets. There were 42 of these at the end of 2016.
- Limited gas trade licensees, who are not entitled to supply end-consumers (except for sales on the organised market), and thus active only on the wholesale market. The limited gas trade licence was introduced in 2013 in order to promote gas trade. As in previous years, market players showed great interest in this opportunity in 2016 with 12 new players entering the market. The number of limited gas trade licensees increased to 43 in 2016.

- Universal service providers, who are gas trading companies with a special licence, are entitled to buy natural gas at a regulated price from the state-owned wholesale trader and are obliged to sell that gas at a regulated price that contains a regulated margin to end-users.

In 2013, the Hungarian government started to carry out a price reduction process on universal suppliers within the policy framework to reduce the cost of living for households. The initial end-consumer price reduction was 10%, but within two years a total reduction of 25% was introduced. As a consequence, universal suppliers (among them those owned by E.ON, ENI and GDF) incurred losses on their operation and the majority of them handed back their USP licence to the regulator. Their customers have been gradually taken over by FŐGÁZ, which is now the sole retailer for the USP market in the country.

### CEEGEX

In January 2013, the Central Eastern European Gas Exchange (CEEGEX), 100% owned by the Hungarian power exchange HUPX, was launched. CEEGEX developed and started the operation of a trading platform offering spot (next hour, intraday and day-ahead, etc.), locational balancing and long-term physical futures products. Natural gas producers, traders, consumers and system operators are allowed to trade anonymously on CEEGEX. Thirteen members trade on the spot market and eight on the physical futures market. Between 1 January 2016 and 1 October 2016, the average closing price on the spot markets was HUF 4 347 or EUR 13.90, and the total traded volume was 190 gigawatt-hours (GWh). Over the same period, the average price on the futures market was HUF 4 366 or EUR 13.99 and the total traded volume was 65 GWh. By the end of 2016, the total traded volume on CEEGEX markets reached 462 GWh (371 GWh on the spot market and 91 GWh on the futures market), the market's most successful year to date.

In CEEGEX, although there is a strong correlation with gas prices on the title transfer facility (TTF), one of Europe's most liquid gas hubs, only a limited number of gas wholesale trades are executed on the exchange. The reason underlying the correlation with TTF is understood to be linked to the applicable universal supply regulation, which stipulates the indexation of Hungarian regulated prices to the TTF (ACER, 2016).[2]

## Retail market, prices and taxes

### The retail market

Since market opening in 2004, the retail market has been characterised by its dual structure: one segment offering regulated prices and a second one where market prices are available. In July 2009, the public utility service previously available to all consumers at a regulated price was replaced by a universal service available to significantly fewer entitled consumers (HEA, 2016).

Consumers entitled to universal service continue to be supplied by universal service providers (USPs), who are bound by the obligation to sell natural gas and to conclude

[2]. An average of the settlement price of the TTF Gas Baseload Futures is set as one of the references used for Hungarian universal supply retail price formulation – the other relates to the prices of a basket of long-term contracts.

contracts with eligible customers. Those who are not entitled to universal service purchase natural gas from the competitive market. When the public utility service was terminated, and later when eligibility for universal service was reduced, consumers with medium and lower levels of consumption were also able to select their natural gas supplier from the market. The retail market underwent some significant changes in 2015-16. First, in 2015, the universal service provider licence of FŐGÁZ, which operates under the supervision of ENKSZ First National Public Utility Services, was extended to the whole country. Universal service providers were then given the opportunity to request the withdrawal of their licence, which had not been possible before. Over the year, a number of suppliers withdrew from the market and returned their licence as the obligation to offer retail tariffs at administered prices exposed them to significant financial losses. During 2016, the migration of customer portfolios of the other USPs to FŐGÁZ commenced as FŐGÁZ completed the purchase of the previous incumbents. This process started in January 2016 when FŐGÁZ took over the customers of E.ON and finished in October 2016 when the customers of TIGÁZ were also taken over by FŐGÁZ.

## Retail prices

In the universal service market, price interventions on the household market have led to the lowest prices among IEA European member countries (see Figure 8.8). The cost of natural gas for households was USD 40 per MWh in 2015 (including 21% taxes and levies). This is 31% lower than in the Slovak Republic, 33% lower than in Poland and 40% below prices in the Czech Republic.

The relevant Hungarian legislation contains provisions on price regulation, stipulating that universal service in Hungary shall be provided under fair, clearly comparable and transparent pricing techniques. With the introduction of universal service, the government aimed at protecting the interests of consumers who are in a less favourable bargaining position (mainly household consumers). Households have the possibility to decide if they wish to purchase gas in the framework of the universal service or on the free market.

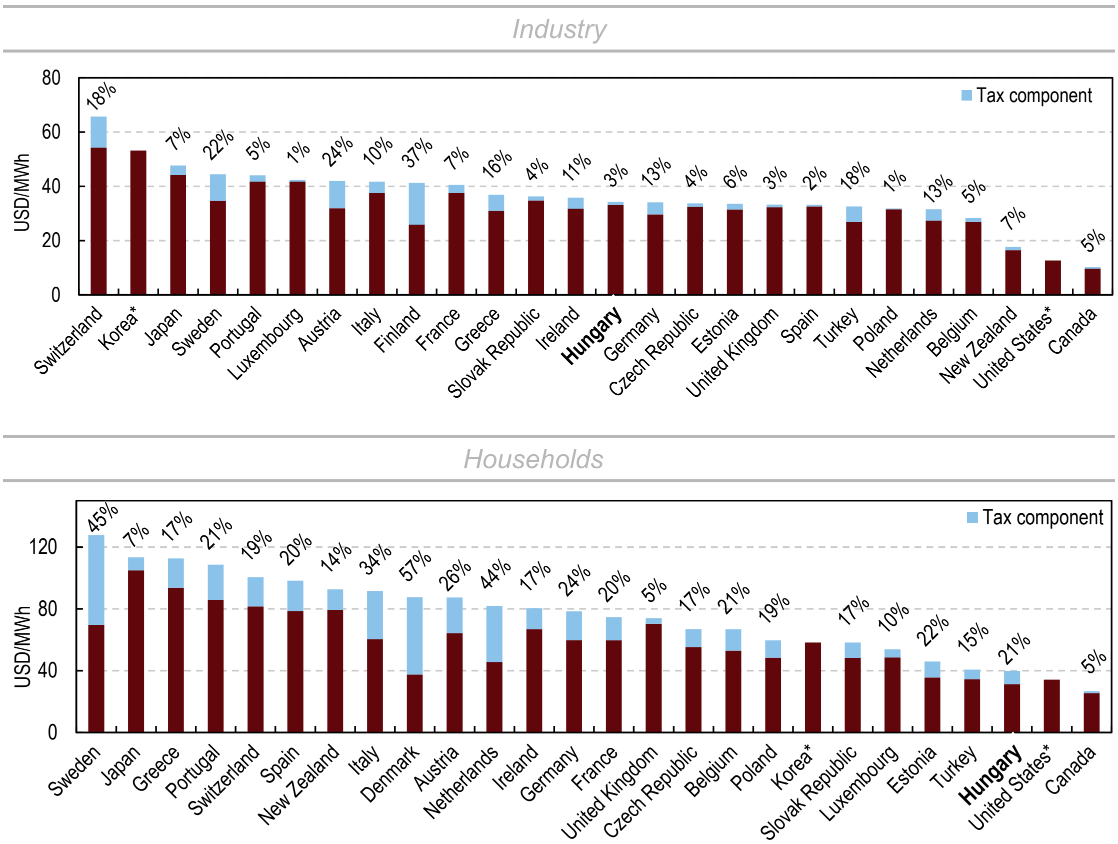
The price of natural gas supplied within the framework of universal services is decreed by the minister responsible for energy, on the basis of a recommendation by the regulator HEA. The price of universal services and their components defined in a ministerial decree are regulated in four-year price regulation cycles. The HEA sends its recommendation on the regulations for setting the price of universal services and for the regulation cycle to the minister at least forty days before the beginning of the next price regulation cycle. Before opening the cycle, HEA carries out an asset and cost review. The price for universal services shall be determined on the basis of the capital invested and the justified and reasonable operating expenses of authorised operators, insofar as such costs correspond to those of an efficient authorised operator. The purpose is to enforce the principle of minimum cost and to encourage the authorised operators to improve both their efficiency and the quality of their services. Additionally, the price shall be sufficient to cover cost-effective measures introduced to better serve of customers with natural gas within the framework of universal services.

In 2012, the government decided to reduce the costs of living for households. This decision was based on their view that utility costs imposed on families were particularly high in comparison with average costs elsewhere in the region and in the Union. In 2013, the price of natural gas for household consumers receiving universal service was reduced. The first phase of the reduction started on 1 January 2013, with a 10%

decrease in the natural gas universal service price alongside district heating and electricity. From 1 November 2013 the second reduction brought about another 11.1% decrease. The third reduction of utility costs resulted in an additional decrease of 6.5% in natural gas prices in the universal services market from 1 April 2014, then a decrease of 5.7% in electricity prices from 1 September 2014, and another decrease of 3.3% in district heating prices from 1 October 2014.

The non-USP market (mainly industry) is competitive and operates without direct government intervention. Consequently, prices in the sector are comparable to those elsewhere in the region. Natural gas price for industries was USD 34 per MWh in 2015, of which 3% was taxes. Hungary does not levy excise duties on the supply of gas to non-business customers. This price was 6% lower than in the Slovak Republic, 2% higher than in the Czech Republic and 8% higher than Poland's industry prices.

## Figure 8.8 Natural gas prices in IEA member countries, 2015



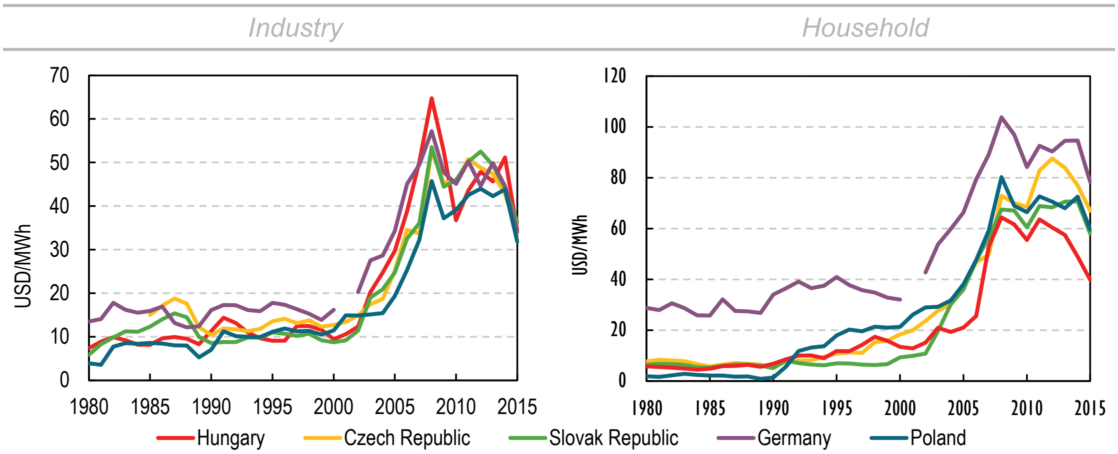

* Tax information is not available.

Note: Data are not available for Australia, Norway, Denmark (industry) and Finland (household).

Source: IEA (2016b), *Energy Prices and Taxes 2016*, www.iea.org/statistics/.

Historically, natural gas price developments in Hungary were similar to those of other central and eastern European countries (see Figure 8.9). Prices increased significantly from 1990 to a peak value in 2008, before falling in 2009 after the financial crisis. In the last five years, prices for households have fallen rapidly as a result of government intervention, which has led to a clear divergence between Hungarian prices and those in neighbouring countries, with only Romania having lower prices. It is also worth noting that below-cost regulated end-user prices for consumers in the retail electricity and gas utility sector brought rates of return to zero in the electricity and gas regulated business segments during the past few years, leaving limited funds for investment (EC, 2016).

**Figure 8.9 Natural gas prices in Hungary and in selected IEA member countries, 1980-2015**




Note: Data are not available for the Check Republic 1980-84 (industry) and Germany 2001 (industry and household).
Source: IEA (2016b), *Energy Prices and Taxes 2016*, www.iea.org/statistics/.

## Emergency response policy

In accordance with the EU Regulation 994/2010, Hungary maintains a both *a Preventive Action Plan* and an *Emergency Plan* and conducts and regularly updates an assessment of risks to national security of supply. The most recent assessment revision was conducted in January 2015 and the preparation of a new version of the Plans was completed in 2016. According to the most recent assessment, Hungary is able to comfortably meet its needs even in the case of coincidence of several disruption events. The N-1 standard would not fall below 90%, even in the most extreme of the evaluated scenarios. Hungary was compliant with the N-1 standard in 2013 and 2014.[3]

The *Preventive Action Plan* outlines duties and responsibilities in various stages of a supply disruption for the government, the Ministry of National Development, the HEA and other key stakeholders. The HEA plays a crucial role in dealing with a supply disruption and serves as the secretariat of the gas National Emergency Strategy Organisation (NESO).

The government may, by decree, set the rules for releasing gas stocks, order demand restraint measures, manage rules on export of natural gas from domestic production or amend business hours to postpone work days. It is the Minister of National Development who takes the decision to release strategic gas stocks and determines the parameters. HUSA, the Hungarian Hydrocarbon Stockpiling Agency, will carry out the release by concluding a sales contract. Stocks may only be sold for a price at least equal to the average acquisition value.

[3]. This indicator refers to a situation in which a very important national gas installation such as a production facility or pipeline falls out of operation



PART II. SECTOR ANALYSIS

The Hungarian Natural Gas Law outlines demand restrictions that can be implemented in case of a supply disruption, when there are no other applicable means of ensuring balance in the system. The responsible authorities are the Minister for National Development and the HEA. The natural gas TSO (FGSZ) executes the disruption measures. In a crisis situation, detailed rules will be established for all market players. There is a priority list of consumers for whom supplies must be guaranteed, even in the event of a severe crisis among which the TSO's self-consumption, household customers, other residential buildings, public institutions, medical centres, consumers for whom the restriction could cause health or environmental risk, district heating power plants.. Other consumers can have their gas supplies curtailed, and are divided into eight specific "limitation" categories. These categories are prioritised, depending on the size and nature of the consumption sectors. Market-based demand reduction (i.e. interruptible contracts) is potentially limited by price caps set on the price of gas (and electricity as well).

Some additional demand restraint measures are also at the government's discretion in a crisis, such as: reducing the opening hours and heating temperature of public buildings; appointing free public holidays; and removing the excise tax on imported fuel oils to encourage fuel switching from natural gas.

In addition, the Hungarian Electricity Law obliges power plants of over 50 MW capacity to hold fuel stocks corresponding to a minimum of eight days of average fuel consumption and an additional eight days of emergency stocks.

Domestic natural gas production could also be increased by 2 mcm for a few days. This would likely lead to a lower quality of the produced gas.

## Assessment

Natural gas is the most prominent source of energy in Hungary's TPES (31.3%): consumption was 9.0 bcm in 2015. Its share in TPES has been declining in recent years, from 44% or 14.9 bcm in 2005, and this level is forecast to stagnate or slightly decrease over the next ten years. The expectation of government is that the market will settle at less than 10 bcm after 2020 and, in certain warmer years, the expected annual demand will be around 9 bcm, while the total end-user market is expected to amount to around 8.5 bcm. For exceptionally cold winters, the annual consumption would be no more than 12 bcm. According to the government, the main reason behind the stagnating gas consumption is the mothballing of natural gas power plants as a result of high gas prices in the recent past, combined with low electricity import prices, but also because Hungary is experiencing a series of mild winters.

Hungary produced 1.8 bcm of natural gas in 2015 or 22% of its demand in the same year but production has been steadily declining and the trend is set to continue, with 1.4 bcm of production forecast for 2020. MOL is Hungary's main producer of natural gas.

Most of the natural gas consumed in the country is imported. In 2015, imports were 6.8 bcm, of which most came from Russia. An extension of the 20-year contract was negotiated in 2015 between Hungary's principal importer Hungarian Gas Trade Ltd and Panrusgaz Gas Trading Plc. Hungary is well-interconnected and further infrastructure improvements will provide ample potential for diversification of supply routes.

In 2014, 32.6% of natural gas was consumed by the residential sector (almost all households are directly (93%) or indirectly via district heating connected to the network), 18.3% by transformation, 24.8% by the industry, 19.5% by commercial/other and 9% by the energy industry (mostly refineries and oil/gas extraction). Natural gas accounted for 17% of Hungary's electricity production in 2015, slightly up from 14% in 2014. The high share of gas consumed by the residential and transformation sectors (where it is used mainly by heat plants and combined heat and power plants) makes secure supply critical, especially in cold winter months.

Hungary plays an important role in advancing natural gas market integration in Central Europe. The process of further diversification of supply sources and of expanding Hungary's role as a transit country includes the development of the reverse flow on the Hungarian-Croatian border, which requires more work on the Croatian side, reverse flow on the Hungarian-Romanian interconnector which is under preparation, and requires some construction on both Hungarian and Romanian sides, as well as future consideration of capacity upgrades for existing interconnectors. The cross-border connection between Hungary and Romania was completed in 2010, and the first one with Croatia has been in operation since the beginning of 2011. Hungary has provided reverse-flow gas to Ukraine since April 2013. In May 2015, Hungary together with Bulgaria, Slovak Republic and Romania signed a regional gas transmission co-operation agreement to connect gas transmission networks and make them suitable for the reverse-flow supplies. The Slovak Republic-Hungary gas interconnector – part of the North-South Gas Corridor – has been operational since July 2015.

Following the 2006 and 2009 Ukrainian/Russian natural gas crises, the country has undertaken one of the most demanding storage-related energy security policies in Europe. Including commercial storage, it has one of the largest storage endowments in comparison to its market size, with five commercial storage facilities offering a total working capacity of 5.13 bcm and a total withdrawal capacity of 58.6 mcm per day. All commercial storage can be accessed by third parties. Hungary has a maximum strategic storage capacity of 1.2 bcm, with a withdrawal capacity of 20 mcm/day. The level of strategic gas stocks currently set by Decree 13/2015 (III. 31) of the Ministry of National Development is 915 mcm. Roughly 90 companies have a licence to trade gas in Hungary, but state-owned Hungarian Gas Trade Ltd (taken over from E.ON by the MVM Group in 2013) has a market share of over 60%. Hungarian Gas Trade Ltd, as a former public utility wholesaler, was the only trading company obliged by law to supply gas to universal service providers (USPs). To date, USPs have taken this opportunity, although they also have the possibility (provided by law) to purchase gas from other traders. At present, FŐGÁZ Group, as a USP, purchases gas from Hungarian Gas Trade Ltd The USP market is almost 3.6 bcm a year, or close to half the domestic gas market.

A gas exchange, CEEGEX (owned by Hungarian power exchange HUPX Ltd), was created in 2013. Its main purpose is to provide for contracts that can help companies to balance their portfolios, thereby reducing the need for the TSO to do the balancing. To this end, one virtual national balancing point and 15 regional balancing points were created. To date, the amount traded is less than 1% of total supply, with a potential to grow to 5% in a few years' time.

In 2013, the Hungarian government started to enforce a price reduction process with regard to universal service providers, within its policy framework of reducing the cost of living for households. The initial end-user price reduction was 10%, but within two years a total reduction of 25% in total was introduced. As a consequence, USPs (among them those owned by E.ON, ENI and GDF) incurred losses on their operation and the majority of them handed back their USP licence to the regulator. Their customers have been gradually taken over by the FŐGÁZ Group, which is currently the sole retailer for the USP market in the country.

The natural gas produced from fields in Hungary that were operational before 1998 has to be sold at a regulated price to Hungarian Gas Trade Ltd by the producer (MOL) for the USP market.

As a result of the price interventions, Hungarian household end-user gas prices are currently among the lowest in the region. The interventions were inspired by a political wish to reduce the financial burden on low-income households stemming from their energy bill. While this has been successful, it should be noted that at the same time FŐGÁZ Group gradually became the sole supplier for the USP market as other universal service providers decided to leave the market and FŐGÁZ has taken over their customer portfolios. The low prices also apply to middle-income and high-income households, thereby reducing the incentive to restrain energy consumption. Further repercussions are unclear, but implications for upstream investments seem likely, as also the upstream price of some existing gas fields is regulated. Investments in biogas installations are also likely to suffer, as they will be less competitive at low prices. As electricity and heat prices for households and municipalities were also reduced, the appetite to build new CCGT power plants has disappeared, risking a shortage of generating capacity in the near future, until new nuclear power plants come on line, at the earliest in 2025. The government should consider using better targeted instruments than across the board price reductions to alleviate the financial burden on low-income households.

## Recommendations

***The government of Hungary should:***

- Explore the potential for enhanced regional co-operation on gas emergency policy by facilitating the use of its abundantly available natural gas storage capacity by companies and agencies from other countries in the region.
- Formulate a clear vision on the natural gas sector, notably regarding the role of natural gas in power generation, combined heat and power, and district heating and, more broadly, the institutional arrangements for all companies in the value chain, from upstream companies down to the retail level.
- Develop a clear and transparent programme for the implementation of full retail market liberalisation in the natural gas market, including the elimination of administratively determined end-user prices. Protection measures for vulnerable customers and less well-off households should form part of a social policy rather than an energy policy.

## References

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# 9. Coal

## Key data
(2015)

**Coal production:** 9.3 Mt, -3% since 2005

**Coal imports and exports:** 1.6 Mt imported, 0.4 Mt exported

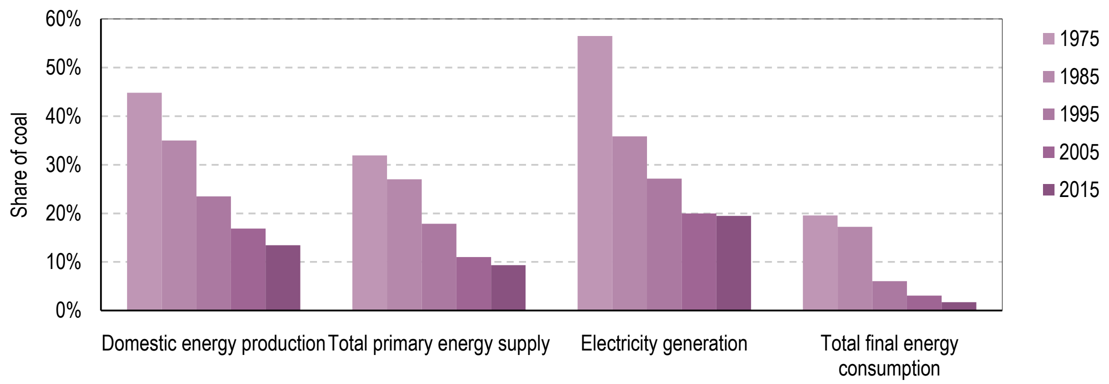
**Share of coal:** 9.3% of TPES and 19.5% of electricity generation

**Consumption by sector:** 10.7 Mt or 2.4 Mtoe (heat and power generation 69.6%, other energy industries 16.5%, industry 9.7%, residential 4.1%, commercial and public services, including agriculture and fishing 0.2%)

## Overview

The continued use of coal forms an important part of the National Energy Strategy 2030 (NES 2030). A key element of the Nuclear-Coal-Green Scenario set out in the strategy foresees the maintenance of the current level of coal-based electricity generation for two reasons. First, in energy crisis situations, coal is the only readily available domestic primary energy source (excluding renewables), and secondly, the government wants to maintain the possibility of increasing the share of coal use in the future depending, however, on the availability of carbon capture and storage (CCS) and clean coal technologies.

**Figure 9.1 Coal share in different energy supplies, 1975-2015.**




Note: 2015 values are provisional.

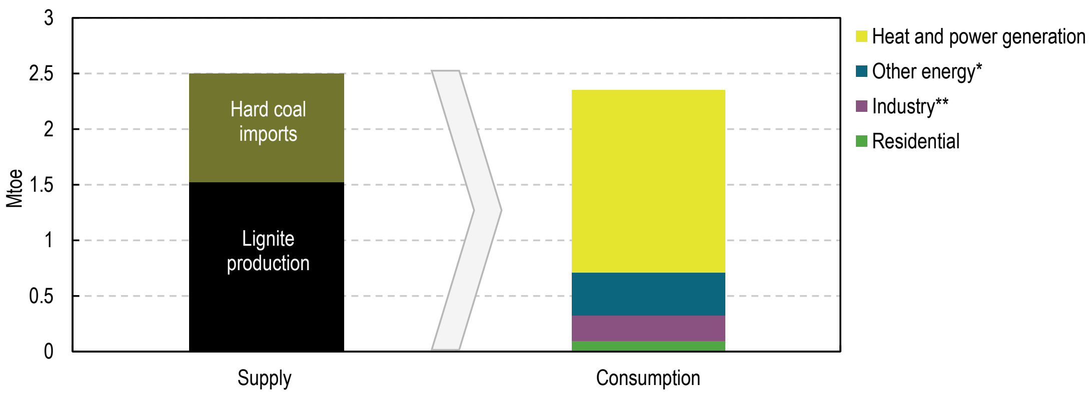
Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

Hungary's coal consumption has fallen significantly since the 1970s and the 1980s, though the rate of decline has slowed down over the past decade. Coal use is essentially in the heat and power generation sector, which accounts for nearly three-quarters of total coal consumption. It accounts for one-fifth of heat and power production and has declined significantly in the residential sector, where it has a very small share of final consumption.

Coal produced in Hungary accounted for two-thirds of total coal supply in 2015.[1] Greater use of domestic coal is encouraged in NES 2030 and new programmes support coal consumption in low-income households.

## Supply and demand

### Figure 9.2 Overview of supply and demand for coal, 2015




**Other energy* includes coke ovens, other refining and energy own-use.

** *Industry* includes non-energy use

Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

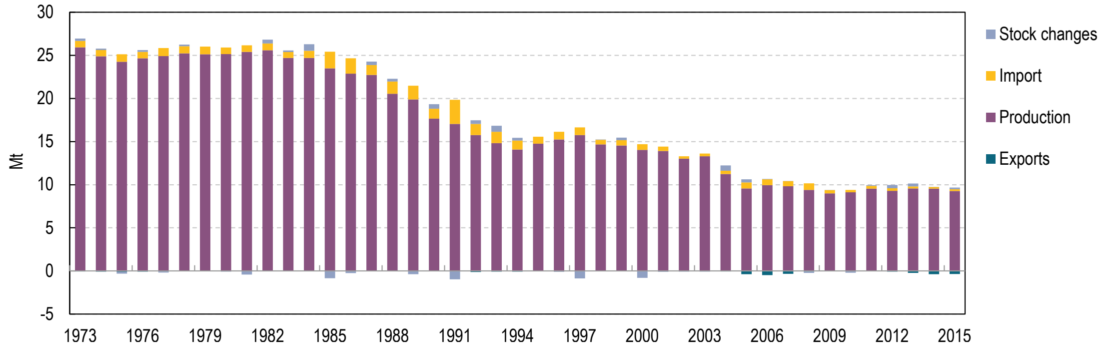
### Supply

Coal consists of hard coal (mainly cooking coal) and brown coal (mainly lignite). Lignite accounted for 59% of total coal supply (in energy) in 2015. Hungary is self-sufficient in lignite production with annual production levels of 9.0 million tonnes (Mt) to 10 Mt over the last decade. Total lignite supply was 9.3 Mt in 2015, a 9% decline compared to 2005 (Figure 9.3).

Hard coal supply has not followed the same declining trend as brown coal. Total consumption of hard coal was 1.4 Mt in 2015, a 1.5% increase compared to 2005. Hard coal production was phased out in 1993 making Hungary import-dependent. The United States supplied 54% of the country's hard coal imports in 2015, followed by its neighbours the Czech Republic (18%) and Poland (11%) (see Figure 9.5).

[1]. This is in terms of energy supply. Domestic lignite production in terms of weight made up 86% of total coal supply.

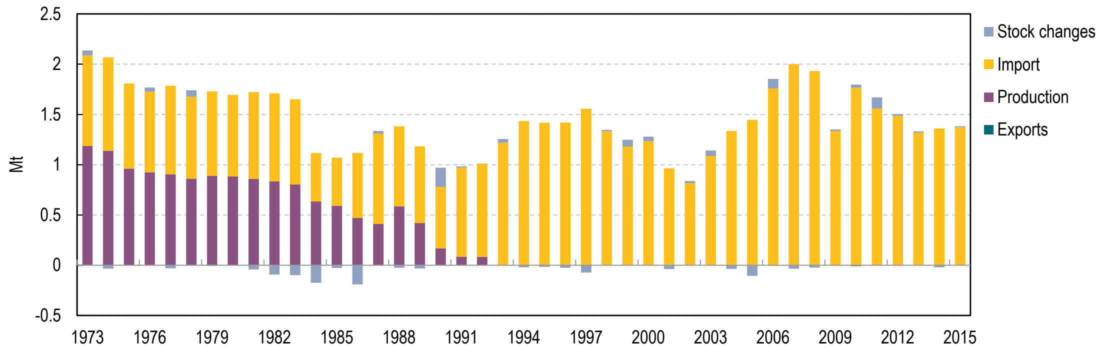
### Figure 9.3 Brown coal supply by source, 1973-2015




Note: 2015 values are provisional.

Source: IEA (2016), *Coal Information 2016*, www.iea.org/statistics/.

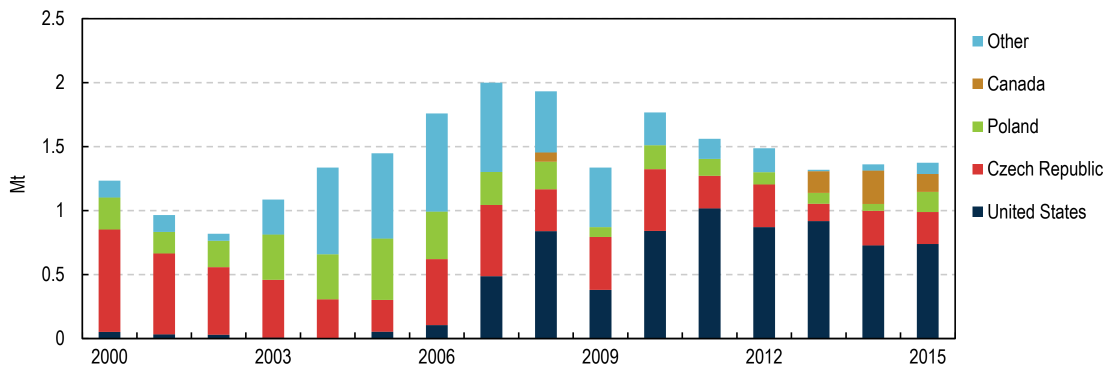
### Figure 9.4 Hard coal supply by source, 1973-2015




Note: 2015 values are provisional.

Source: IEA (2016), *Coal Information 2016*, www.iea.org/statistics/.

### Figure 9.5 Hard coal net imports by country of origin, 2000-15



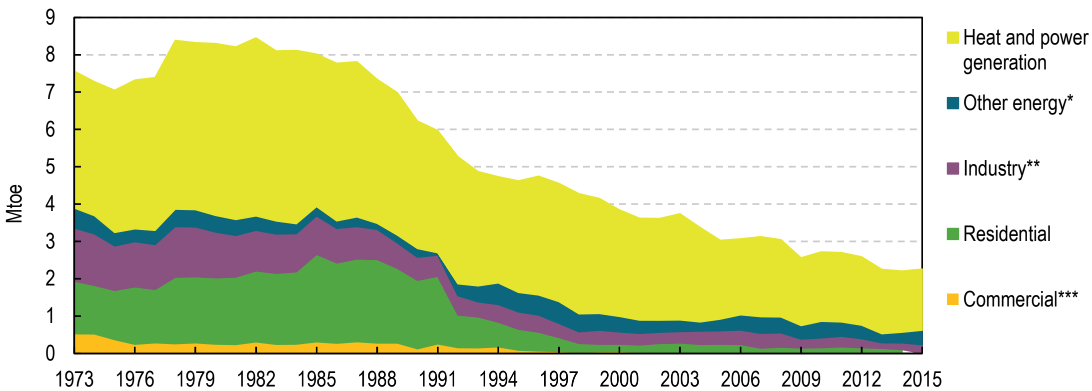

Source: IEA (2016), *Coal Information 2016*, www.iea.org/statistics/.

## Demand

The energy sector is the largest coal consumer, with heat and power generation accounting for 69.6% of total coal demand in 2015, and other energy uses consuming 16.5% (Figure 9.6). Brown coal is mainly used in coal-fired power plants (94% of total brown coal consumption) and hard coal mainly in coke ovens (97% of total hard coal consumption). Coal-fired power generation was 5.9 TWh in 2015, which represented 19.5% of total electricity production. The share of coal in electricity production has remained constant since 2005. Coal provides 1.8% of total non-electricity energy use in households. This share has fallen from 4.1% in 2005.

In the most recent government projections, the share of coal in TPES is expected to decline from 9.6% in 2015 to 5% in 2020. Over the longer term, NES 2030 foresees the capacity of coal-fired power to fall to 440 megawatts (in the Nuclear-Coal-Green Scenario).

**Figure 9.6 Coal consumption by sector, 1973-2015**




**Other energy* includes coke ovens, other refining and energy own-use.

***Industry* includes non-energy use.

****Commercial* includes commercial and public services, agriculture/forestry and fishing.

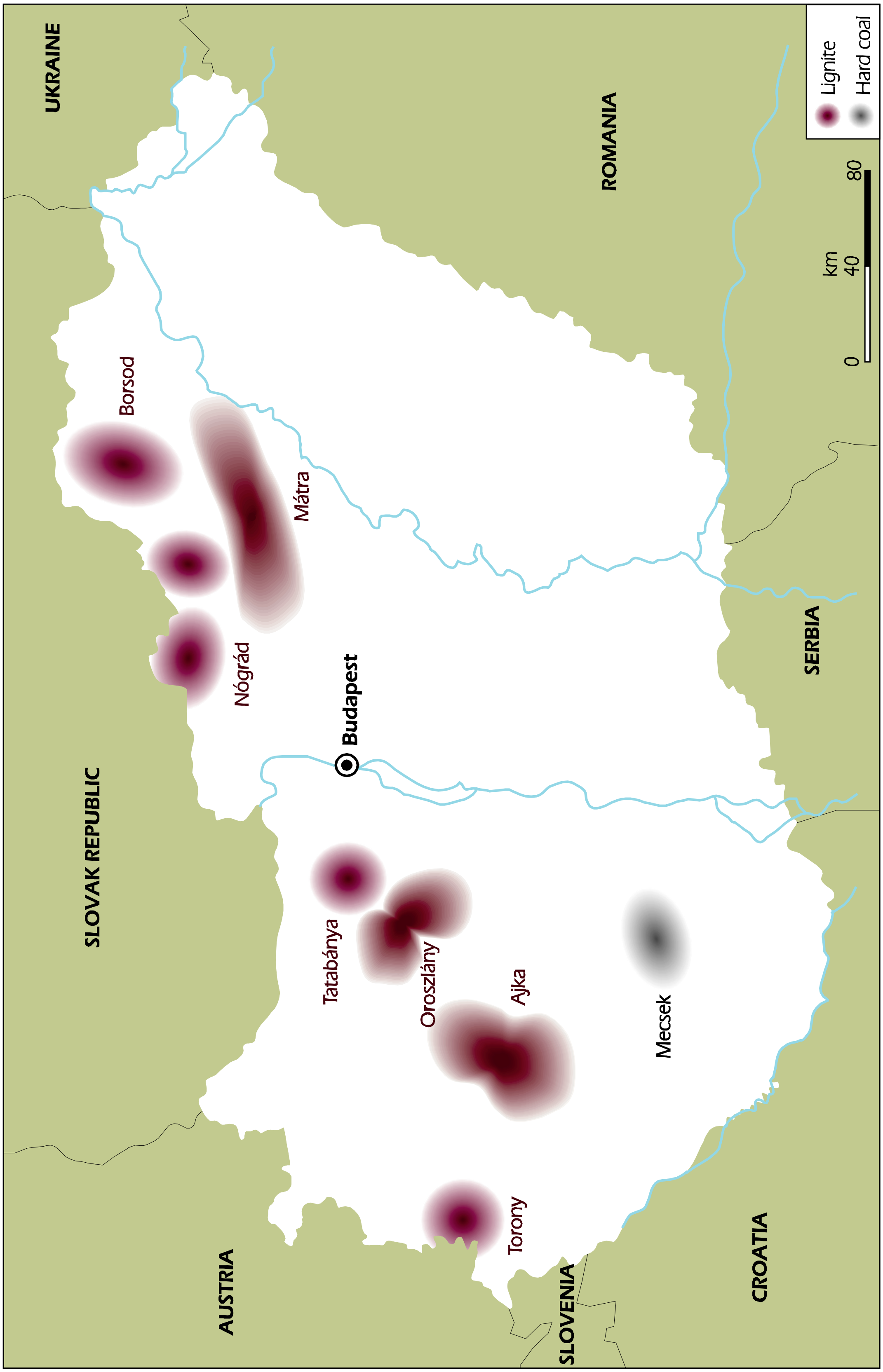
Note: TPES by consuming sector. Includes coke-oven coke, coke-oven gas, and blast-furnace gas; mainly used in energy and industry.

Source: IEA (2017), *World Energy Balances - 2017 Preliminary edition*, www.iea.org/statistics/.

## Coal reserves

Total exploitable reserves of coal in Hungary were 8.4 billion tonnes at the end of 2015 (MBFH, 2017). Lignite and sub-bituminous coal reserves account for almost 80% of the country's total coal resources and are the most important indigenous sources of energy currently exploited. Hungary's lignite and hard coal resources are largely concentrated in the regions of Transdanubia and in northern and north-eastern Hungary. Most of Hungary's lignite production is from the two opencast mines, Visonta and Bükkábrány owned by Mátrai Erőmű Zrt, whose largest shareholders are RWE Power Aktiengesellschaft (51%) and the MVM Group (26%). The mines are located 90 kilometres north-east of Budapest. In 2015, the two mines produced approximately 7.3 million tonnes of lignite. Lignite is used in the nearby company-owned power plant which comprises five units providing 876 megawatts (MW) of coal-fired capacity and 66 MW of natural gas-fired capacity.

## Figure 9.7 Coal reserves




This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

Source: Euracoal (2017), *Coal Industry Across Europe*.

The majority of mining companies are privately owned with the exception of Vértesi Erőmű Zrt, which is owned by MVM Hungarian Electricity Plc. The main players in the coal industry over the 2011 to 2015 period and their annual coal production figures are shown in Table 10.1.

## Table 9.1 Coal-mining output by company, 2011-15

| Company | Coal production (kt) | | | | |
|---|---|---|---|---|---|
| | 2011 | 2012 | 2013 | 2014 | 2015 |
| Vértesi Erőmű Zrt | 399.861 | 427.826 | 232.410 | 182.446 | 0 |
| Mátrai Erőmű Zrt | 6 843.521 | 6 660.557 | 7 168.380 | 7 193.348 | 7 344.219 |
| Pannon Hőerőmű Zrt | 0 | 0 | 0 | 9 | 45.983 |
| Duszén Kft | 2.115 | 2.728 | 734 | 600 | 11.000 |
| Meliorációs, Rekultivációs és Környezetrendező Kft | 25.619 | 22.041 | 29.174 | 21.923 | 711.575 |
| Szuha 2000 Kft | 6.327 | 0 | 0 | 0 | 19.920 |
| Ormosszén Kft | 31.760 | 44.790 | 48.220 | 1.598 | 132.323 |
| EOSZÉN Kft | 0 | 0 | 10.726 | 12.863 | 148.280 |
| CALAMITES Kft | 1.932 | 0 | 0 | 0 | 0 |
| Nógrádszén Kft | 182 | 211 | 0 | 0 | 0 |
| *Coal* | *467.796* | *497.596* | *321.264* | *219.439* | *1 069.081* |
| *Lignite* | *6 843.521* | *6 660.557* | *7 168.380* | *7 193.348* | *7 344.219* |
| **Total:** | **7 311.317** | **7 158.153** | **7 489.644** | **7 412.778** | **8 413.300** |

Source: Ministry of National Development, Hungary IDR submission to the IEA.

## Clean coal technologies

In the city of Kazincbarcika, in the Borsod region in north-east of the country, a group of companies has been working on the application of clean coal technology that enables the pilot production of methanol by using lower-quality coal.

A joint project was launched on the basis of an agreement between the governments of Japan and Hungary, for the purpose of expanding the use of clean coal technology. The purpose of the project was to examine the feasibility of a methanol factory based on the large amount of coal available in the Borsod region. The study was completed in April 2016 and is currently being evaluated.

### *Carbon capture and storage*

In terms of $CO_2$ storage, Hungary has some theoretical potential, which could be developed. According to NES 2030, the theoretical storage capacity is over 26 billion tonnes of $CO_2$ but more comprehensive research is required in order to establish the actual potential. Brines at a depth of over 1 000 metres represent the greatest potential but the country's geological and technological knowledge is limited. In the case of appropriate exploration, such strata may be suitable for the long-term storage of carbon dioxide ($CO_2$), as they cannot be utilised for other purposes.

An assessment of the geological structures potentially capable of storing $CO_2$ and their capacity was undertaken in 2013 by the Hungarian Office for Mining and Geology. According to Government Decree no. 145/2012 (VII. 3), the Mining Authority shall re-estimate the storage capacity every five years and disclose the results to the public on its website. The latest assessment identified 13 former hydrocarbon-mining sites (or plots), which are suitable for the storage of almost 100 $MtCO_2$ and 12 regions within basins, where deep brine reservoirs have a storage capacity of 761 $MtCO_2$.

## Assessment

Coal supply was 2.3 Mtoe, or 9.6% of TPES in 2015 and represented 19.5% of electricity generation. It has declined steeply from 8.5 Mtoe in 1982. Coal use has declined across all sectors, particularly in the residential and commercial sectors which collectively accounted for 33% of use in 1985 but only 4.7% of use in 2015. Hungary's domestic coal production is broadly limited to lignite, 9.3 Mt in 2015, which provides 88.5% of total coal supply. Power generation is the largest coal-consuming sector, accounting for 74.5% of total consumption or 1.6 Mtoe in 2015. Coal-fired power generation was 5.9 terawatt-hours (TWh) in the same year, largely from the Mátrai Erőmű power plant.

Since Hungary's transition to democracy at the end of 1989, many large state-owned industrial companies have been transformed into smaller privatised companies and, as a result, many large uneconomic coal mines have been closed. Thus, the fuel structure shifted from domestic coal towards greater reliance on natural gas and other sources of energy.

The National Energy Strategy 2030 encourages the maintenance of the share of coal in the energy mix and greater use of domestic coal and lignite resources in an environment-friendly manner for power generation, along with the expansion of domestic nuclear capacity, the development of new petroleum and natural gas resources and increased generation from renewables. The only large coal-fired power plant, the 950 MW Mátrai Erőmű plant, is over 40 years old. Therefore, in most recent government projections the share of coal in TPES is expected to decline from 10% in 2015 to 5% in 2020. Over the longer term, NES 2030 foresees the capacity of coal-fired power to fall to 440 MW (Nuclear-Coal-Green Scenario).

# Recommendations

***The government of Hungary should:***

- ☐ On the basis of the National Energy Strategy 2030, clarify the role of coal in the country's future energy mix, and, if coal use is deemed beneficial, ensure that it is used in the most environment-friendly way possible, both in power generation and in the residential sector.

## References

Euracoal (European Association for Coal and Lignite) (2017), *Coal industry across Europe*, Euracoal, Brussels.

IEA (International Energy Agency) (2017), *World Energy Balances - 2017 Preliminary edition*, OECD/IEA, Paris. www.iea.org/statistics/.

IEA (2016), *Coal Information 2016*, OECD/IEA, Paris. www.iea.org/statistics/.

MBFH (Hungarian Office for Mining and Geology) (2017), *Mineral Raw Material Reserves*, www.mbfh.hu/home/html/index.asp?msid=1&sid=0&hkl=72&lng=2 (accessed 2 January 2017).

# 10. Energy technology research, development and demonstration

## Key data
(2012*)

**Government energy RD&D spending:** HUF 25 billion (EUR 86 million)

**Share of GDP:** 0.088% (IEA median**: 0.048)

**RD&D per capita:** HUF 2 542

**Exchange rate (2012):** 1 HUF = 0.00358 USD *or* 0.00323 EUR; 1 USD = 0.901EUR

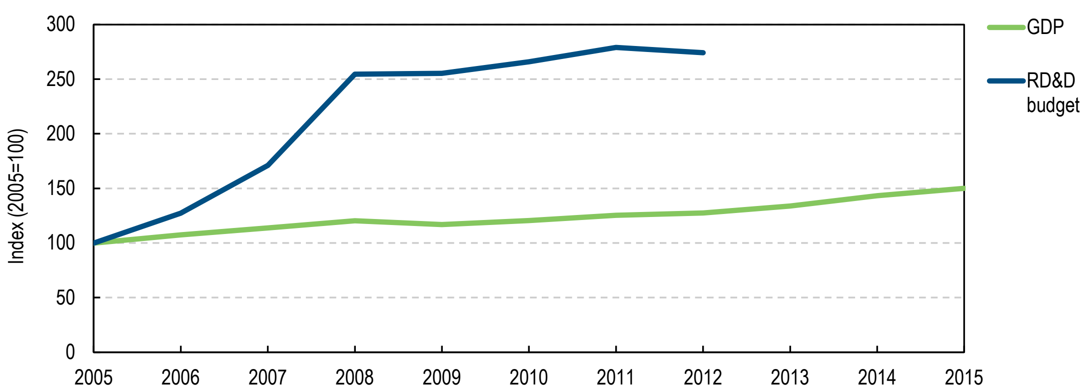
** 2012 data are the latest available for Hungary.*

*** Median of 27 IEA member countries for which 2012 data are available.*

## Overview

Hungary's gross domestic product (GDP) increased by 50% from 2005 to 2015 but the share spent on research and development (R&D) has grown at a faster rate. The research, development and demonstration (RD&D) budget increased significantly from 2005 to 2008, and its share of GDP increased from 0.05% to 0.09% in three years. Since then, the RD&D budget has increased more moderately and declined by 2% in 2012. The country, however, does not have a specific energy technology research, development and innovation strategy and the National Energy Strategy 2030 (NES 2030) contains no energy technology-related research and innovation goals or objectives.

**Figure 10.1 Energy RD&D budget compared to GDP (nominal), 2005-15**




Source: IEA (2016), "RD&D budget", *IEA Energy Technology RD&D* (database), www.iea.org/statistics/.

## Institutions

In the past, there were a number of agencies and ministries overseeing the broader R&D sector, which resulted in sometimes complex decision-making and funding arrangements. This changed with the establishment of the National Research, Development and Innovation Office (NRDIO) in 2014. The NRDIO was established with the aim of creating a stable institutional framework for government co-ordination of the national research, development and innovation system, providing predictable funding and implementing the efficient and transparent use of available resources. The law creating the NRDIO also established a unified National Research, Development and Innovation Fund.

The National Research Infrastructure Committee (NRIC) assists the NRDIO and is responsible for mapping domestic research infrastructure, assessing development needs, planning co-operation with foreign research infrastructures and continuously monitoring effectiveness in the relevant fields of science and research.

The NRDIO is at the core of the Hungarian research and innovation system. It is responsible for implementing strong horizontal and vertical co-ordination mechanisms with other ministries in the sector, as well as with stakeholders. The Innovation Board brings together nine senior representatives from different sectors for the purpose of defining research, development and innovation (RDI) policy principles, elaborating an RDI strategy framework based on economic strategies, and selecting expert group members for the evaluation of RDI proposals.

## Major energy programmes

Hungary does not have a specific energy technology RDI strategy. The National Smart Specialisation Strategy (S3), co-ordinated by NRDIO, outlines three national specialisations (systems science, smart production and sustainable society), which are very broad.

The S3 highlights a number of sectoral priorities which can drive structural change in the economy, one of which is the promotion of clean and renewable energies, including renewables and bioenergy, nuclear energy and energy efficiency. Activities in this sector are to be promoted in order to reduce the energy dependence of the country by using clean and environment-friendly energy. Activities in these sectors should also decrease environmental stresses and be cost-effective. In addition to renewable energies; the goal is to make energy-producing sectors more efficient, environment-friendly and sustainable. Priority is given to energy efficiency, efficient energy storage and distribution, as well as greater utilisation of waste energy. S3 also promotes cross-border co-operation, notably with Austria and Slovenia, in the development of energy-efficient and eco-friendly transport infrastructures, urban freight transport and sustainable transport chains. It also highlights the need for co-operation of energy-related RDI activities within the four countries of the Visegrád Group and the Danube Region Strategy of the European Union.

Stakeholder involvement in the priority-setting process was mainly implemented within the S3 framework, which was formalised to follow the guidelines of the European

Commission as an *ex ante* conditionality for access to the EU Structural Funds in the current period.

The National Research, Development and Innovation (NRDI) Strategy, which was published in 2013, aimed to improve innovation activities in certain sectors (health care, environment, energy, education, and transport/logistics) and in addition established a number of horizontal objectives to address key socio-economic challenges. An update of the NRDI Strategy is in progress and will be finalised in 2017.

The Industrial Development Strategy (known as the Irinyi Plan), prepared by the Ministry of National Economy, also contains a set of strategic pillars and a list of prioritised sectors. The Irinyi Plan is a mechanism to generate the driving force required for long-term economic growth and turn Hungary into one of the most highly-developed industrial regions in Europe by the year 2020. The plan highlights the need for Hungary to shift towards an innovation-focused economy and an industrial sector supported by up-to-date knowledge, R&D skills as well as strong tertiary and vocational education.

### Monitoring and evaluation

The EU Policy Support Facility (PSF) conducts reviews of the national RDI systems in EU member states which request this service voluntarily. The reviews are conducted by independent international experts and involve consultation with local stakeholders. It results in suggestions for RDI policy reforms and measures. The PSF peer review of the Hungarian Research and Innovation system conducted in 2016 found, among other things, high-quality higher education with established knowledge centres, the growing economic role of networking, co-operation and innovation clusters, closer co-operation between academia and the business sector; strengthening excellence in public research and education, and an integrated research and innovation funding system that supports smart specialisation and avoids double financing (EU, 2016).

Conversely, the review found that the system of governance of RDI in Hungary has been subjected to constant structural changes since the beginning of the 1990s, which have led to lack of political commitment, instability of the RDI system, shortfalls in the policy implementation, and slow, insufficiently informed policy learning processes. It also noted a weak supply of researchers especially in the public sector, weak technology transfer capacities and capabilities in public research centres, little use of innovative financing solutions such as private-public partnerships, weak programme evaluation culture outside of EU-funded programmes and weak entrepreneurial culture and framework conditions (EU, 2016).

The review highlighted the fact that Hungary has a vast science and innovation potential that can bring about a structural shift and steady growth in its economy through reform and sustained increases in public funding for R&D. To capitalise on this potential, the country needs a research and innovation vision shared across government departments, understood by society and resulting from continuous dialogue with stakeholders.

### Public funding

There have been two main competitive funding sources for research and innovation since January 2015:

- The National Research, Development and Innovation Fund (NKFIA), which integrates the former National Research and Technology Innovation Fund and the Hungarian Scientific Research Fund (OTKA).
- Various Operational Programmes of the Structural Funds co-funded by the central budget, mostly from the Economic Development and Innovation Operational Programmes.

The integrated NKFIA had a budget of about EUR 247 million (HUF 74.1 billion) in 2015, the main source of which is an innovation levy that is collected from medium-sized and large companies and that is based on their income before taxation and the contribution of the central budget.

EU Structural Funds play an important role in national R&D funding: approximately 55% of total RDI project support is financed from the Operational Programmes of the Structural Funds. Nevertheless, annual statistical data are not available on the activities funded by the Structural Funds (EU, 2016). According to the Cohesion Policy Database of the European Commission, Hungary received a total of EUR 2 126 million from the Structural Funds to support R&D and Innovation between 2007 and 2013. For the period 2014-20, EUR 2 149 million is committed to research and innovation projects.[1]

The two main EU funding programmes are the Economic Development and Innovation Operative Programme (GINOP) and the Competitive Central Hungary Operational Programme (VEKOP). GINOP aims to stimulate the economies of the less-developed regions in Hungary. Its most important priorities are the competitiveness of small and medium-sized enterprises, research and innovation, and employment. VEKOP, which runs from 2014 to 2020, aims to enhance the development and competitiveness of Central Hungary. It supports R&D and technological innovation as well as the development of energy efficiency and enhanced use of renewable energy resources, among other things. It does not explicitly specify any industries or technologies to be targeted.

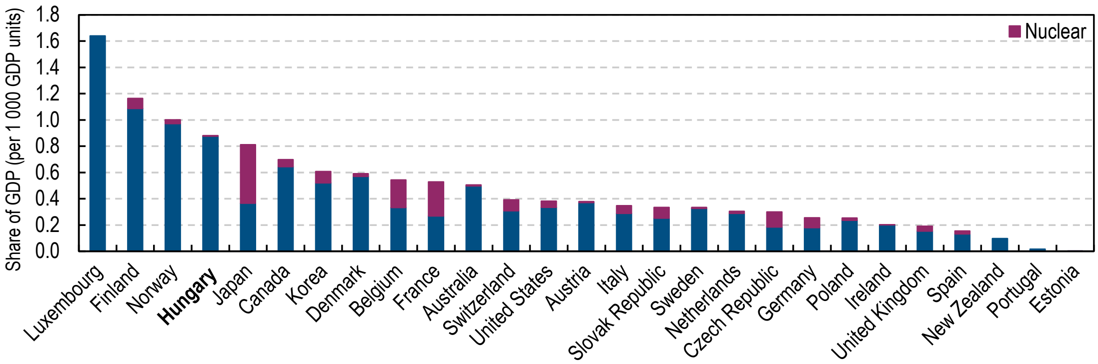
Energy is one of eight national priorities in the S3 Strategy which is a form of RDI strategy for the country. Only those projects which are targeting at least one of the national priorities can apply for governmental support. Therefore, the “clean and renewable energies” priority ensures the availability of funds for the energy-related research projects, notably in the fields of renewables and bioenergy, nuclear energy and energy efficiency. In the 2015 and 2016 calls for proposals under “Support of business RDI activities GINOP 2.1.1-15”, applicants submitted 904 proposals, among which 57 were for the S3 priority “clean and renewable energy”.

The NRDIO is not responsible for energy-related RDI, but it is for the whole research, development and innovation supporting system, in which energy has a priority together with seven other fields of activity. Total spending on energy RD&D was HUF 25 billion (EUR 86 million) in 2012. This accounted for 0.088% of GDP, the fourth-highest share among IEA member countries (Figure 10.2). Energy efficiency is the main research field, accounting for 94% of total energy research funding, followed by renewables with 5% and fossil fuels with 1% (Figure 10.3).

[1]. https://cohesiondata.ec.europa.eu/countries/HU accessed 1 February 2017.

In 2016, the total funding available from European sources and the National Research, Development and Innovation Fund was HUF 300 billion (EUR 968 million). These funds were drawn from the GINOP (62.3%), the Competitive Central Hungary Operative Programme provided by the EU (25%), and from the NRDI Fund (12.6%)

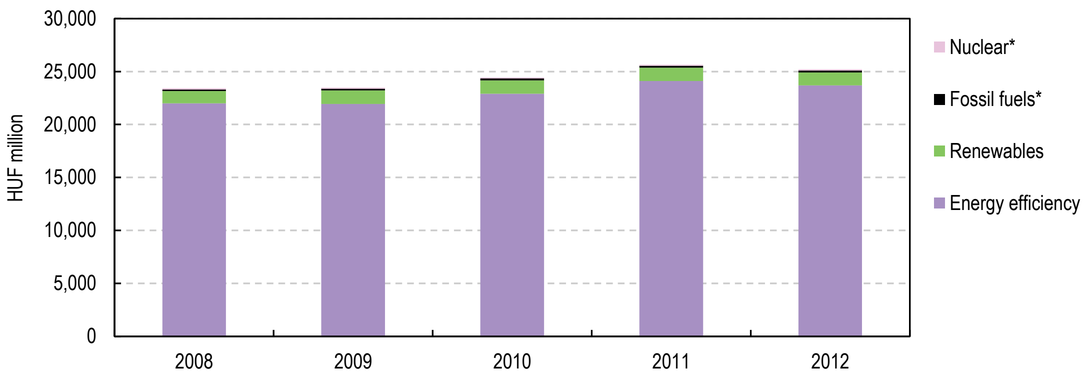
**Figure 10.2 Government energy RD&D spending as a ratio of GDP in IEA member countries, 2012**




Notes: Data not available for Greece and Turkey; 2012 data are the latest available for Hungary.

Source: IEA (2016), "RD&D budget", *IEA Energy Technology RD&D* (database), www.iea.org/statistics/.

**Figure 10.3 Government energy RD&D spending by category, 2008-12**




* Negligible.

Source: IEA (2016), "RD&D budget", *IEA Energy Technology RD&D* (database), www.iea.org/statistics/.

## International collaboration

As regards the international RDI collaboration, the picture is mixed. Hungary is engaged in a number of international initiatives and organisations. The share of publications and patents with foreign co-authors is among the highest in OECD countries. Furthermore, the country has established a network of attaches for science in seven of its embassies. The networking skills of Hungarian R&I performers (including large companies and SMEs) do not yet allow them to influence the EU-level decision-making processes in various thematic programme committees and other international forums. In addition, there is no clear strategy to align with countries of the region in order to build a critical mass around shared concerns or competences.

## Assessment

Since the last review in 2011, Hungary has made positive progress in the national research and innovation sector such as the publication of the National Smart Specialisation Strategy in 2014 and the establishment of the National Research, Development and Innovation Office in 2015. Conversely, priorities in the sector are unclear but the IEA understands that Hungary devotes considerable resources to overall research and innovation activities and has been successful in obtaining research and demonstration grants in the energy part of the EU framework programmes for research and technological development, and structural funds. More information about the RDI programme portfolio generally open for all priority areas of the S3 (including energy-related research) and financed by EU Structural Funds (EDIOP and Competitive Central Hungary Operational Programme, CCHOP) and the domestic NKFIA is available at the website of the NRDIO.[2] In Horizon 2020, 29 projects selected from the energy programmes and eight projects from the EURATOM programme have received funding to date (EUR 6.13 million and EUR 0.65 million, respectively).

The IEA welcomes the development of a new R&D action plan for the energy sector, which is in progress at present and will be published in the first half of 2017. Energy R&D is an important policy instrument to meet national energy policy objectives. Given the stringent budgetary conditions for governmental energy R&D programmes in many member countries, a coherent energy R&D strategy with clear prioritisation of activities in line with national energy policy goals is essential. Transparency and involvement of major stakeholders in defining a national energy R&D strategy are of key importance and must be integrated into the process. This should include academic institutions active in the sector, industry stakeholders, other government ministries and agencies, as well as European funding agencies as appropriate. The strategy should look to best practice elsewhere within the IEA membership and seek to support the key goals of the national energy policy. Without a comprehensive action plan that considers the entire innovation chain, different parts of government would have a tendency to support different energy technologies at different times, often with the result that there is inadequate co-ordination or follow-up.

Decisions on which activities are to receive funding – and how much – should be determined through structured analytical processes and mechanisms such as technology roadmapping, foresight exercises, and technology assessment and evaluation.

Hungary is in the process of revising its monitoring and evaluation mechanisms in the sector. The use of external evaluators to monitor and assess research and innovation outcomes should be integrated into this process. The adoption of external evaluation tools provides an effective tool to monitor and evaluate the performance of publicly funded energy R&D activities and to maximise the cost-effectiveness of the R&D programmes.

To maximise the efficiency of the sector, the government should also develop links between the energy RD&D action plan and other relevant policy areas such as science and technology, education, economic development and industry. The action plan should also focus on measures to commercialise domestic research activities with a view to meeting broader economic targets such as broadening the domestic industrial base and expanding exports.

2. http://nkfih.gov.hu/funding/portfolio-of-calls-to.

## Recommendations

***The government of Hungary should:***

- Define in the forthcoming action plan, following a multi-stakeholder involvement process, clear priorities for energy technology research, development and innovation directly linked to the National Energy Strategy's priorities alongside an increased and stable funding mechanism.
- Use all opportunities to integrate Hungarian research and innovation programmes into international co-operation frameworks.
- Integrate the use of external evaluators to monitor and assess research and innovation outcomes into the funding review process.
- Develop links between the energy RD&D action plan and other relevant policy areas.

### References

IEA (International Energy Agency) (2016), "RD&D budget", *IEA Energy Technology RD&D* (database), www.iea.org/statistics/.

EU (European Union) (2016), *RIO Country Report 2015: Hungary*, EU, Brussels.

# ANNEX A: Organisation of the review

## REVIEW CRITERIA

The Shared Goals, which were adopted by the International Energy Agency Ministers at their 4 June 1993 meeting in Paris, provide the evaluation criteria for the in-depth reviews conducted by the Agency. The Shared Goals are presented in Annex C.

## REVIEW TEAM

The review team visited Budapest from 10 October to 14 October 2016. During the visit, the review team met with government officials, representatives from ministries and government agencies, market participants, non-governmental organisations, consumer groups, and other organisations and stakeholders. This report was drafted on the basis of the information obtained in these meetings, the Hungarian government response to the IEA energy policy questionnaire and information from many other sources. The team is grateful for the co-operation and hospitality of the many people it met during the visit. Thanks to their openness and willingness to share information, the review visit was highly productive.

The team is grateful for the co-operation and assistance of the many people it met throughout the visit. Thanks to their openness and willingness to share information, the visit was highly informing, productive and enjoyable. The team wishes to express its gratitude to Mr András Aradszki, State Secretary for Energy Affairs, Ms Andrea Kádár, Deputy State Secretary for Energy Affairs and Ms Martina Makai, Deputy State Secretary for Green Economy, Climate Policy and Key Public Services in the Ministry of National Economy and their management teams for hosting our visit. The team is also grateful to Ms Éva Totok, Head, Department of Strategy and Energy Policy and Dr Kitti Kropkó, Deputy Head, Department of Strategy and Energy Policy, their teams and support staff for their input and support throughout the week. The team is also thankful to Ms Gabriella Pálos, Counsellor, Permanent Delegation of Hungary to the OECD and UNESCO for her assistance in organising the team visit and supporting the team throughout the week.

The members of the IDR review team were:

### IEA member countries

Team leader: Mr Tomáš Smejkal, Head of Strategy Unit, Department of Strategy and International Cooperation in Energy, Ministry of Industry and Trade, Czech Republic

Mr Matthias Löhrl, Policy Advisor, Security of Electricity Supply, Wholesale Electricity Market, Federal Ministry for Economic Affairs and Energy, Germany

Mr Diego Vázquez, Vice-Deputy Director, Sub-Directorate General for Hydrocarbons, Ministry of Industry, Energy and Tourism, Spain

Mr Klaus Hammes, Chief Economist, Energy Analysis Department, Swedish Energy Agency, Sweden

Mr Balazs Jozsa, Economic Analyst, European Commission, DG ENER A4, European Commission

Mr Marc Deffrennes, Nuclear Energy Analyst, Nuclear Development Division, Nuclear Energy Agency, OECD

### International Energy Agency

Mr Aad van Bohemen, Head of Country Studies Division

Mr Kieran McNamara, Energy Analyst, Country Studies Division

Mr Oskar Kvarnström, Energy Research Analyst, Country Studies Division

The review was prepared under the guidance of Mr Keisuke Sadamori, Director, Energy Markets and Security Directorate, IEA, and Mr Aad van Bohemen, Head of Country Studies Division, IEA.

Kieran McNamara managed the review and is the author of the report with the exception of Chapter 2 on energy and the environment and Chapter 3 on energy efficiency, which were drafted by Mr Oskar Kvarnström, and Chapter 6 on nuclear energy, which was drafted by Mr Marc Deffrennes of the Nuclear Energy Agency. Mr Jan Bartos was also a substantial contributor to Chapter 7 on oil and Chapter 8 on natural gas.

Mr Oskar Kvarnström prepared and drafted the sections relating to energy data contained in each chapter. Mr Aad van Bohemen, Mr Carlos Fernandez-Alvarez, Mr David Morgado, Ms Julie Cammell, Ms Rebecca Gaghen, Mr Keisuke Sadamori and Mr Laszlo Varro each contributed helpful comments throughout.

Mr Oskar Kvarnström, Ms Jiyeon Lim and Mr Bertrand Sadin prepared the figures. Ms Roberta Quadrelli and Mr Remi Gigoux provided support on statistics. Ms Viviane Consoli and Ms Therese Walsh provided editorial assistance, while Ms Muriel Custodio, Ms Astrid Dumond, Ms Katie Russel and Ms Isabelle Nonain-Semelin managed the production process. Mr Oskar Kvarnström and Ms Jiyeon Lim helped in the final stages of preparation.

## ORGANISATIONS VISITED

Association of Hungarian District Heating Enterprises

Central Eastern European Gas Exchange CEEGEX

Energiaklub

Energy and Public Utility Regulatory Authority

ENKSZ FŐGÁZ

FGSZ Ltd, Natural gas transmission system operator

FŐTÁV

Hungarian Atomic Energy Authority

Hungarian Gas Storage Ltd

Hungarian Gas Trade Ltd

Hungarian Gas Transit Ltd

Hungarian Office for Mining and Geology

Hungarian Petroleum Association

Hungarian Power Exchange HUPX

Hungarian Hydrocarbon Stockpiling Agency HUSA

MAVIR, the transmission system operator

Ministry of National Development

Ministry of National Economy

National Gas Storage Ltd MMBF

MOL Group, International, Integrated Oil and Gas Company

Hungary Power Company MVM Group

National Research, Development and Innovation Office

Nuclear Waste Management Plc

Paks Nuclear Power Plant Ltd (MVM)

Prime Minister's Office

# ANNEX B: Energy balances and key statistical data

## Energy balances and key statistical data

Unit: Mtoe

| SUPPLY | | 1973 | 1990 | 2000 | 2010 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|---|---|
| **TOTAL PRODUCTION** | | **12.70** | **14.69** | **11.62** | **11.87** | **11.47** | **11.08** | **11.30** |
| Coal | | 6.05 | 4.22 | 2.89 | 1.59 | 1.61 | 1.59 | 1.52 |
| Peat | | - | - | - | - | - | - | - |
| Oil | | 2.02 | 2.27 | 1.68 | 1.09 | 0.88 | 0.84 | 0.87 |
| Natural gas | | 4.03 | 3.81 | 2.47 | 2.23 | 1.54 | 1.44 | 1.37 |
| Biofuels and w aste[1] | | 0.59 | 0.70 | 0.76 | 2.67 | 3.19 | 2.89 | 3.15 |
| Nuclear | | - | 3.58 | 3.71 | 4.12 | 4.02 | 4.10 | 4.15 |
| Hydro | | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 |
| Wind | | - | - | - | 0.05 | 0.06 | 0.06 | 0.06 |
| Geothermal | | - | 0.09 | 0.09 | 0.10 | 0.11 | 0.09 | 0.11 |
| Solar/other[2] | | - | - | - | 0.01 | 0.04 | 0.06 | 0.07 |
| **TOTAL NET IMPORTS[3]** | | **8.60** | **14.00** | **13.63** | **14.88** | **11.80** | **14.06** | **13.40** |
| Coal | Exports | 0.11 | - | 0.13 | 0.28 | 0.44 | 0.45 | 0.31 |
| | Imports | 1.74 | 1.63 | 1.21 | 1.41 | 1.04 | 1.06 | 1.11 |
| | Net imports | 1.63 | 1.63 | 1.08 | 1.13 | 0.60 | 0.62 | 0.80 |
| Oil | Exports | 0.91 | 1.50 | 1.78 | 2.78 | 2.89 | 3.15 | 2.75 |
| | Imports | 7.38 | 7.93 | 6.99 | 8.56 | 7.87 | 8.94 | 9.34 |
| | Int'l marine and aviation bunkers | -0.05 | -0.16 | -0.23 | -0.24 | -0.17 | -0.18 | -0.18 |
| | Net imports | 6.42 | 6.27 | 4.98 | 5.54 | 4.81 | 5.61 | 6.41 |
| Natural Gas | Exports | 0.01 | 0.02 | 0.07 | 0.19 | 1.21 | 0.62 | 0.46 |
| | Imports | 0.17 | 5.19 | 7.35 | 7.91 | 6.77 | 7.43 | 5.68 |
| | Net imports | 0.15 | 5.17 | 7.28 | 7.72 | 5.56 | 6.82 | 5.22 |
| Electricity | Exports | 0.09 | 0.19 | 0.52 | 0.40 | 0.41 | 0.49 | 0.54 |
| | Imports | 0.49 | 1.14 | 0.82 | 0.85 | 1.43 | 1.64 | 1.71 |
| | Net imports | 0.40 | 0.96 | 0.30 | 0.45 | 1.02 | 1.15 | 1.18 |
| **TOTAL STOCK CHANGES** | | **-0.02** | **0.10** | **-0.25** | **-0.24** | **0.62** | **-1.31** | **0.51** |
| **TOTAL SUPPLY (TPES)[4]** | | **21.28** | **28.78** | **25.00** | **26.51** | **23.89** | **23.83** | **25.21** |
| Coal | | 7.91 | 6.23 | 3.85 | 2.72 | 2.25 | 2.21 | 2.36 |
| Peat | | - | - | - | - | - | - | - |
| Oil | | 8.15 | 8.35 | 6.63 | 6.55 | 5.68 | 6.39 | 6.85 |
| Natural gas | | 4.17 | 8.91 | 9.65 | 9.81 | 7.70 | 6.98 | 7.49 |
| Biofuels and w aste[1] | | 0.64 | 0.66 | 0.76 | 2.70 | 2.99 | 2.77 | 2.94 |
| Nuclear | | - | 3.58 | 3.71 | 4.12 | 4.02 | 4.10 | 4.15 |
| Hydro | | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 |
| Wind | | - | - | - | 0.05 | 0.06 | 0.06 | 0.06 |
| Geothermal | | - | 0.09 | 0.09 | 0.10 | 0.11 | 0.09 | 0.11 |
| Solar/other[2] | | - | - | - | 0.01 | 0.04 | 0.06 | 0.07 |
| Electricity trade[5] | | 0.40 | 0.96 | 0.30 | 0.45 | 1.02 | 1.15 | 1.18 |
| ***Shares in TPES (%)*** | | | | | | | | |
| *Coal* | | *37.2* | *21.6* | *15.4* | *10.3* | *9.4* | *9.3* | *9.3* |
| *Peat* | | - | - | - | - | - | - | - |
| *Oil* | | *38.3* | *29.0* | *26.5* | *24.7* | *23.8* | *26.8* | *27.2* |
| *Natural gas* | | *19.6* | *31.0* | *38.6* | *37.0* | *32.2* | *29.3* | *29.7* |
| *Biofuels and waste[1]* | | *3.0* | *2.3* | *3.0* | *10.2* | *12.5* | *11.6* | *11.7* |
| *Nuclear* | | - | *12.4* | *14.8* | *15.5* | *16.8* | *17.2* | *16.4* |
| *Hydro* | | *0.0* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* | *0.1* |
| *Wind* | | - | - | - | *0.2* | *0.3* | *0.2* | *0.2* |
| *Geothermal* | | - | *0.3* | *0.3* | *0.4* | *0.5* | *0.4* | *0.4* |
| *Solar/other[2]* | | - | - | - | *0.0* | *0.2* | *0.3* | *0.3* |
| *Electricity trade[5]* | | *1.9* | *3.3* | *1.2* | *1.7* | *4.3* | *4.8* | *4.7* |

0 is negligible, - is nil, .. is not available, x is not applicable. Please note: rounding may cause totals to differ from the sum of the elements.

Unit: Mtoe

| DEMAND | | | | | | | |
|---|---|---|---|---|---|---|---|
| **FINAL CONSUMPTION** | **1973** | **1990** | **2000** | **2010** | **2013** | **2014** | **2015** |
| **TFC** | **16.53** | **20.69** | **17.22** | **18.97** | **17.85** | **17.76** | **18.87** |
| Coal | 4.08 | 2.36 | 0.58 | 0.41 | 0.29 | 0.29 | 0.33 |
| Peat | - | - | - | - | - | - | - |
| Oil | 6.46 | 7.12 | 5.20 | 6.06 | 5.34 | 5.96 | 6.51 |
| Natural gas | 2.80 | 6.20 | 6.69 | 6.46 | 5.73 | 5.50 | 5.72 |
| Biofuels and waste[1] | 0.62 | 0.62 | 0.69 | 1.91 | 2.35 | 2.05 | 2.17 |
| Geothermal | - | 0.09 | 0.08 | 0.09 | 0.10 | 0.06 | 0.05 |
| Solar/other[2] | - | - | - | 0.01 | 0.01 | 0.01 | 0.01 |
| Electricity | 1.51 | 2.72 | 2.53 | 2.94 | 3.00 | 2.99 | 3.11 |
| Heat | 1.06 | 1.59 | 1.45 | 1.09 | 1.04 | 0.91 | 0.97 |
| ***Shares in TFC (%)*** | | | | | | | |
| *Coal* | *24.7* | *11.4* | *3.4* | *2.2* | *1.6* | *1.6* | *1.7* |
| *Peat* | - | - | - | - | - | - | - |
| *Oil* | *39.1* | *34.4* | *30.2* | *32.0* | *29.9* | *33.5* | *34.5* |
| Natural gas | *17.0* | *30.0* | *38.8* | *34.0* | *32.1* | *31.0* | *30.3* |
| *Biofuels and waste [1]* | *3.7* | *3.0* | *4.0* | *10.1* | *13.2* | *11.6* | *11.5* |
| *Geothermal* | - | *0.4* | *0.5* | *0.0* | *0.0* | *0.0* | *0.3* |
| *Solar/other [2]* | - | - | - | *0.0* | *0.0* | *0.0* | *0.1* |
| *Electricity* | *9.1* | *13.1* | *14.7* | *15.5* | *16.8* | *16.8* | *16.5* |
| *Heat* | *6.4* | *7.7* | *8.4* | *5.7* | *5.8* | *5.1* | *5.1* |
| **TOTAL INDUSTRY[6]** | **7.41** | **7.82** | **4.89** | **4.66** | **5.31** | **5.67** | **5.94** |
| Coal | 1.57 | 0.57 | 0.33 | 0.26 | 0.15 | 0.18 | 0.23 |
| Peat | - | - | - | - | - | - | - |
| Oil | 2.22 | 2.08 | 1.53 | 1.81 | 1.70 | 1.95 | 2.15 |
| Natural gas | 2.22 | 3.76 | 1.70 | 1.33 | 1.67 | 1.75 | 1.69 |
| Biofuels and waste[1] | 0.02 | 0.00 | 0.06 | 0.12 | 0.13 | 0.17 | 0.18 |
| Geothermal | - | - | - | 0.00 | 0.00 | 0.00 | 0.00 |
| Solar/other[2] | - | - | - | - | - | - | - |
| Electricity | 0.92 | 1.18 | 0.76 | 0.84 | 1.28 | 1.26 | 1.32 |
| Heat | 0.46 | 0.23 | 0.52 | 0.30 | 0.38 | 0.34 | 0.35 |
| ***Shares in total industry (%)*** | | | | | | | |
| *Coal* | *21.2* | *7.2* | *6.8* | *5.6* | *2.9* | *3.2* | *3.8* |
| *Peat* | - | - | - | - | - | - | - |
| *Oil* | *29.9* | *26.6* | *31.2* | *38.8* | *32.1* | *34.5* | *36.3* |
| *Natural gas* | *30.0* | *48.0* | *34.7* | *28.6* | *31.4* | *30.9* | *28.5* |
| *Biofuels and waste [1]* | *0.3* | - | *1.2* | *2.5* | *2.5* | *3.1* | *3.1* |
| *Geothermal* | - | - | - | - | - | - | - |
| *Solar/other [2]* | - | - | - | - | - | - | - |
| *Electricity* | *12.5* | *15.1* | *15.5* | *18.0* | *24.0* | *22.3* | *22.3* |
| *Heat* | *6.2* | *2.9* | *10.6* | *6.5* | *7.1* | *6.0* | *6.0* |
| **TRANSPORT[4]** | **2.28** | **2.93** | **3.04** | **4.12** | **3.49** | **3.91** | **4.22** |
| **OTHER[7]** | **6.83** | **9.93** | **9.30** | **10.18** | **9.06** | **8.19** | **8.72** |
| Coal | 2.13 | 1.79 | 0.25 | 0.15 | 0.14 | 0.11 | 0.10 |
| Peat | - | - | - | - | - | - | - |
| Oil | 2.41 | 2.21 | 0.73 | 0.43 | 0.43 | 0.43 | 0.45 |
| Natural gas | 0.58 | 2.44 | 4.99 | 5.10 | 4.03 | 3.71 | 4.00 |
| Biofuels and waste[1] | 0.60 | 0.62 | 0.63 | 1.62 | 2.08 | 1.69 | 1.81 |
| Geothermal | - | 0.09 | 0.08 | 0.09 | 0.10 | 0.06 | 0.05 |
| Solar/other[2] | - | - | - | 0.01 | 0.01 | 0.01 | 0.01 |
| Electricity | 0.52 | 1.43 | 1.69 | 2.01 | 1.62 | 1.62 | 1.69 |
| Heat | 0.60 | 1.36 | 0.93 | 0.79 | 0.66 | 0.57 | 0.61 |
| ***Shares in other (%)*** | | | | | | | |
| *Coal* | *31.2* | *18.0* | *2.7* | *1.5* | *1.5* | *1.3* | *1.1* |
| *Peat* | - | - | - | - | - | - | - |
| *Oil* | *35.3* | *22.2* | *7.8* | *4.2* | *4.7* | *5.2* | *5.2* |
| *Natural gas* | *8.5* | *24.6* | *53.7* | *50.0* | *44.4* | *45.3* | *45.8* |
| *Biofuels and waste [1]* | *8.8* | *6.2* | *6.8* | *15.9* | *23.0* | *20.7* | *20.8* |
| *Geothermal* | - | *0.9* | *0.9* | *0.0* | *0.0* | *0.0* | *0.6* |
| *Solar/other [2]* | - | - | - | - | *0.1* | *0.1* | *0.1* |
| *Electricity* | *7.6* | *14.4* | *18.2* | *19.7* | *17.9* | *19.8* | *19.4* |
| *Heat* | *8.7* | *13.7* | *10.0* | *7.7* | *7.3* | *6.9* | *7.0* |

Unit: Mtoe

| DEMAND | | | | | | | |
|---|---|---|---|---|---|---|---|
| **ENERGY TRANSFORMATION AND LOSSES** | **1973** | **1990** | **2000** | **2010** | **2013** | **2014** | **2015** |
| **ELECTRICITY GENERATION**[8] | | | | | | | |
| Input (Mtoe) | 6.36 | 9.62 | 10.18 | 9.88 | 8.31 | 8.15 | 8.39 |
| Output (Mtoe) | 1.52 | 2.45 | 3.03 | 3.21 | 2.61 | 2.53 | 2.61 |
| Output (TWh) | 17.64 | 28.44 | 35.19 | 37.37 | 30.29 | 29.39 | 30.34 |
| ***Output Shares (%)*** | | | | | | | |
| *Coal* | *66.0* | *30.5* | *27.6* | *17.0* | *21.1* | *20.8* | *19.5* |
| *Peat* | - | - | - | - | - | - | - |
| *Oil* | *17.2* | *4.8* | *12.5* | *1.3* | *0.3* | *0.3* | *0.3* |
| *Natural gas* | *16.2* | *15.7* | *18.8* | *31.0* | *18.3* | *14.4* | *16.8* |
| *Biofuels and waste* [1] | - | *0.1* | *0.3* | *6.6* | *6.4* | *7.6* | *7.6* |
| *Nuclear* | - | *48.3* | *40.3* | *42.2* | *50.7* | *53.2* | *52.2* |
| *Hydro* | *0.6* | *0.6* | *0.5* | *0.5* | *0.7* | *1.0* | *0.8* |
| *Wind* | - | - | - | *1.4* | *2.4* | *2.2* | *2.3* |
| *Geothermal* | - | - | - | - | - | - | - |
| *Solar/other* [2] | - | - | - | - | *0.2* | *0.4* | *0.6* |
| **TOTAL LOSSES** | **5.40** | **7.78** | **7.77** | **7.52** | **6.23** | **6.37** | **6.47** |
| of which: | | | | | | | |
| Electricity and heat generation[9] | 3.65 | 5.41 | 5.50 | 5.40 | 4.53 | 4.48 | 4.54 |
| Other transformation | 0.72 | 0.30 | 0.30 | 0.54 | 0.30 | 0.37 | 0.47 |
| Own use and transmission/distribution losses[10] | 1.03 | 2.08 | 1.97 | 1.58 | 1.40 | 1.53 | 1.47 |
| **Statistical Differences** | **-0.65** | **0.31** | **0.01** | **0.03** | **-0.20** | **-0.30** | **-0.13** |
| **INDICATORS** | **1973** | **1990** | **2000** | **2010** | **2013** | **2014** | **2015** |
| GDP (billion 2010 USD) | 72.34 | 103.77 | 106.60 | 130.26 | 133.16 | 138.55 | 142.91 |
| Population (millions) | 10.43 | 10.37 | 10.21 | 10.00 | 9.89 | 9.87 | 9.84 |
| TPES/GDP (toe/1000 USD)[11] | 0.29 | 0.28 | 0.23 | 0.20 | 0.18 | 0.17 | 0.18 |
| Energy production/TPES | 0.60 | 0.51 | 0.46 | 0.45 | 0.48 | 0.47 | 0.45 |
| Per capita TPES (toe/capita) | 2.04 | 2.78 | 2.45 | 2.65 | 2.41 | 2.42 | 2.56 |
| Oil supply/GDP (toe/1000 USD)[11] | 0.11 | 0.08 | 0.06 | 0.05 | 0.04 | 0.05 | 0.05 |
| TFC/GDP (toe/1000 USD)[11] | 0.23 | 0.20 | 0.16 | 0.15 | 0.13 | 0.13 | 0.13 |
| Per capita TFC (toe/capita) | 1.59 | 2.00 | 1.69 | 1.90 | 1.80 | 1.80 | 1.92 |
| $CO_2$ emissions from fuel combustion ($MtCO_2$)[12] | 66.4 | 65.7 | 53.3 | 47.1 | 40.2 | 40.0 | 42.5 |
| $CO_2$ emissions from bunkers ($MtCO_2$)[12] | 0.2 | 0.5 | 0.7 | 0.7 | 0.5 | 0.5 | 0.5 |
| **GROWTH RATES (% per year)** | **73-90** | **90-00** | **00-10** | **10-12** | **12-13** | **13-14** | **14-15** |
| TPES | 1.8 | -1.4 | 0.6 | -3.5 | -3.3 | -0.3 | 5.8 |
| Coal | -1.4 | -4.7 | -3.4 | -2.5 | -13.0 | -2.0 | 6.7 |
| Peat | - | - | - | - | - | - | - |
| Oil | 0.1 | -2.3 | -0.1 | -5.2 | -3.5 | 12.4 | 7.3 |
| Natural gas | 4.6 | 0.8 | 0.2 | -7.6 | -8.0 | -9.4 | 7.3 |
| Biofuels and waste[1] | 0.1 | 1.5 | 13.5 | 2.6 | 5.3 | -7.3 | 6.0 |
| Nuclear | - | 0.4 | 1.1 | 0.1 | -2.7 | 2.0 | 1.2 |
| Hydro | 3.1 | - | 0.6 | 6.1 | - | 44.4 | -23.1 |
| Wind | - | - | - | 19.8 | -6.1 | -8.1 | 5.3 |
| Geothermal | - | - | 1.4 | 4.0 | 5.6 | -19.5 | 15.4 |
| Solar/other[2] | - | - | - | 22.5 | 311.1 | 64.9 | 9.8 |
| TFC | 1.3 | -1.8 | 1.0 | -3.2 | 0.5 | -0.5 | 6.3 |
| Electricity consumption | 3.5 | -0.7 | 1.5 | 1.1 | -0.4 | -0.4 | 4.2 |
| Energy production | 0.9 | -2.3 | 0.2 | -0.5 | -2.4 | -3.4 | 1.9 |
| Net oil imports | -0.1 | -2.3 | 1.1 | -7.0 | 0.5 | 16.6 | 14.3 |
| GDP | 2.1 | 0.3 | 2.0 | 0.1 | 2.1 | 4.0 | 3.1 |
| TPES/GDP | -0.3 | -1.7 | -1.4 | -3.5 | -5.3 | -4.1 | 2.6 |
| TFC/GDP | -0.8 | -2.1 | -1.0 | -3.3 | -1.5 | -4.4 | 3.0 |

## Footnotes to energy balances and key statistical data

1. Biofuels and waste comprises solid biofuels, liquid biofuels, biogases, industrial waste and municipal waste. Data are often based on partial surveys and may not be comparable between countries.
2. Other includes tide, wave and ambient heat used in heat pumps.
3. In addition to coal, oil, natural gas and electricity, total net imports also include peat, biofuels and waste and trade of heat.
4. Excludes international marine bunkers and international aviation bunkers.
5. Total supply of electricity represents net trade. A negative number in the share of TPES indicates that exports are greater than imports.
6. Industry includes non-energy use.
7. Other includes residential, commercial and public services, agriculture/forestry, fishing and other non-specified.
8. Inputs to electricity generation include inputs to electricity, CHP and heat plants. Output refers only to electricity generation.
9. Losses arising in the production of electricity and heat at main activity producer utilities and autoproducers. For non-fossil-fuel electricity generation, theoretical losses are shown based on plant efficiencies of approximately 33% for nuclear and solar thermal, 10% for geothermal and 100% for hydro, wind and solar photovoltaic.
10. Data on "losses" for forecast years often include large statistical differences covering differences between expected supply and demand and mostly do not reflect real expectations on transformation gains and losses.
11. Toe per thousand US dollars at 2010 prices and exchange rates.
12. "$CO_2$ emissions from fuel combustion" have been estimated using the IPCC Tier I Sectoral Approach from the *2006 IPCC Guidelines.* In accordance with the IPCC methodology, emissions from international marine and aviation bunkers are not included in national totals. Projected emissions for oil and gas are derived by calculating the ratio of emissions to energy use for 2013 and applying this factor to forecast energy supply. Projected emissions for coal are based on product-specific supply projections and are calculated using the IPCC/OECD emission factors and methodology.

## ANNEX C: International Energy Agency "Shared Goals"

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

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

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

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

4. More environmentally acceptable energy sources need to be encouraged and developed. Clean and efficient use of fossil fuels is essential. The development of economic non-fossil sources is also a priority. A number of IEA member countries wish to retain and improve the nuclear option for the future, at the highest available safety standards, because nuclear energy does not emit carbon dioxide. Renewable sources will also have an increasingly important contribution to make.

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

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

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

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

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

(The Shared Goals were adopted by IEA Ministers at the meeting of 4 June 1993 Paris, France.)

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

## ANNEX D: Glossary and list of abbreviations

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

### Acronyms and abbreviations

| | |
|---|---|
| ACEA | European Automobile Manufacturers' Association |
| AEA | annual emission allocations |
| CCGT | combined-cycle gas turbines |
| CCHOP | Competitive Central Hungary Operational Programme |
| CCNS | Climate Change National Strategy |
| CEE | Central East European |
| CEEGEX | Central Eastern European Gas Exchange |
| CEF | Connecting Europe Facility |
| CESEC | Central and South East Europe Gas Connectivity |
| CHP | combined heat and power |
| COP | Conference of the Parties |
| DAM | day-ahead market |
| DH | district heating |
| DSO | distribution system operator |
| EAFRD | European Agricultural Fund for Rural Development |
| EDF | Electricité de France |
| EDIOP | Economic Development and Innovation Operational Programme |
| EECF | Energy Efficiency Credit Fund |
| EED | Energy Efficiency Directive (European Union) |
| EEEOP | Environment and Energy Efficiency Operational Programme |
| EEOP | Energy Efficiency Programme |
| EGS | Economy Greening Scheme |
| ENKSZ | *Első Nemzeti Közműszolgáltató Zrt* (National public utility services) |
| ENSREG | European Nuclear Safety Regulators Group |
| EPBD | Energy Performance in Buildings Directive (European Union) |
| EPC | engineering, procurement and construction agreement |
| ESCO | energy services company |
| ESD | Effort Sharing Decision |
| ESI | European Structural and Investment Fund |
| ETBE | ethyl tertiary butyl ether |
| ETS | Emissions Trading System |
| EU | European Union |
| EUA | EU allowance |

| | |
|---|---|
| FiS | feed-in tariff system |
| FIT | feed-in tariff |
| GEFS | Green Economy Financing Scheme |
| GINOP | Economic Development and Innovation Operative Programme |
| GIS | Green Investment Scheme |
| HAEA | Hungarian Atomic Energy Authority |
| HAG | Austrian–Hungarian interconnector pipeline |
| HEU | highly enriched uranium |
| HFC | hydrofluorocarbon |
| HGS | Hungarian Gas Storage Ltd (formerly E.ON Gas Storage Ltd) |
| HGV | heavy-goods vehicle |
| HHI | Herfindahl-Hirschman Index |
| HLW | high-level waste |
| HUF | Hungarian forint. In 2015 1 HUF = 0.00358 USD or 0.00323 EUR; |
| HUPX | Hungarian Power Exchange |
| HUSA | Hungarian Hydrocarbon Stockpiling Agency |
| IAEA | International Atomic Energy Agency |
| IGA | intergovernmental agreements |
| IPCC | Intergovernmental Panel on Climate Change |
| ISO | independent system operator |
| ITO | independent transmission operator |
| KEHOP | *Környezeti és energiahatékonysági operatív program* |
| LEU | low-enriched uranium |
| LPG | liquefied petroleum gas |
| MAVIR | *Magyar Villamosenergia-Ipari Atviteli Rendszeriranyito Zrt* (Hungarian transmission system operator) |
| MGT | Hungarian Gas Transit Ltd |
| MMBF | MMBF Natural Gas Storage Ltd |
| MOL | MOL Group (international, integrated oil and gas company from Hungary) |
| MRC | Multi-Regional Coupling |
| MTBE | methyl tertiary -butyl ether |
| MVM | MVM Group (Hungarian power company) |
| NABEPS | National Building Energy Performance Strategy |
| NAS | National Adaptation Strategy |
| NCCS | National Climate Change Strategy 2008-2025 |
| NDC | nationally determined contributions |
| NEEAP | National Energy Efficiency Action Plan |
| NEMO | nominated electricity market operator |
| NES | National Energy Strategy 2030 |
| NESO | National Emergency Strategy Organisation |

| | |
|---|---|
| NPP | nuclear power plant |
| NREAP | National Renewable Energy Action Plan |
| NRWR | National Radioactive Waste Repository |
| NSDS | National Sustainable Development Strategy |
| NTS | National Transport Strategy |
| NWE | North Western European |
| OMV | OMV Group |
| OPAL | *OPAL Szolgaltato Zrt* |
| OTKA | Hungarian Scientific Research Fund |
| OSART | Operational Safety Review Team |
| PCI | projects of common interest |
| PSF | Policy Support Facility (European Union) |
| PURAM | Public Limited Company for Radioactive Waste Management |
| RDI | research, development and innovation |
| RDP | Rural Development Programme |
| SME | small and medium-sized enterprise |
| TEEIAP | Transport Energy Efficiency Improvement Action Plan |
| TFC | total final consumption |
| TPES | total primary energy supply |
| TSO | transmission system operator |
| TTF | Title Transfer Facility |
| TYNDP | ten-year network development plan (European Union) |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USP | universal service provider |
| VAT | value-added tax |
| VEKOP | Competitive Central Hungary Operational Programme |
| V4 | Visegràd Group (Hungary, Czech Republic, Slovak Republic and Poland) |
| VPP | virtual power producer |
| WANO | World Association of Nuclear Operators |
| XBID | cross-border intraday market project |

## Units of measurement

| | |
|---|---|
| b/d | barrels per day |
| bcm | billion cubic metres |
| GW | gigawatt |
| GWh | gigawatt-hour |
| Hr | hertz |
| kb/d | thousand barrels per day |
| km | kilometre |

| | |
|---|---|
| $km^2$ | square kilometre |
| kWh | kilowatt-hour |
| $m^3$ | cubic metre |
| mb | million barrels |
| mcm | million cubic metres |
| MJ | megajoule |
| Mt | million tonnes |
| $MtCO_2$ | million tonnes of carbon dioxide |
| $MtCO_2$-eq | million tonnes of carbon dioxide-equivalent |
| Mtoe | million tonnes of oil-equivalent |
| MW | megawatt |
| MWh | megawatt-hour |
| PJ | petajoule |
| toe | tonne of oil-equivalent |
| tU | tonne of uranium |
| TWh | terawatt-hour |
| W | watt |

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# ENERGY POLICIES OF IEA COUNTRIES

## Hungary

### 2017 Review

Hungary's new energy strategy, the National Energy Strategy to 2030, published in 2012, was a major step in formulating a long-term vision for government policy in the sector. The main objective of the strategy was to ensure a sustainable and secure energy sector while supporting the competitiveness of the economy.

Mindful of high energy costs and their impact on family incomes, the government initiated a policy of mandatory price cuts to reduce household energy bills. While the short-term impact has been a reduction in energy bills, in the long term, this policy may damage national competitiveness. Renewable energy production has increased significantly in the last decade but growth in the sector has slowed. Recent reforms and the introduction of a new support system for electricity from renewable sources could arrest this slowdown. On the other hand, measures that limit wind power developments are likely to have a negative impact on the sector.

Greenhouse gas emissions have declined as the economy has become less carbon-intensive. Nonetheless, the country could adopt more ambitious targets for emission reductions. Energy security has been strengthened and there have been a number of large investments in oil, electricity and natural gas infrastructure. Further investments are expected, notably the construction of two new nuclear power generating units.

This latest review of Hungary's energy policies, the first since 2011, examines the current energy-policy landscape and makes recommendations for improvements. These recommendations are intended to guide the country towards a more secure and sustainable energy future.