

Introduction to the Hungarian energy market

WHY INVEST IN THE

HUNGARIAN GREEN INDUSTRY?

- competitive investment environment
- competitive energy prices
- favorable implementation costs
- Government commitment in the areas of sustainability and energy efficiency
- significant governmental investment plans, continuously developing environment
- ambitious renewable target (13% by 2020) – active area in terms of regulation, state support, technological innovations and investment opportunity
- advancing feed-in-tariff as well as “green” and “brown” market premium (tendering system) for renewable energy sources
- availability of state and European Union funds
- implementation of single energy market currently in progress in the EU



● GENERAL OVERVIEW

3rd Energy Package has been carried out

The liberalization of the Hungarian electricity and natural gas market was completed in 2008. Today every consumer has a free choice of supplier, although the prices for universal suppliers are still regulated. As far as European Union legislation is concerned, the application of the 3rd Energy Package has been carried out.

High energy import dependency

The majority of Hungary's energy supply is imported, and it will remain so for a long time. In 2016 74.7% (805 PJ) of the total primary consumption (1078 PJ) was imported. According to 2010-2020 forecasts, overall energy consumption in the next years will increase.

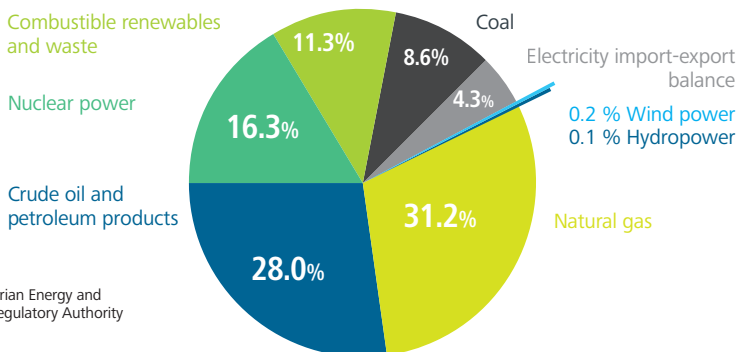
Hydrocarbon based energy mix

Natural gas and oil products play the most important role in Hungary's energy consumption and account for 59.2% of the total in 2016.

High RES potential

Renewable energy sources (RES) play an increasingly important role in the consumption mix. The share of RES in the total gross energy consumption was about 15% in 2016. The main contributor was biomass-based power generation. In addition, geothermal generation is forecasted to expand in Hungary in the coming years.

PRIMARY ENERGY CONSUMPTION IN 2016



Source: Hungarian Energy and Public Utility Regulatory Authority

ELECTRICITY MARKET

Stabile network infrastructure

Stable network infrastructure and international connections (further developments in progress). The development and operation of the Hungarian transmission system is carried out by MAVIR Hungarian Independent Transmission Operator Company Ltd.

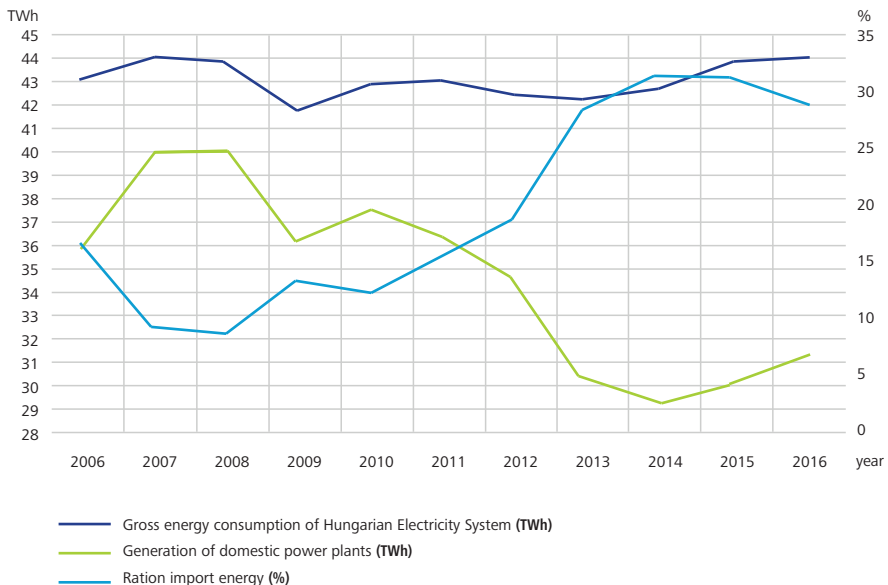
Good regional cooperation (Czech, Slovak, Hungarian and Romanian day-ahead electricity markets integrated).

Decreasing installed capacity

The installed total capacity of Hungarian power stations is about 8,500 MW. Electricity production capacity is continuously decreasing mainly due to the old age of power plants. The dedicated goal of the Government is to expand domestic production capacity.

The gross electricity generation of Hungary in 2016 was a total of 31.3 TWh, and gross consumption reached 43.9 TWh. In 2016 the import ratio was 28.88%. The main import partners are Slovakia and Ukraine; the main export partner is Croatia (north – south direction flow).

TOTAL GROSS ELECTRICITY CONSUMPTION, GENERATION OF DOMESTIC POWER PLANTS AND RATIO OF IMPORT ENERGY 2006-2016



Source: MAVIR VER 2016, Data of the Hungarian Electricity System

High market concentration

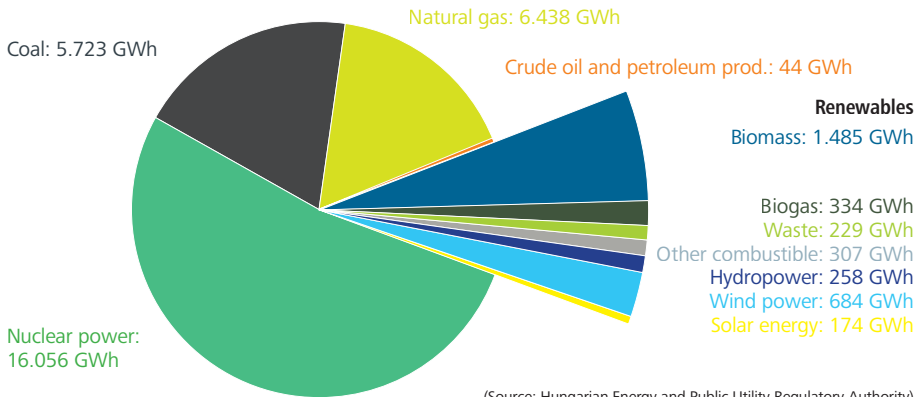
The production and wholesale market concentration is relatively high, with incumbent players like MVM, E.ON, RWE and NKM (national public utility company) ruling the market. Biggest transactions in 2007: MVM acquired 50% of NKM Ltd.; and NKM Ltd acquired DÉMÁSZ Ltd. (DSO).

Important role of nuclear energy

The resource side of the Hungarian electricity system is still dominated by the Paks Nuclear Power Plant, accounting for more than 50% of total domestic production.

The Paks II Nuclear Power plant with 2,400 MW installed capacity is in the preparation phase. The plant has already received the site permission and the environmental permit. Preparation of the site establishment application is in progress.

GROSS ELECTRICITY PRODUCTION IN 2016



Price regulated residential sector

The residential sector is under price regulation, and just a small number of households benefit from the advantages of the competitive market. NKM Ltd. is the only player who has a universal service license for the whole country.

Competitive supply market

There are more than 150 certified suppliers on the market, of which 30-40 are actively present on the market.

Advanced power exchange (HUPX) with continuously growing traded volume (HUPX - physical futures, day ahead, and intraday market). Market integration is continuing, Transmission System Operators and Electricity Market Operators - including Hungary ones - established a Local Implementation Project (LIP) to realize the coupling of intraday electricity markets by introducing implicit allocation of cross-border transmission intraday capacities on the Czech-German, Czech-Austrian, Austrian-Hungarian, Hungarian-Romanian and Hungarian-Croatian borders. Based on the initial project timeline, the LIP parties intend to go-live in Q4 2018.



NATURAL GAS MARKET

Decreasing consumption

Hungary's annual natural gas consumption has been gradually declining in the past few years; it was 12.6 billion m³ in 2010, but in 2016 it dropped to 9.7 billion m³ (336 PJ).

As a result of the fact that most of the natural gas is used for heating purposes, consumption is strongly seasonal.

The primary reason was a reduction in electricity generation from natural gas and a decrease in residential consumption. Another reason is the fact that energy-efficient solutions (such as insulation) are spreading and heating periods became shorter and shorter due to climate change. Energy security and diversification of sources has become a priority issue within the country and also in the EU.

High dependency on imports

In recent years, 20-25% of Hungarian natural gas consumption was secured from domestic production (60 PJ in 2016) and the rest was imported (302,5 PJ in 2016) from the direction of Ukraine and Austria.

Available grid and storage capacity

The Hungarian natural gas system is well-developed and young by the standards of European systems (the system has been built up during the past 30 years). Considering current consumption trends, the domestic gas supply and storage system is significantly over-sized, thus there is available capacity.

The Hungarian natural gas grid is 5,874 km long, and is operated by FGSZ Natural Gas Transmission Ltd. (MOL Group) and MGT Ltd. (MVM Group).

Hungary has 6 interconnection points, and has high storage capacity (6.33 Mm³) by regional standards.

Price regulated residential sector

The residential sector is under price regulation, and just a small number of households take advantage of the competitive market. Household consumption under universal service was 3,869 Mm³ in 2016. 4,676 Mm³ gas was sold on the liberalized market in 2016.

In 2017 NKM Ltd. acquired FŐGÁZ Ltd. (DSO) and received a universal service license for the whole country.

Developing a trading and retail market

The market-concentration is high. In the wholesale market just 3 companies had more than 5% market share. The liquidity of the Hungarian gas exchange (CEEGEX) is growing steadily.



RENEWABLE ENERGY MARKET (RES) AND GREEN INDUSTRIES

○ Hungary has excellent comparative assets in certain areas of green energy sources.

Considering Hungary's geographical conditions, of the renewable energy sources, energy generation from biogenic sources (forestry and agricultural biomass, biogas and biofuels), geothermal energy and, in the long term, solar energy and hydropower are the most important. Hungary's renewable generation at present is dominated by biomass.

The number and installed capacity of household small power plants has grown significantly in the past few years, increasing from 0.51 MW (2008) to more than 165 MW by the end of 2016¹. Hungary's 2020 RES target is 13%. However, in the National Renewable Action Plan, the government has set a target of 14.65%.

○ Renewable energy support scheme

In Hungary, the Government traditionally supports renewable electricity production with a Feed-in Tariff System and guaranteed price but from 2017, based on EU legislation, the system is changing. Feed-in Tariff entitlements based on the "old" regime could only be applied for until 31st December 2016. More than 2,400 applications (covering nearly 1400 MW) were submitted for participation in the Feed-in Tariff system based on the "old" regime at the end of 2016. The reason behind this is that these applications could receive an entitlement providing a much longer guaranteed profit margin (subject to electricity prices in the next 25 years) than what will likely be available under the new legislation. Approximately 30-50% of the planned solar power plant investments will be implemented.

The Renewable energy support scheme is changing based on EU legislation. The main features of the new system are:

- for power plants under 0.5 MW, Feed-in tariff system and guaranteed prices remain in place (available budget through 2026 is HUF 1 billion);
- for power plants between 0.5 and 1 MW (except wind) green premium prices can be given without a tendering process (available budget through 2026 is HUF 0.5 billion);
- power plants above 1 MW and all wind technologies can be supported through a tendering system (available budget through 2026 is HUF 1 billion):
 - producer sells on the market;
 - have to take the cost of schedule differences;
 - support / premium price = offered price – reference market price;
 - HEPURA (Energy Office) tender request;

¹ Source: Hungarian Energy and Public Utility Regulatory Authority



- MAVIR ZRt. (TSO) manages the system.
- those demonstration projects which have already received investment support for the implementation can be entitled to the Feed-in tariff as well
- as a new element of the support scheme, brown premium was introduced and came into force as of November 9th 2017.
 - it serves maintenance of the biomass and biogas power plants
 - under 5 MW, brown premium prices can be given without a tendering process
 - above 5 MW, power plants can be supported through a tendering system

Biofuel

Hungary has a large potential in biofuel production, supported by agricultural products. Based on experts' estimates, more than 10% of the estimated consumption can be fulfilled just from first-generation biofuels through 2020, while at the same time ensuring the fulfilment of food and feed provision objectives. With the emergence of second-generation biofuels, via the expansion of the scope of raw materials, this volume can be increased even further depending on the seasonal variations in the amounts of agricultural produce.

At present in Hungary there are two operating bioethanol producers: the Pannónia Ethanol Zrt. plant (year of opening: 2012), and the Hungrana Zrt plant. Both are operating profitably with their product exported to the German market.

Biomass and biogas

Hungary possesses excellent agro-ecological conditions for the competitive production of biomass. Hungarian agriculture is capable of sustainably producing biomass in excess of demand for food and feed, and at the same time there is significant biogas production potential. The theoretical potential of energy sources of biological origin (bioenergy) could exceed 20% of the energy source demand estimated for 2020, and bioenergy-based electricity production can be planned well in advance, and is also controllable. Therefore, the limitations on the production of bioenergy mainly lie in competitiveness. Bioenergy can primarily play a more important role in fulfilling local heating demand in the future, but there is also a goal of emphasizing the spread of small and medium-capacity combined electricity and heat generating systems in accordance with Hungary's Renewable Energy Utilization Action Plan.

Waste management¹

In Hungary, about four million tons of waste is generated every year, of which nearly 2/3 (2.6 million tons) is disposed of in landfills, 0.4 million tons is incinerated (in Budapest and in the Rákospalota incineration plant), and the remaining one million tons are recycled. The waste collection services and disposal is managed by a state owned company (NHKV Zrt.)

The government's main goals are:

- to decrease the volume of disposal;
- to increase energy based utilization (biogas recovery, co-incineration);
- to raise the volume of recycling.

¹ Source: National Waste Management Public Services Action Plan, 2016

Solar

There is notable solar potential in Hungary, with nearly 2,100 annual hours of sunlight, reaching a value of 1000 W/m² in some summer periods.

Hungary's biggest photovoltaic power plant, with 16 MWp capacity, opened in October 2015, on the premises of and under the ownership of Mátrai Power Plant, the largest coal-fired power plant in the country. Apart from this, only a small amount of solar capacity has been created, mostly through solar collectors. In 2016, MVM Group constructed a photovoltaic power plant with 10 MWp capacity in Pécs. In the future, the company is planning many other power plant investments such as in Felsőzsolca and Oroszlány (with total capacity of 100 MWp). MOL Hungarian Oil and Gas Group is planning an installation of 18 MWp capacity solar power by brownfield investment in three of its industrial parks. Furthermore, the company is looking for opportunities to install solar cells onto the top of 500 gas stations.

National and EU-level support plays a central role in the spread of solar energy systems.

Hydro

Hungary traditionally utilized hydro-energy up to the 19th century, and turned its attention back towards it again during the 1950s. Today, hydro power plants have a total production capacity of 50 MW, and are capable of generating around 200 GWh energy annually.

Geothermal

Hungary has excellent geothermal conditions and outstanding natural resources of thermal water; there are huge thermal wells both on the Great Plain and the Little Plain. Hungary's geothermal gradient (42-45 °C/km) is also higher than the world average. The heat content of thermal water is also outstanding. Its temperature exceeds 120-150 °C in many areas, where the same amount of heat can be gained considerably more cheaply than from natural gas.

Wind

The climate in Hungary is humid continental, and the prevailing winds mainly blow from the rim of the basin towards the central parts. The most optimal regions for the exploitation of wind energy can mainly be found in the country's North, North-West, and some South-East areas.

The connection of wind energy to the Hungarian electricity system began in 2006, when the Hungarian Energy Office opened a 330 MW capacity quota for wind energy. This amount has not been extended since then.

Today there are over 170 wind turbines in the country, with a tendency for growth in wind energy electricity generation. As far as wind is concerned, the National Renewable Action Plan foresees around 750 MW built in capacity and 1500 GWh of annual electricity generation through 2020.



SUCCESS STORIES FROM THE ENERGY SECTOR

Matrai photovoltaic power plant (16 MW)

Matrai Power Plant, the largest coal-fired power plant in Hungary, has opened the way to the innovative connection of traditional and renewable energy generation. The new power generating facility has been developed by the majority owner of the Matrai Power Plant, the German energy company RWE. The costs of the power plant reached EUR 20 million, nearly half of which was covered by a development tax-related allowance.

ALTEO Group

The company was established in 2008, defining energy generation as its main activity. In the following year ALTEO, in possession of a license from the Hungarian Energy Office, launched energy trading activity that produced outstanding sales revenues in the first year and then continuously developed, increasing the base of customers and the amount of electrical energy sold. ALTEO shares were floated on the Budapest Stock Exchange.

In 2017 ALTEO implemented a new power plant investment in Debrecen. The power plant can utilize and neutralize the landfill gas rich in methane produced through the decomposition of organic waste deposited in the Debrecen Regional Disposal Site.



