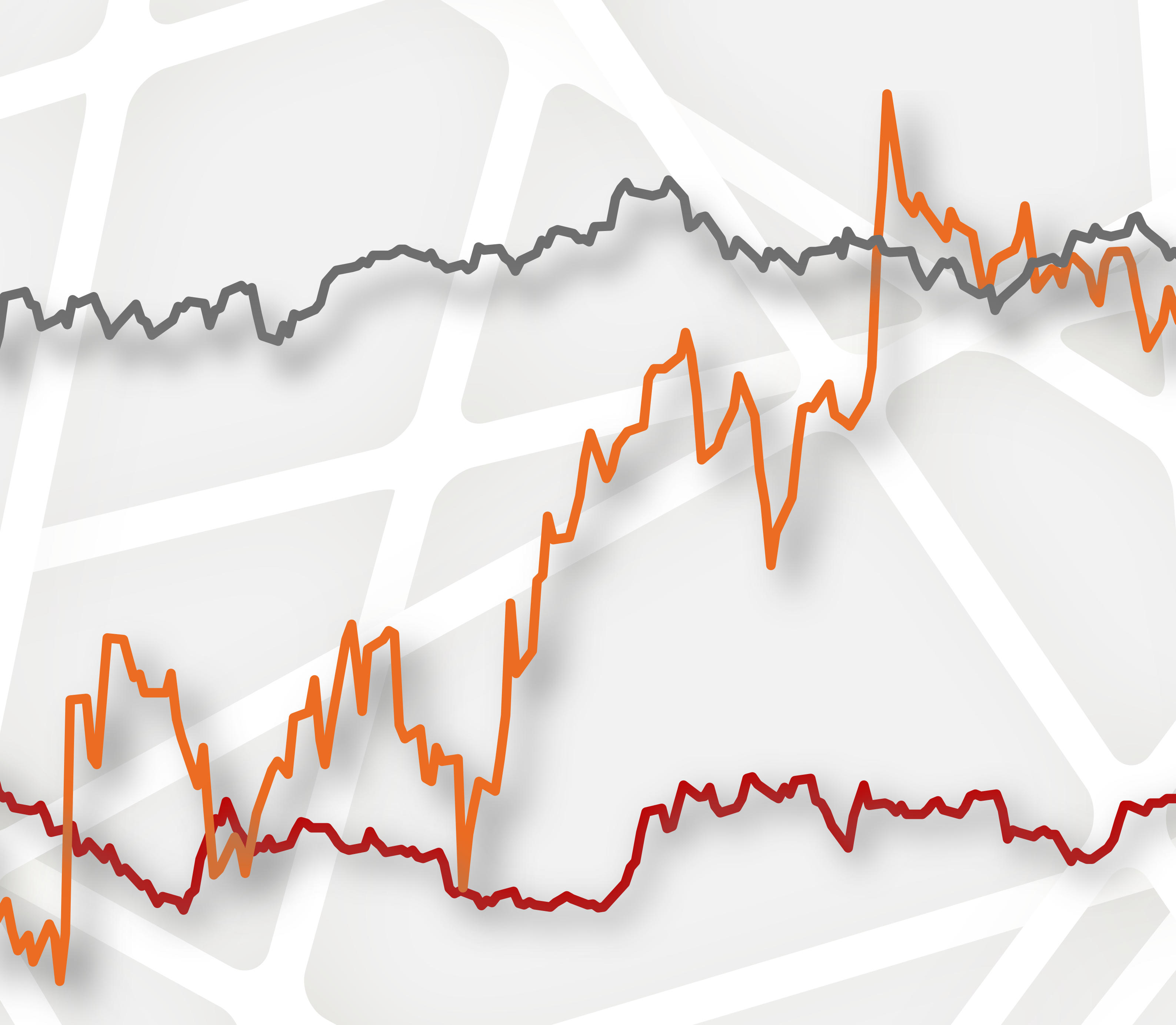


HUNGARIAN

# ENERGY MARKET REPORT

Q4 2016

REKK

FOUNDATION FOR REGIONAL POLICY CO-OPERATION IN ENERGY AND INFRASTRUCTURE

The REKK Foundation was formally established in March 2016 but its credentials, activities and purpose are centered on REKK's extensive experience from over 10 years of educational and regional forum activities.

The mission of REKK Foundation is to create a professional European-wide public forum engaging government officials, industry players, regulators, consumers, journalists and other interested individuals to discuss energy policy issues at the Hungarian, regional, European and international level. Our goal is for the REKK Foundation to be the preeminent energy 'think-tank' of Central and South Eastern Europe.

REKK was ranked #47 in 2016 and #48 in 2015 in University of Pennsylvania's 'Global Go To Think Tank Index' and is the only research institute in the region making the list of 'Top Energy and Resource Policy Think Tanks'.

In 2016 REKK Foundation has launched the 'MarketMonitoring Club' series, covering current energy market and energy policy issues. Topics discussed in 2016 were: Alternative scenarios for electricity and gas universal service pricing in Hungary, The role of SK-HU gas interconnector in the regional gas market and future expectations, Integration of RES-E generation to the Hungarian electricity network and Regulatory obstacles of better groundwater body usage.

Besides Hungarian market related events, REKK Foundation organizes regional energy policy forums as well. In 2016 in co-operation with Aures project lead by Technical University Denmark, we hosted the ‚Regional RES Planning – Renewable Energy Strategies in the 2020 context ' workshop. The flagship event of REKK Think Tank in 2016 was the 1st CSEEE Policy Forum: Regional vision of EU-level renewable energy governance and effort sharing for 2030 where high-level ministry representatives and other relevant stakeholders from the CSEE countries discussed the current state and outlook of regional renewable target setting for 2030.

Key 2017 events:

Regulatory implications of the European Union "Clean Energy" package workshop (16th February): The workshop dealt with the regulatory changes of the Clean Energy Europe package. Besides discussing the overall implications for the European energy markets, the presentations focused on the expected effects to the Hungarian energy markets.

Analysing the causes of the Hungarian wholesale electricity spike in January 2017 (29th March), MarketMonitoring Club

"Electricity Market Integration 2.0" in Central and South East Europe conference with keynote speaker Mr. Maroš Šefčovič (Vice-President for Energy Union, European Commission): The objective of the 2nd Central and South East Europe Energy Policy Forum is to bring together decision makers and industry representatives from the CSEE region to discuss the next steps of electricity market integration in this region.

**If you are interested in our actual events, please visit rekk.org!**

Dear Reader,

This issue features three in-depth articles covering a range of issues within the energy sector. First, an analysis of recent developments in Hungary's retail electricity and natural gas markets using aggregated company data within these sectors. The second article explores how expanded nuclear capacities at Paks and renewable based electricity generation may co-exist in 2020 and 2030. The final article reviews the substantial recent changes in natural gas transmission tariff levels across the Central and Eastern European region.

The first article deals follows the operation of the domestic energy trading companies. After reviewing the key regulatory developments of electricity and gas trading in Hungary over the last two decades, the accounting reports of representative energy trading companies are examined over the period. The effects of liberalization and nationalization are reflected by changes in market shares, trends in the profitability of energy traders and the working capital management of sector participants. Despite all the methodological difficulties, the time series data can be used to provide a more accurate picture of the changing profitability levels in domestic energy trading, the capability of companies to adapt and the market and business challenges that they face.

In the second article we examine how increased nuclear production with the enlargement of the Paks facility will interact with the planned expansion of renewable capacities according to Hungary's national energy plan. Discussions on the future of the domestic electricity sector often revolve around the conflict of nuclear and renewable production, with many claiming that given the size and structure of the domestic electricity market, the simultaneous expansion of the two technologies is incompatible. This concept is tested with the size of the domestic market, the magnitude of cross border capacities, must-run of natural gas power plants providing reserve capacity and the expected energy mix as inputs. The goal is to determine if enhanced renewable and nuclear capacities can co-exist within the domestic electricity system without the forced chargeback and reduced profitability of nuclear units and without endangering reserve management.

Our third article looks at the substantial changes in European natural gas transmission fees and their potential implications. The large scale tariff reductions across the region trend toward the formation of a "tariff competition" with the countries facing lower demand diverting transmission to their own gas networks. If this indeed happens, then natural gas trading may gather momentum within the Central-Eastern European region, possibly leading to more competitive gas prices both for the countries of the region and its southern neighbors.

Peter Kaderjak, director

# Contents




**Editor-in-chief**

Lajos Kerekes

**Authors:**

Ákos Beöthy, Balázs Felsmann, Enikő Kácsor, András Mezősi

**Proofreading:**

Nolan Theisen

**Published by:**

REKK Foundation



**For further information please contact:**

Edina Vári-Kiss

Tel.: (+36 1 ) 482 7073

E-mail: edina.varikiss@rekk.hu

# Energy market developments

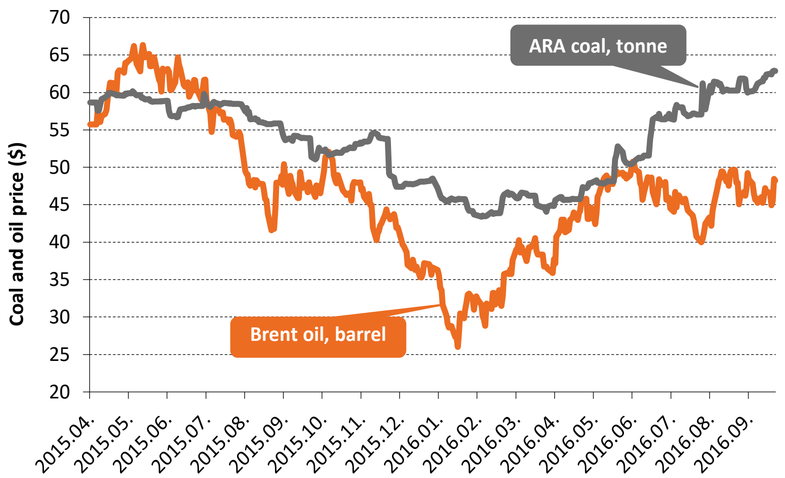
***The third quarter of 2016 witnessed skyrocketing global coal prices that translated to higher European electricity prices by the end of the quarter. Despite persistently low CO2 allowance prices, the higher coal prices combined with continued low gas prices led to the increasing competiveness of gas-fired power plants. The amount of gas transported from Austria to Hungary rose by more than 80% year-to-year accounting for some exports to Ukraine, while domestic gas exports grew to more than double.***

## International prices trends

The moderate rise in coal prices in the first half of the year – up 15% between January and June – was followed by a surge in the third quarter: average Q3 ARA prices were up by nearly 22% (Figure 1). Since coal prices were declining until February 2016, the rise in prices is less significant on an annualized level at 6%. The trend was reversed by capacity cutting measures of the biggest coal producer in the world, China. In line with these measures, mining companies are allowed to operate only for 276 days a year instead of the previous 330 days. Oil markets leave a less eventful quarter behind: quarterly average Brent prices were nearly identical to the average price of the period from April to June 2016.

The third quarter saw a significant (one third) rise in the average Q3 Japanese LNG price in EUR compared to the second quarter, however, it still lags behind year-on-year by nearly 30% (Figure 2). Falling prices might be reversed by the increasing resistance to restart nuclear blocks that replace gas-fired power generation capacities. In July, pressured by local inhabitants, a court decision suspended the planned recommissioning of two blocks of Takahama power plants amounting to 870 MW, and even the Szendai power plant that was recommissioned with two blocks of 890 MW at the end of 2015 might stop its operations following a security review initiated in October and scheduled for three months. Uncertainty over the future of nuclear energy may slow down fall in Japanese LNG demand (estimations suggest that 1 GW nuclear capacity can replace 1 million tons of LNG per year), even though both coal and renewables may be alternatives and strong competitors to LNG.

**Figure 1 Prices of month-ahead EEX ARA coal and Brent crude oil spot prices from April 2015 to September 2016**




Source: CME, IEA

TTF spot prices and German border prices of Russian long-term contracted gas nearly reached parity in Q3 2016, after being nearly 40% lower in Q3 2015. TTF prices were greatly influenced by news concerning the biggest British natural gas storage in the third quarter. In July, operators of Rough announced they would close the facility until next Spring due to technical issues, resulting in a significant oversupply on European markets when 3.3 bcm capacity intended for this storage had to be sold immediately on the Continent (European LNG re-exports increased as well). Lower July TTF prices in July were also caused by capacity constraints on the Belgian-France border, limiting Dutch L-gas exports to France. The moderate price increase at the end of the quarter is due to cuts in Norwegian production.

Russian exports to Europe exceeded 113 mcm in the first 9 months of 2016, nearly 14% higher the same period of previous year, because of favorable oil-linked prices. For the third time during its history and second time this year, Gazprom sold gas on European exchanges at the end of August/beginning of September. Delivery points for seasonal winter bundled products were Greifswald, Germany (the Nord Stream end-point), GASPOOL virtual hub, the German-Czech border, and for the first time in history Baumgarten and the Austrian-Italian border. This sold double the 2015 quantity amounting to 2 bcm, with a quarter at Baumgarten. Gazprom stated that in 2016 as opposed to 2015, market prices were lower than contracted prices, and reiterated that long-term contracts will remain the focus of its European sales strategy.

Year-ahead German baseload and peak electricity prices were relatively stable most of the third quarter (Figure 3). At the beginning of September, CO2 allowance prices fell below 4 EUR/ton for the first time in 3 years. Combined with the temporarily low coal prices, this led to baseload prices under 26 EUR/MWh. However, prices then increased following coal, gas and EUA prices as well as concerns about availability of nuclear capacities.

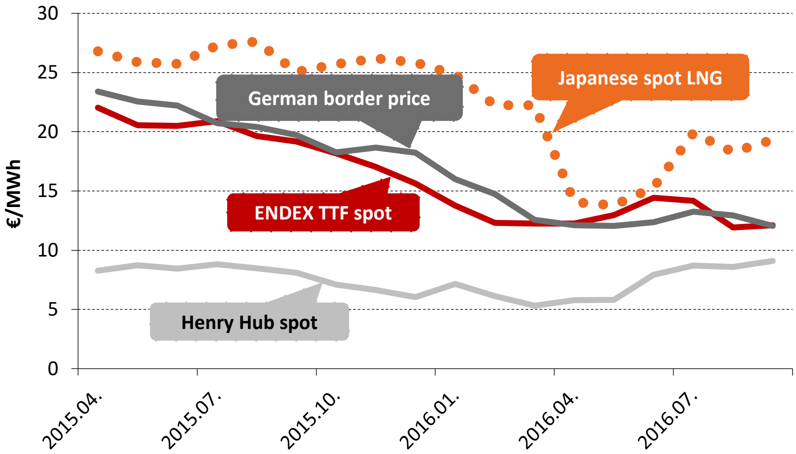
Increasing coal prices and the favorable effect of last months' fall in gas prices further improved the competitiveness of gas-fired power plants (Figure 4). Clean spark spread using German spot power prices was positive in August and September, meaning gas-fired power plants were profitable. This was also confirmed by the market information on gas-fired power plants in Germany that were out of operation earlier and started production later in the quarter. In August, coal-based power plants produced 1 TWh less than the previous year entirely offset by gas-fired power plants.

However, coal-fired power plants still have better prospects with low EUA prices. In Germany, gas-based co-generation unambiguously improved, shown by the sector's growth. In Hungary, gas-fired power plants were in a more favorable position due to much higher power prices with gas prices only slightly higher than in Germany.

## Overview of domestic power market

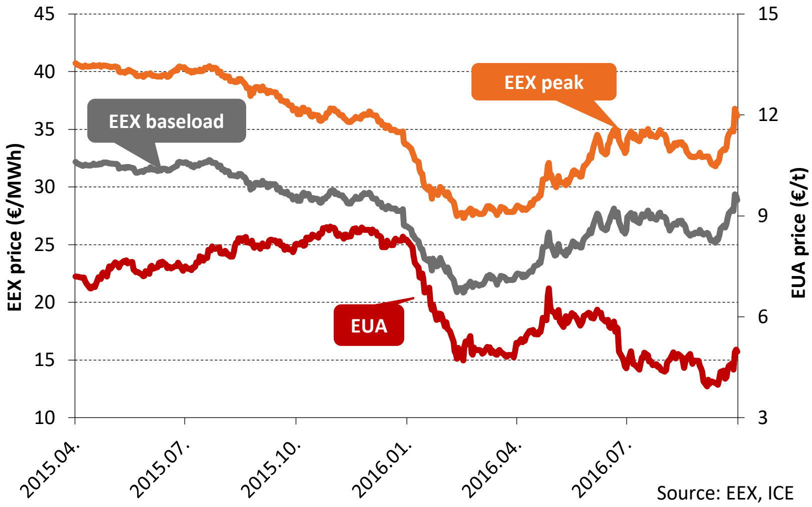
With no monthly capacity offered for import on the Austrian-Hungarian interconnection in June and only small amounts accounting for 19-29 MW in July-September, the result was relatively high capacity prices exceeding 11 EUR/MWh in August (Figure 5). Although Slovakian prices were the highest in August, they did not reach half of the Austrian level. Compared to the previous quarter, import capacity prices rose significantly on the Romanian-Hungarian interconnection: June prices

**Figure 2 Prices on select international gas markets from July 2015 to September 2016**



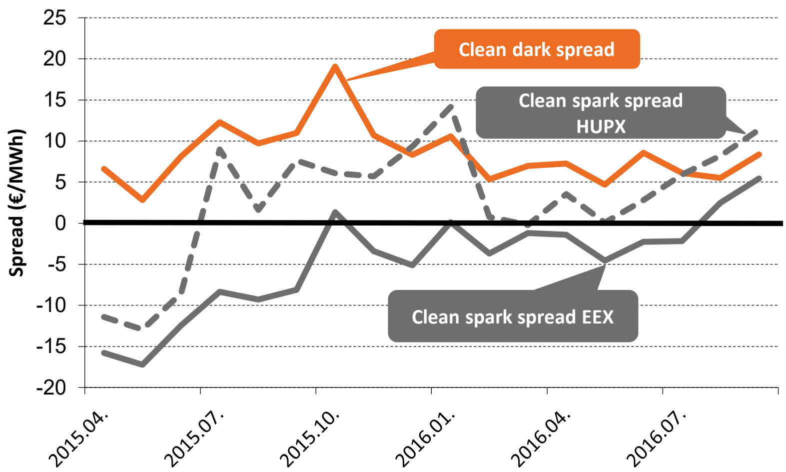

Source: Statistical Office of Japan Hivatal, EIA, Gaspool, IMF

**Figure 3 Prices of EEX year-ahead futures and CO2 allowances (EUA) with December delivery from July 2015 to September 2016**




Source: EEX, ICE

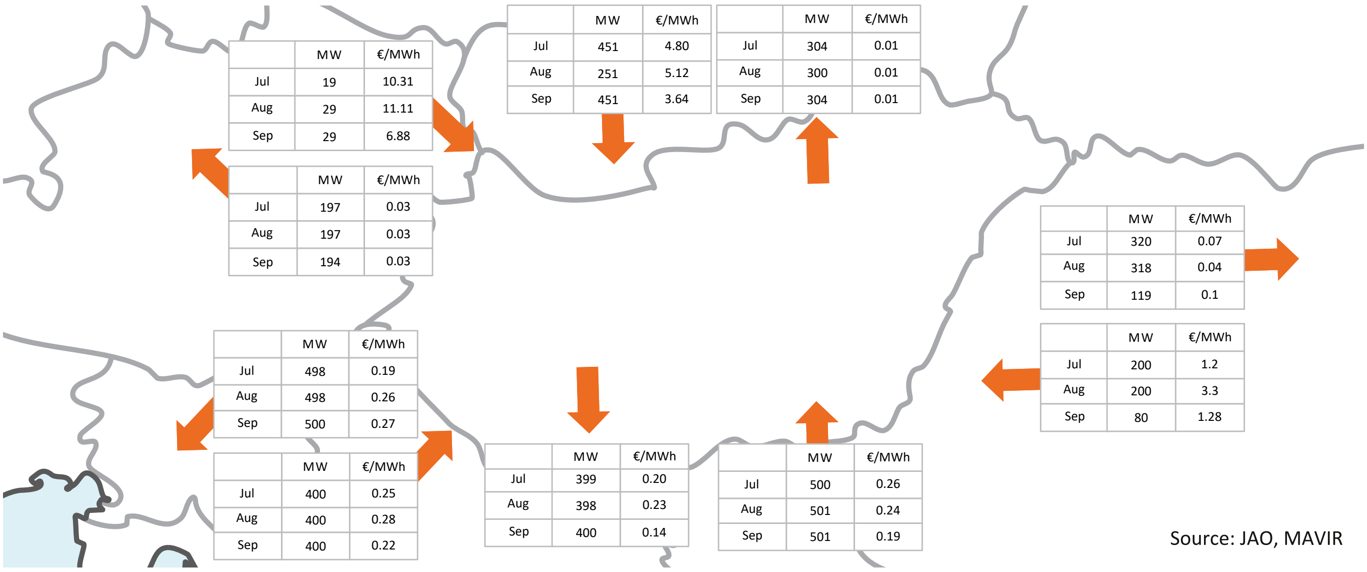
**Figure 4 Clean spark spread (gas fired power plants) and clean dark spread (coal fired power plants) on German market from April 2015 to September 2016**




Source: REKK calculations based on EEX, ICE and Gaspool data

*Note: Both indicators show the difference between electricity prices on exchanges and the cost of electricity generation, where the cost of production is added up by the cost of gas (spark spread) or coal (dark spread) needed for generating 1 MWh of electricity and the additional cost of CO2 emission allowances. Calculations are based on spot baseload power prices on the German EEX exchange, Dutch TTF spot prices and ARA coal prices. The Figure shows the monthly averages of these two indicators calculated with day-head market prices, assuming 50% energy efficiency in the case of gas-fired power plants and 38% in the case of coal-fired ones.*

**Figure 5 Results of monthly cross-border capacity auctions in Hungary, Q3 2016**



| | MW | €/MWh |
|---|---|---|
| Jul | 19 | 10.31 |
| Aug | 29 | 11.11 |
| Sep | 29 | 6.88 |

| | MW | €/MWh |
|---|---|---|
| Jul | 197 | 0.03 |
| Aug | 197 | 0.03 |
| Sep | 194 | 0.03 |

| | MW | €/MWh |
|---|---|---|
| Jul | 451 | 4.80 |
| Aug | 251 | 5.12 |
| Sep | 451 | 3.64 |

| | MW | €/MWh |
|---|---|---|
| Jul | 304 | 0.01 |
| Aug | 300 | 0.01 |
| Sep | 304 | 0.01 |

| | MW | €/MWh |
|---|---|---|
| Jul | 320 | 0.07 |
| Aug | 318 | 0.04 |
| Sep | 119 | 0.1 |

| | MW | €/MWh |
|---|---|---|
| Jul | 200 | 1.2 |
| Aug | 200 | 3.3 |
| Sep | 80 | 1.28 |

| | MW | €/MWh |
|---|---|---|
| Jul | 498 | 0.19 |
| Aug | 498 | 0.26 |
| Sep | 500 | 0.27 |

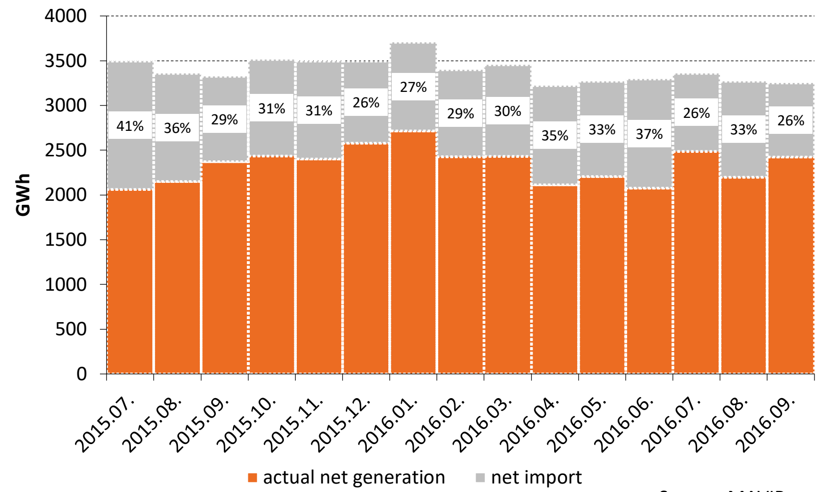
| | MW | €/MWh |
|---|---|---|
| Jul | 400 | 0.25 |
| Aug | 400 | 0.28 |
| Sep | 400 | 0.22 |

| | MW | €/MWh |
|---|---|---|
| Jul | 399 | 0.20 |
| Aug | 398 | 0.23 |
| Sep | 400 | 0.14 |

| | MW | €/MWh |
|---|---|---|
| Jul | 500 | 0.26 |
| Aug | 501 | 0.24 |
| Sep | 501 | 0.19 |

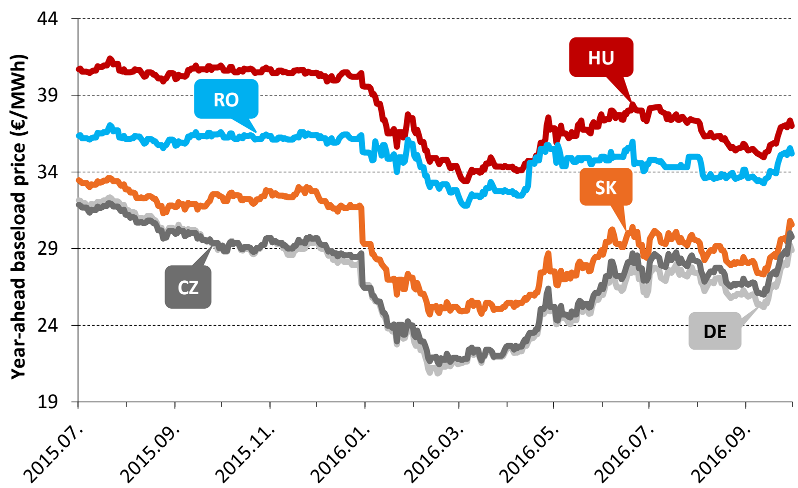
Source: JAO, MAVIR

**Figure 6 Hungary's net electricity production and monthly net electricity imports between July 2015 and September 2016**




Source: MAVIR

**Figure 7 Year-ahead baseload futures prices between July 2015 and September 2016**




Source: EEX, PXE

amounting to 0.6 EUR/MWh doubled by July, and peaked at 3.3 EUR/MWh in August, while quantity exceeded the June sales. This demonstrates an effective growth in demand for Romanian electricity imports.

Domestic power consumption declined nearly 3% in the third quarter on a yearly basis, while production grew by 8% due to the better utilization of gas-fired power plants. Consequently, the average import share fell from 35% to 28% (Figure 6).

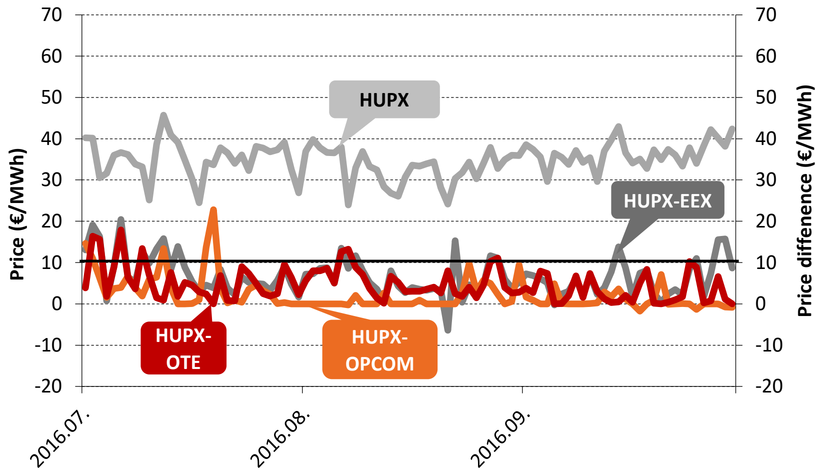
The third quarter average year-ahead HUPX baseload price was similar to the second quarter's average. Since EEX prices rose by more than 1.5 EUR in the same period, the HUPX premium fell by 15% to 9.72 EUR/MWh (Figure 7).

There were not any special deviations in day-ahead HUPX prices in the course of the third quarter (Figure 8). In the first half of July prices rose temporarily due problems with the cooling system of Mátra Power Plant that limited capacity and a non-scheduled outage of one of the blocks of Paks Power Plant. At the beginning of August another block at Paks Power Plant was stopped due to scheduled maintenance and several gas-fired power plants reported small outages, but these effects were moderated by mild weather and the low demand of the summer holiday season. By the time demand began to increase in September, Paks Power Plant was operating at full capacity. In the second half of September, import capacities from Slovakia halved because of scheduled maintenance of the 600 MW Győr-Gabcikovo transmission line, which was replaced by imports from Ukraine, Austria and Serbia and additional operation of domestic gas-fired power plants. In the last week of September, smaller power plant outages again led to price increases.

Amongst 4M MC, HUPX prices aligned most closely with the Romanian prices, with September the most aligned month of the quarter showing no difference between HUPX and Romanian prices in 83% of the hours. Interestingly, there were no differences between Slovakian and Czech prices in any hours of the quarter. HUPX prices were the same only in 28% of hours in August, with the highest level 55% in September (Figure 9).

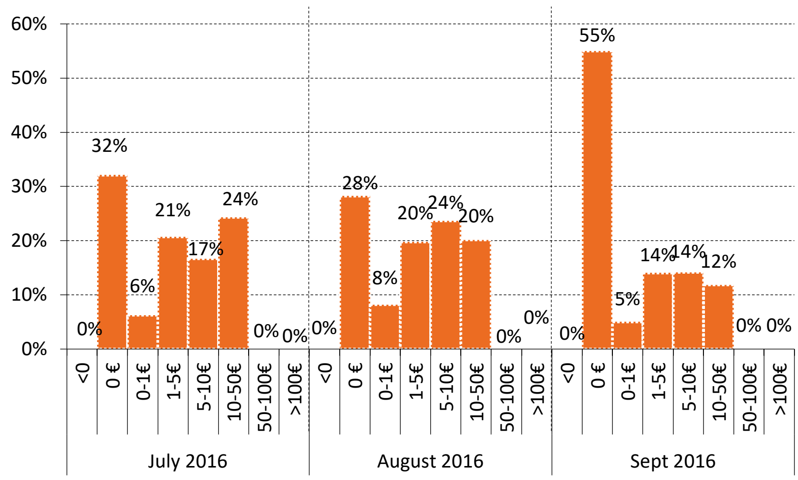
The wholesale price is affected by the costs incurred from the deviation of energy prices from normal schedule and balancing. The system charges for balancing energy was developed by MAVIR to provide incentives for market participants to try to manage foreseeable deficits and surpluses through exchange based transactions – in other words, covering the expected deficit and surplus by balancing the energy market would not otherwise be desirable. For this purpose, the price of upward balancing energy cannot be lower than the HUPX price for the same period, while the system operator does not pay more for downward balancing energy than the price at the exchange. In the third quarter of 2016, the average price of positive balancing was under 19 HUF/kWh and was more than 4 HUF less than the average of the second quarter. Peaks between 8 and 11 September are explained by the non-availability of several gas-fired power plants including the Csepel facility of 400 MW due to maintenance.

**Figure 8 Comparison of day-ahead baselaod prices on the EEX, OPCOM, OTE and HUPX exchanges between July and September 2016**



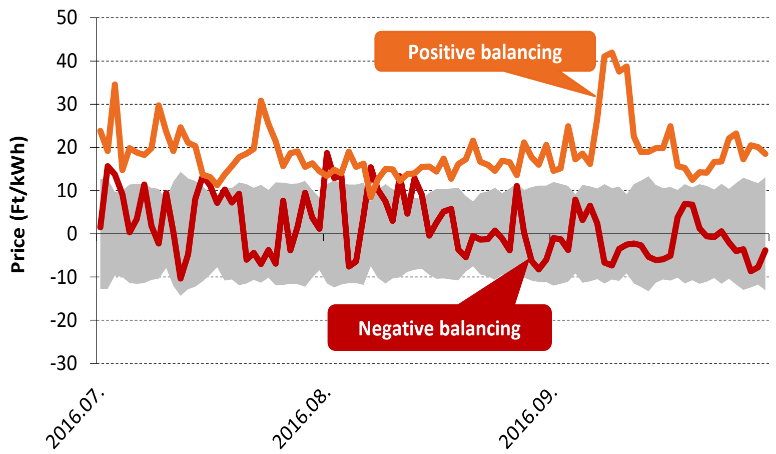

Source: EEX, OPCOM, OTE, HUPX

**Figure 9 Frequency of various levels of price difference between the Hungarian and the Czech exchanges between July and September 2016**




Source: REKK calculation based on OTE data

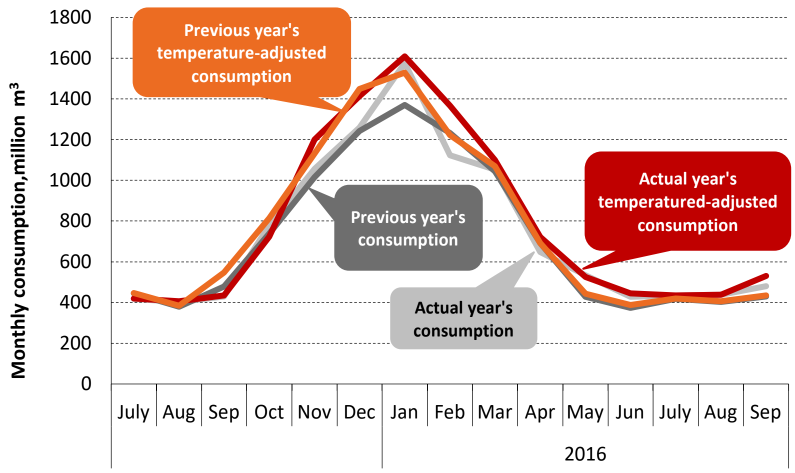
**Figure 10 Daily average of balancing prices and spot HUPX prices, Q3 2016**




Source: MAVIR, HUPX

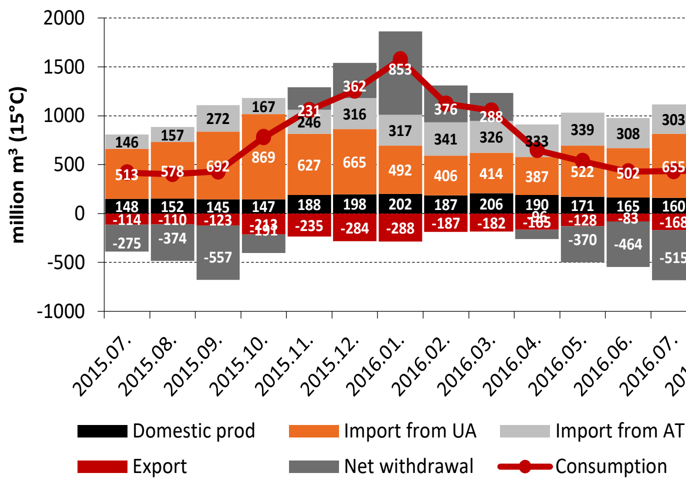
*Note: The upper edge of the grey range in the figure is determined by the next day price of HUPX, while the lower edge is the opposite of the same price. According to the Trading Rules of MAVIR the price of positive balancing power is limited to the next day price on HUPX, while the negative balancing power is constrained by the opposite of the next day price.*

**Figure 11 Raw and temperature-adjusted monthly gas consumption between July 2015 and September 2016 compared with the previous year**



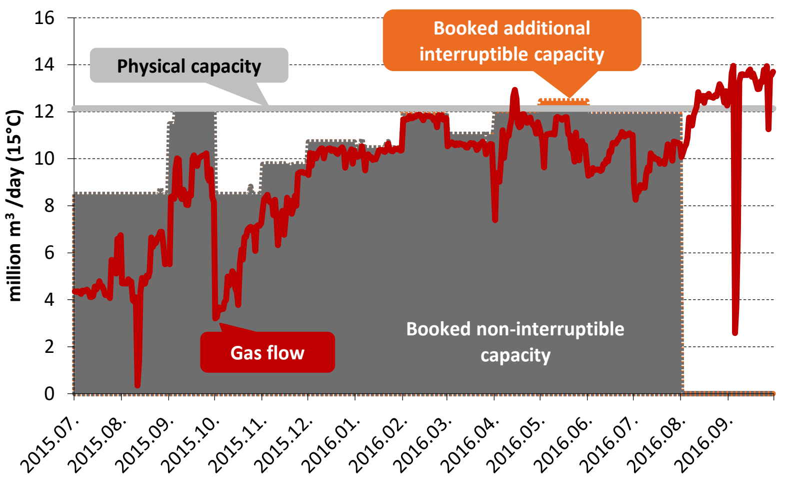

Source: FGSZ, European Climate Assessment & Dataset, and REKK calculations

**Figure 12 Source structure of Hungarian gas market by month between July 2015 and September 2016**




Source: FGSZ

**Figure 13 Transmission at the Mosonmagyaróvár (Austrian border) entry point between July 2015 and September 2016 together with booked interruptible and non-interruptible capacities**




Source: FGSZ

*Note: August and September capacity contracting data were not available until deadline.*

## Overview of domestic gas market

The nearly 1.4 bcm gas consumption of the third quarter exceeds the consumption of the previous year's third quarter by more than 100 mcm. Although the temperature does not have any special significance in this period, the shift in temperature-adjusted consumption was 40 mcm higher than the growth in effective gas consumption owing to a mild 2016 September compared to the year before (Figure 11).

Domestic production grew slightly more than consumption in the third quarter compared to the same period in the previous year, accounting for 37% of total consumption (Figure 12). Imports from Ukraine rose by 12% while imports from Austria were up by more than 80%. The latter is primarily explained by Ukraine's purchase of Western European gas. In August, maintenance works affecting the North Stream and the German-Polish interconnection also contributed to the restructuring of regular transport routes, leading to a significant fall in the volume of Russian gas transported through North Stream and Poland that shifted to the Ukrainian-Slovakian route. Growing transit through Hungary is represented by the value of annual domestic exports which doubled in the quarter.

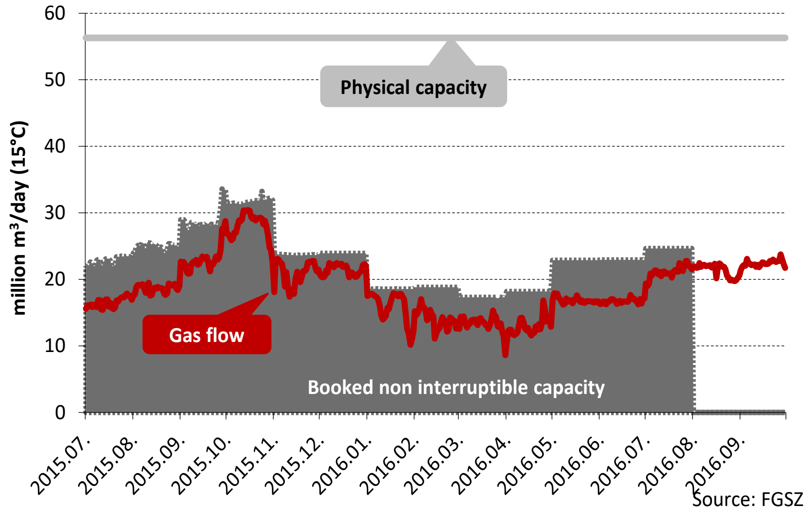
By the end of the quarter, market players injected 20% more gas into storages than the previous year, which was supported by regulatory measures. While universal service providers were required to inject 60% of the expected winter demand of households in underground storages up to 15 October, the basis of the 60% ratio will now be what amounts to the highest winter consumption of the last 10 years. Although the underground storage levels were less than 17% compared to last year's 21%, domestic storages closed in September at a much higher 57% compared to last year's 48%.

Figure 13 shows a significant shift in the capacity utilization of Mosonmagyaróvár entry point in August, when the monthly average utilization of the pipeline reached its physical capacity, even exceeding it in September. The quarterly average of utilization of 94% was far higher than the previous year's 52%. The 38% utilization of Beregdaróc entry point is also slightly higher than that of the previous year's 34% (Figure 14).

Natural gas exports more than doubled to 540 mcm year-on-year; 57% left to Serbia, 42.3% to Ukraine and 0.3% to Romania. While Ukraine did not import any gas from Hungary in Q3 2015, its gas imports accounted for more than 310 mcm in Q3 2016 because Ukraine supplanted gas purchases from Russia with Western sources. Market information suggests that the Ukrainian demand also effected the big Q3 increase of 98 GWh in gas traded at CEEGEX, more than 800 times 120 MWh of the same period one year ago. Nevertheless, even 98 GWh accounts for only 10 mcm, which less than 1% of domestic consumption in the period. From Q4, CEEGEX trades might grow since the number of tradable products was extended with balancing products.

Figure 16 shows that the rise in imports from the West in the third quarter might have been a result of favourable spot prices. While Russian import prices remained below TTF prices in the previous quarter, spot prices were lower than Russian import prices from July to September. The average purchase price (consisting of the weighted average of oil-indexed price and spot price at market exchange rates caluclated by REKK) moderately exceeded the recognised natural gas price of universal service providers.

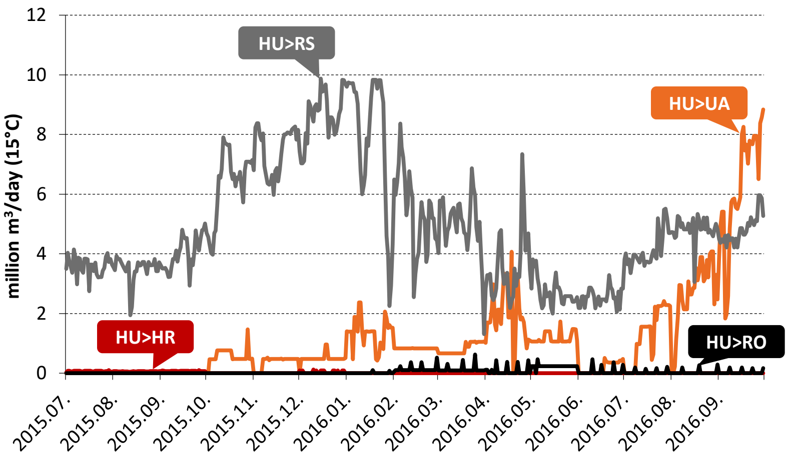
**Figure 14 Transmission at the Beregdaróc (Ukrainian border) entry point between July 2015 and September 2016, alongside booked interruptible and non-interruptible capacities**




Source: FGSZ

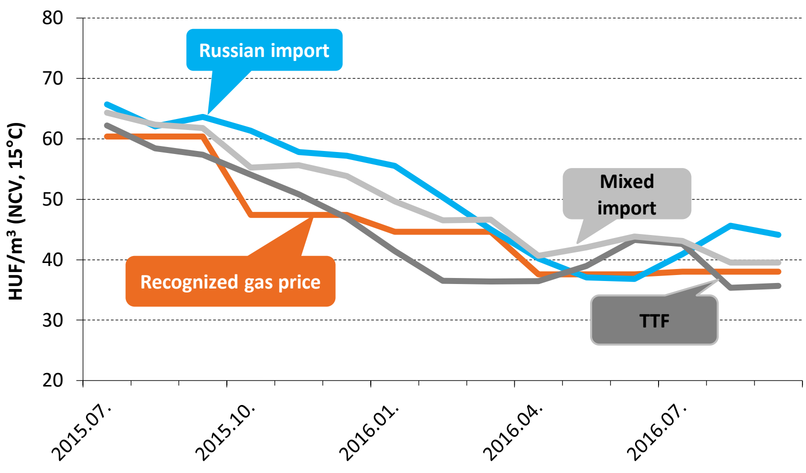
*Note: August and September capacity contracting data were not available until deadline.*

**15 Figure Hungary's natural gas exports to Ukraine, Croatia, Romania and Serbia from July 2015 to September 2016**




Source: FGSZ

**Figure 16 Recognised natural gas sales price of universal service providers and elements of the gas price formula between July 2015 and September 2016**




Source: REKK calculations based on EIA, Gaspool and Eurostat data

*Note: Russian import prices are calculated from Eurostat monthly data and converted to HUF at a market exchange rate. TTF price is a monthly average calculated from daily day-ahead prices converted into HUF at a market exchange rate. Recognised natural gas price is a price estimated on the basis of KHEM decree 29/2009. Mixed import price contains 60% oil linked price estimated on the basis of the decree and 40% TTF price. It differs from the recognised natural gas price not only in the weighthing of spot and oil linked price but also in the reference time period and the applied USD and EUR exchange rates, since spot prices determined by the decree are the averages of TTF future prices for the actual quarter quoted in the period from the 1st until the 15th day of the 2nd month of the quarter prior to the actual quarter, and are calculated at a non-market based USD and EUR exchange rate.*

# Before, during or after a model shift? – A review of the domestic retail energy market

***Over the last few years Hungary's retail gas and electricity markets have been significantly restructured by the state. Competition has been more or less eliminated from the household segment of the gas market and after a little more than a decade the market has come full circle - Hungarian households cannot choose their natural gas supplier. The program announced by the National Energy Strategy in 2011 to acquire direct public ownership of energy utilities has been essentially completed in the gas market. Since October 2016 FŐGÁZ – a gas supplier now under state supervision – has been serving the consumers that had previously been supplied by TIGÁZ. At the end of the year the universal service provider purchased from GDF SUEZ during the summer of 2015 and renamed ENKSZ Észak-Dél Regionális Földgázszolgáltató Zrt. was also merged into FŐGÁZ. Thus, 2017 started with FŐGÁZ becoming the one and only supplier of the universal service market with a sales volume of 3.5 billion m$^3$ (accounting for 45% of the total market).***

The question is whether this last consolidation marks the end of the changing market structures over the past decade and a half, or whether the current stage of market evolution is also temporary. In contrast with the gas sector, the universal service segment of the electricity market still includes two major privately owned companies, and although with the recently announced acquisition of EDF-DÉMÁSZ by the government state ownership has started to increase, the exclusively state controlled service model has not yet materialized. At the same time, the European Commission places increasing emphasis on its intention to eliminate regulated prices in retail markets. According to the draft directive on the rules guiding the internal market, released as part of the "Winter Package" in December 2016, Member States must remove regulations on final consumer prices, because they distort the market. According to the proposal, the institution of universal service may be retained for households and also for corporations with a maximum head count of 50, the annual revenues and the balance sheet of which stay below EUR 10 million, and member states can ensure universal access to energy through targeted social policy measures instead of general price regulation. For the time being the Commission's proposal only affects the electricity market, but eventually these changes are likely to apply to the gas sector as well. Once this happens, Hungary's centralized household gas supply system would come into question and additional reforms would be necessary.

With the prospect of further reforms in relation to the 'winter package' still years away, it is a good time to assess the development of the sector over the last decade. In our analysis, first we provide a brief overview of the most important events that influenced the development of the electricity and gas markets. Then we inspect the 2008-2015 accounting data of 25 energy trading companies registered in Hungary. For the last five years, the total revenues of these companies averaged slightly above HUF 2500 billion and 95% of market share, meaning the data will adequately represent the domestic energy trading sector.

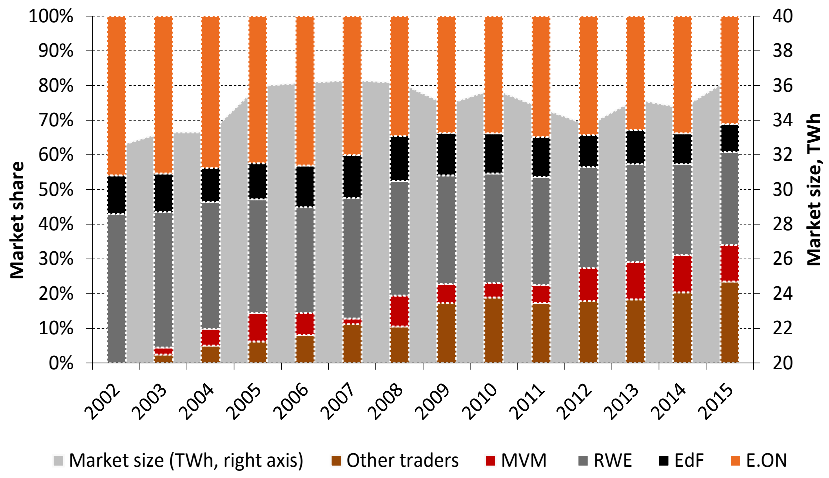
## The decisive events of the past two decades

The development of energy trading in Hungary for the last two decades can be split into three distinct sections: (1) privatization without competition allowing for regional monopolies (1995-2002); (2) liberalization and the appearance of alternative service providers within the market segment for households (2003-2011); (3) centralization efforts and strengthening state ownership (since 2011).

(1) The development path of the Hungarian retail energy sector can be traced back to the wave of privatization that took place during the mid-1990's. The energy trading and distribution companies, still vertically integrated at that time, were acquired by the dominant European companies of the sector: E.ON, RWE and EDF in the electricity market, and E.ON, GDF and ENI within the gas market. Following the privatization, a unique market structure evolved in Hungary. With the exception of FŐGÁZ, the only company with majority domestic ownership (although RWE, as a minority owner received important management rights here as well), all domestic retail positions were owned exclusively by multinational companies when the market opened in 2003.

(2) The evolution of Hungarian energy trading into a multi-player competitive market started with the partial liberalization of electricity and gas markets in 2003 as part of Hungary's EU accession negotiations. Immediately after the regulatory amendments of 2003 new, independent energy traders appeared in the market to supply the so-called eligible consumers which were allowed to meet their electricity and gas needs on the competitive market. After 2003 - in addition to the incumbent companies that had already been present since privatization in the mid 90's – major regional energy service providers, like CEZ and MOL also established their Hungarian trading subsidiaries. State owned MVM, which had a dominant position in the wholesale market, also expanded its activities into the retail market by establishing MVM Partner. The previous public utility model came to an end with the adoption of the Electricity Act of 2007 and the Natural Gas Act of 2008. Following the adoption of these new regulations, 2008-2011 was the period when the market was fully opened for electricity and gas trading, and even the economic turmoil in the fall of 2008 could not derail these developments. New trading companies, such as the MOL Energiakereskedő Kft. (renamed to MET Zrt. later on), under partial ownership of MOL, entered the market. Another major entrant to the liberalized energy market was the trading company of Magyar Telekom, created in 2011 with the purpose of generating competition for universal service providers within the household segment of the market. The entry of this company into electricity and gas trading coincided with substantial changes to the regulatory environment that raised questions as to the viability of the competitive market model. By 2011, the freezing of universal service prices, modification of the previous regulation on margins, and setting of regulated prices essentially restored the original market conditions of the period before liberalization to the universal service market.

**Figure 1 Market shares and the size of the retail electricity market in Hungary between 2002 and 2015 (based on the Parliamentary reports of the MEKH and edited by REKK)**



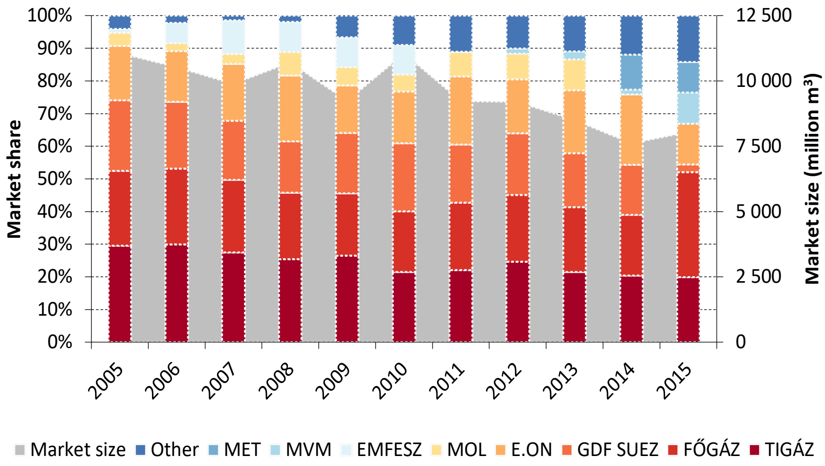

Source: REKK based on HEPURA reports

(3) The "National Energy Strategy 2030", adopted in 2011, created new priorities for sector regulation. The new strategy argues in favor of strengthening direct state participation. According to the authors of the strategy "ensuring the coherence of legal and economic conditions in itself is not sufficient to efficiently impose public good and the national interest." Robust ownership and powerful state regulation are also necessary for the development of the energy sector to align with the direction envisaged by the government. The changes have reached as far as the regulatory environment of the trading sector, primarily through the introduction of regulated prices for household (universal) services to replace the previous price margin regulation, and also through the purchase of natural gas universal service providers and portfolios under government control.

## The development of market shares

Changes in the market can be better understood by the market share time series prepared annually by MEKH as part of its Parliamentary Report. Market shares are calculated by the authority from physical quantities. As the data series shows, as a result of the liberalization of the retail electricity market, enacted in 2003 and reaching maturity by 2008, the market share of the three traders that had previously enjoyed regional monopolies (the domestic subsidiaries of E.ON, RWE and EDF) gradually started to decline. Figure 1, however, also highlights the limits of liberalization, since 10 years after the first market opening measures the former incumbent traders still supply almost 70% of market.

**Figure 2 Market shares and the size of the retail gas market in Hungary between 2005 and 2015 (Edited by REKK based on the Parliamentary reports of the MEKH)**




Source: REKK based on HEPURA reports

With respect to market shares within the retail gas market we can also observe that, despite turbulent changes in the market environment, the decisive retail market conditions changed slowly until 2014. Up until the recent past the dominance of the incumbent players (TIGÁZ, FŐGÁZ, GDF SUEZ and E.ON) was intact, even though their total market share fell from 91% in 2005 to 67% in 2015. First the household gas segment of E.ON, then the GDF SUEZ subsidiary providing universal services were transferred to FŐGÁZ, the company that was then purchased by the state. In addition to changes in ownership and the rules governing universal service, gas traders are also challenged by the deep contraction of the market, as its size fell from 11 billion $m^3$ in 2005 to 8 billion $m^3$ in 2014.

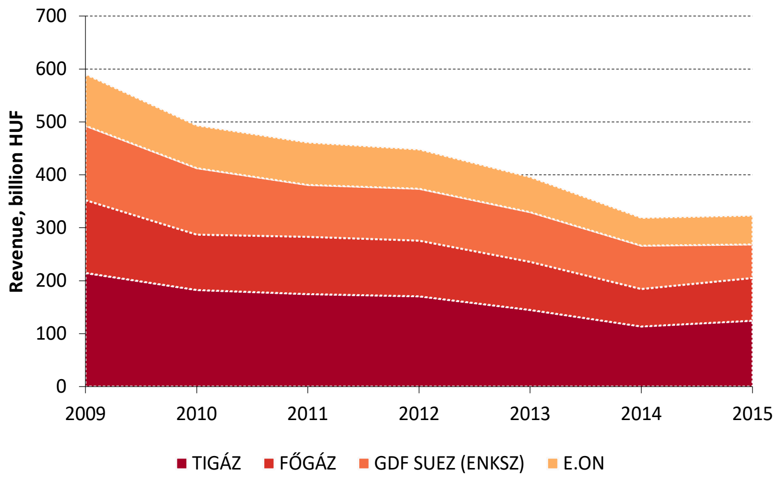
Further analysis of the electricity market reveals a reversal in trends of quantitative and qualitative indicators for the last few years. Between 2013 and 2016 the average monthly value of electricity sales in the competitive market increased from 1900 GWh to 2100 GWh, while sales within the universal service segment ranged between 900 and 960 GWh. Despite growing volumes, the value of sales radically declined in both market segments. Sales in the universal service market shrank from 17.5 billion HUF/month on average in 2013 to 13.7 billion HUF/month in 2016, while the size of the competitive market fell from 36.4 to 31.8 billion HUF/month. The whole period can be characterized by gradually eroding prices, the prime explanation of lower revenues. While, according to MEKH data, during the 1st quarter of 2013 the average price was 19.07 HUF/kWh in the competitive market and 18.76 HUF/kWh within the universal service market, these prices fell to 14.29 HUF/kWh and 15.09 HUF/kWh by the 2nd quarter of 2016.

Regulatory price setting and declining gas prices instigated a dramatic decline for the universal service sector of the gas market, both within the competitive and the household segment. According to Figure 3 the total sector revenue of the four universal service providers fell from HUF 590 billion in 2009 to HUF 323 billion in 2015. Not surprisingly, the drop in revenues also influenced profitability. Since 2013 all universal service branches faced operating losses, between 2010 and 2015 the aggregated operating income of the service providers amounted to a loss of HUF 103 billion.

Nevertheless, in spite of all of these challenges, the market share of independent traders increased and has now reached about 30%. This concentration is especially high if we consider that the household market segment, or about 45% of the whole market, is not accessible for new entrants.

Next, we analyse the company financial reports to review how the changes in the market and regulatory environment impacted the performance of companies in the electricity and natural gas sectors since full market opening nearly a decade ago.

**Figure 3 Annual revenue of the gas branch of universal service providers between 2009 and 2015 (Edited by REKK based on market segment data published in the supplementary annexes of corporate reports)**




Source: REKK based on annexes of company annual reports

## The analytical method for corporate data

In our analysis, we examined the financial data of 25 companies active in the field of energy trading, covering the period of 2008 to 2015. The data came from the corporate information service of the Ministry of Justice, e-beszamolo.im.gov.hu. It was our intention to define a sample that is as representative of the domestic market as possible. The sample contains all electricity and gas trading incumbent companies – those that were already in the market before 2003 – the domestic subsidiaries of EDF, E.On, GDF SUEZ, RWE, ENI, as well as the trading companies of domestic incumbents FŐGÁZ/ENKSZ and the MVM Group. Of the new entrants of the post-2013 period Alteo, Budapesti Energiakereskedő (Budapest Energy Trader), CEZ, CYEB, Econgas, E-OS, Greenergy, IFC/Optenergy, JAS, Nordest Energy, and VPP were included in the sample. While this group of companies does not make up the whole market, we believe that they properly represent the sector, with a few limiting remarks:

Since our primary goal was the analysis of the retail market, we excluded those companies that clearly focus on wholesale activities (EFT, MFGK)

There are international companies that conduct their energy trading activities in Hungary without having an established domestic subsidiary under Hungarian law, operating as a branch office. Since determining the share of Hungarian activities based on the reports of these companies is difficult, we decided to remove them from the analysis

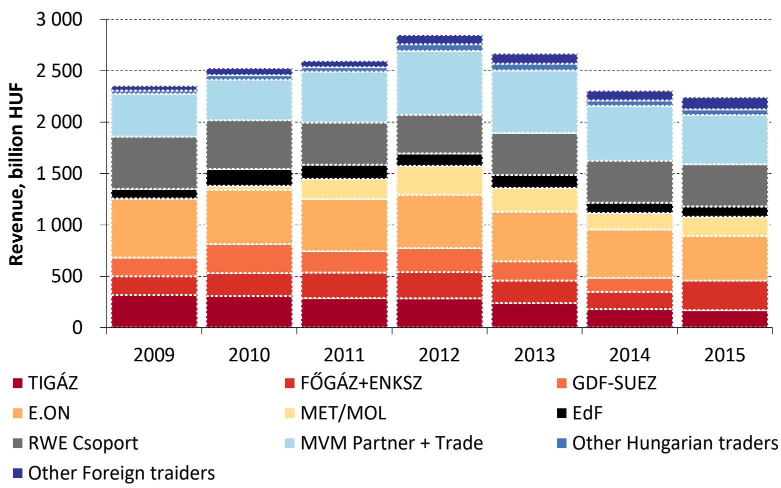
Those companies that were included in the sample either achieved a turnover of at least HUF 10 billion in any of the inspected years or surpassed the HUF 1 billion mark in at least three years within the examined period

Our analysis is restricted to two groups of indicators due to space limitations. Of the earnings related indicators we show the gross margin percentage (revenues minus the cost of sold goods and the value of transmitted services) and the EBITDA per revenue. Within operational indicators we devote our attention mainly to the question of working capital. We examine changes in the need for working capital and the turnover rate for accounts receivable.

In order to standardize the data, we modified the raw financial statements in several respects. The companies contained in the database operate under differing management and organizational structures. Most companies carry their trading activities in legally independent subsidiaries, while others function in an operative holding structure, conducting trading and investment activities in the same company. The most typical sector specific investment - characteristic to the incumbents - is ownership of the DSOs. Most of these traders (ELMŰ-ÉMÁSZ, FŐGÁZ, GDF SUEZ, TIGÁZ, EDF-DÉMÁSZ) directly own the business segments of the distribution companies that belong to the holding, therefore the legal entity in charge of trading is also an investment company, best described with the organizational scheme of the operative holding. E.On chose a different organizational solution and proceeded with full legal unbundling, as a result of which all its Hungarian investments were placed under a strategic holding company (E.On Hungária Zrt.) as independent subsidiaries.

We also find other examples for mixed profile companies, such as ALTEO and Greenergy, where trading companies in the competitive market own producers (power plant companies) as well. In order to ensure improved data standardization, we amended the reports of those companies that have substantial investments according to their accounting reports. On the asset side of the balance sheet we subtracted the book value of non-commercial investments from total investments, while on the liability side we reduced the value of the equity with the same figure. We also amended the raw financial numbers within the income statement by subtracting the value of dividends received from distributor or producer subsidiaries.[1] We employed these amended reports for subsequent analysis.

**Figure 4 The revenue of Hungarian electricity and gas traders between 2009 and 2015**




*1 One may question why, in the case of companies with several business segments, we did not use activity (business segment) reports that are obligatory to prepare as annexes to the annual report. Since activity reports do not distribute general expenses among individual business segments, and they do not contain capital consolidation, in our opinion their use would have resulted in increased distortion within the analysis.*

## The profitability of energy traders

Since MEKH calculates the market share based on sold volume, it makes sense to supplement this calculation with the analysis of the time series of revenues. The revenues of the companies in the sample displayed constant growth during the first part of the inspected period before declining between 2012 and 2015. The total electricity and gas trading revenue of the former incumbent companies that also have distribution networks topped at HUF 1,974 billion in 2010, then fell to HUF 1,404 billion by 2015.

One of the new entrants, MVM Partner[2] reached its peak revenue of HUF 623 billion in 2012, maintained this level in 2013, but faced lower revenues of HUF 477 billion in 2015. The revenue of MET also peaked in 2012 at HUF 280 billion, shrinking to HUF 158 billion in 2014, but started to rise again in 2015, reaching HUF 187 billion.

In addition to revenues, the gross margin (revenue minus the purchase cost of sold goods and services, divided by revenue) also displays an interesting tendency. The average value of gross margin reveals relative stability for the sample as a whole. The lowest value was 8.5% in 2013, while the highest value was 11.2% in 2011.

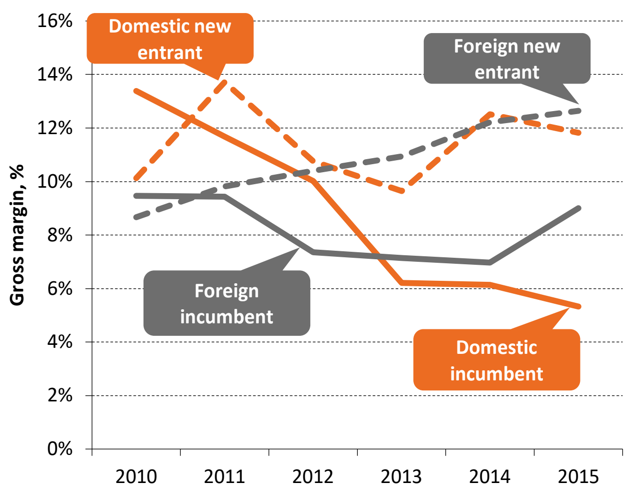
Figure 5, however, makes the picture more nuanced. New entrants typically enter market segments that offer higher margins, and their gross margin tend to exceed the level of incumbent companies. Traders present strictly in the competitive market and traders with a mixed presence are also worth comparing. The drastic impact of regulated prices on margins is clearly visible for the latter group for the post-2012 period.

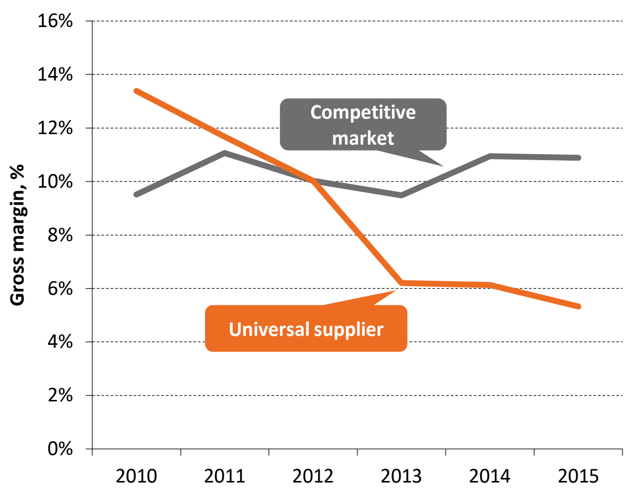
EBITDA (earnings before interest, taxes, depreciation, and amortization) is an even more telling indicator than gross margins. This indicator may be the most suitable to compare the profitability of companies with different capital conditions, asset base and financing.

As the data of Figure 6 aptly illustrates, the "golden age" of the sector clearly came to an end in 2013. In line with the announcement of lower regulated prices, the average profitability of companies with an interest in universal service dramatically dropped. The inspection of individual company data, however, reveals a more complex situation.  Of the three incumbent electricity suppliers, the companies that belong to the EDF and RWE groups were able to sustain positive net income, with EDF outperforming the sector average for the whole inspected period. On the other hand, E.On, which until 2015 had interests in the gas sector in addition to its presence in the electricity market, reached a negative EBITDA in five out of the seven examined years. GDF-SUEZ, which terminated its commercial activities at the end of 2014, performed even worse, as its EBITDA stayed negative for the whole period. TIGÁZ suffered the worst decline in 2012 and 2013 when its previous modestly positive EBITDA fell to -5.1% and then to -6%. 2013 was also the turning point for MVM. Before this year, the company achieved outstanding levels of profitability of between 3.2% and 8.7%, with an eye-catching decline after 2013. MET, however, performed well for the whole period, with positive EBITDA values for all inspected years.

Of course, conclusions based on corporate data should be taken with a pinch of salt. The good or bad performance of a given company is influenced not only by the quality of its management, but other factors as well. Poor numbers are sometimes expla-

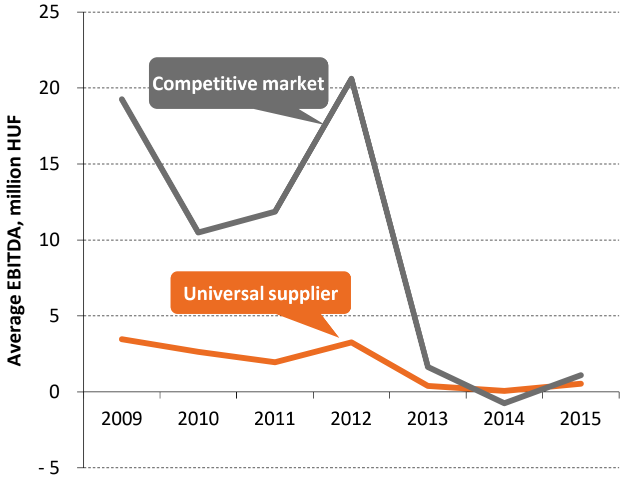
**Figure 5 Changes of the gross margin in retail energy trading between 2010 and 2015**

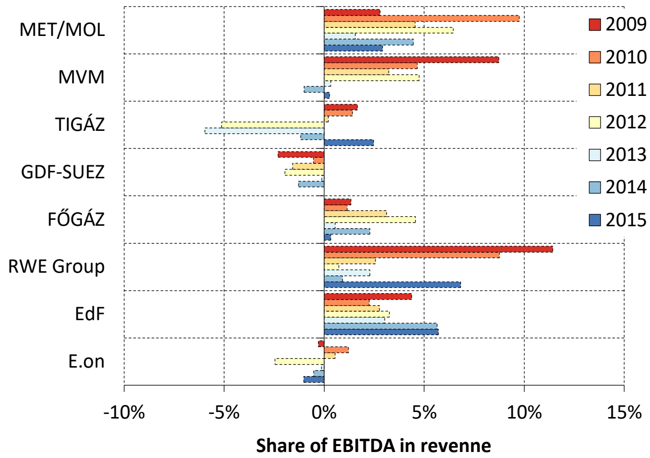



*2 MVM Partner took over the activities of MVM Trade in July 2012, therefore for the first half of 2012 we considered the data of both MVM companies..*

**Figure 6 The EBITDA of companies in the competitive segment only and companies that also provide universal services (left hand figure) and EBITDA per revenue for the largest market participants (right hand figure)**




ined by various group level profit optimization strategies. This is especially typical for companies that are also active in other segments of the production and wholesale value chain. The purchase from a power plant within a corporate portfolio may improve or impair net income figures depending on how much the price of the transaction applied within the group deviates from the market price. Such a deviation may notably impact the reported annual net income in case of companies like MVM or E.On. Likewise, gas wholesale positions may impact the profitability of retail companies within a larger group. Nevertheless, inspection of the time series data of a company can paint an overall picture.

## Working capital management

In the second part of our analysis based on corporate data, we look at the working capital policy of individual companies. We inspect the time series of two indicators:

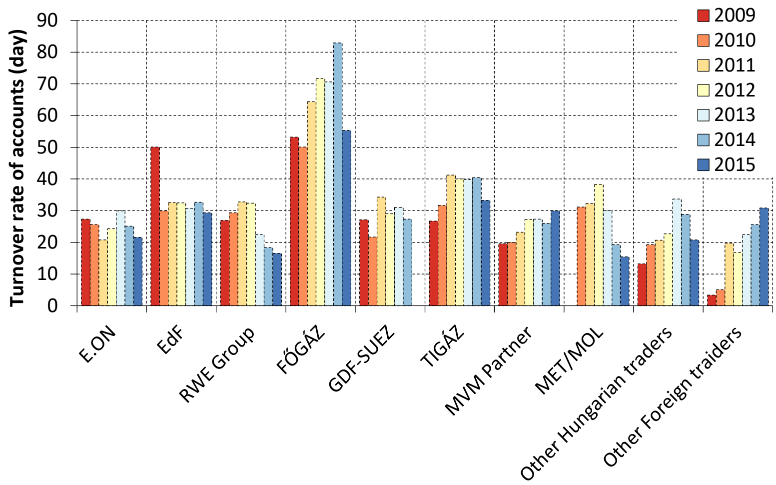
- the turnover rate of accounts receivable of buyers from outside the group
- the share of net working capital need and revenues. We calculated the net working capital need as the difference between working capital without cash and securities, and the short-term liabilities without interest bearing short term liabilities.

Figure 7 illustrates that the companies within the sector were able to keep the turnover rate of accounts receivable at close to 30 days. The noticeably high value of FŐGÁZ for the full period is only partly explained by the fact that this company acquired several market players during 2014-2015.

The development of the net working capital need is more telling than the trend in accounts receivable. A positive working capital figure implies that the short-term assets of the company (accounts receivable, inventories, other receivables) exceed current liabilities without an interest (suppliers and other liabilities), and the difference needs to be covered through a loan or financing provided by the owner. There may be several explanations for the positive working capital need:

- increasing revenue;
- regrouping within the corporate holding;
- inefficient operation.

**Figure 7 The turnover rate of accounts receivable at energy trading companies**

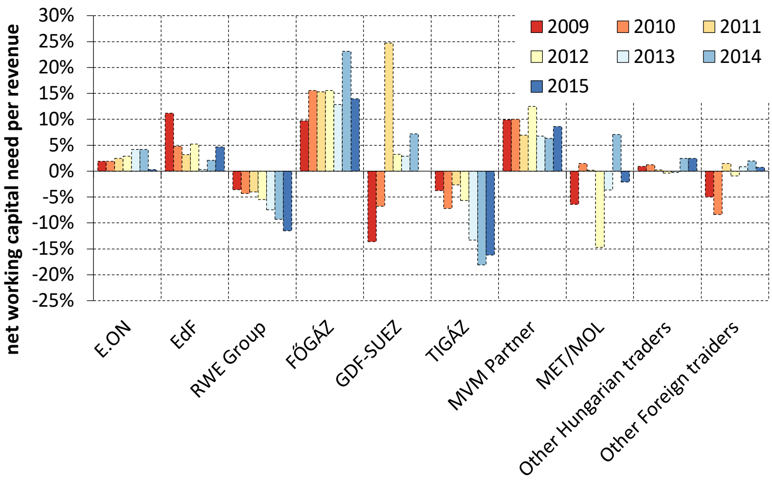


A negative working capital may need be triggered by a decline in revenues and the discovery and exploitation of efficiency reserves. Figure 8 allows us to draw several conclusions. The indicator values of some of the companies display textbook-like behavior. For example, the revenues of TIGÁZ have been on a gradual decline since 2009, almost naturally generating a negative working capital need. The case of the companies owned by RWE is more interesting, as the working capital need indicator stays in negative territory, even though since 2013 revenues were no longer in decline. Data from the last three years suggests that the efficiency of working capital management improved. In the case of MVM increasing revenues justified the positive working capital need until 2013. Between 2013 and 2015, however, the revenues of the company fell by HUF 132 billion. Nonetheless, the net working capital need increased by HUF 34 and 41 billion during these years, implying that MVM Partner financed other activities within the holding company. A similar trend can be observed at E.On, where the working capital need is positive even though revenues decreased from the record-breaking HUF 569 billion in 2009 by HUF 134 billion to HUF 435 billion in 2015 – partly as a result of abandoning household gas services. Here the working capital need is positive for the whole duration of the examined period, suggesting that resources were reallocated within the holding company.

## Summary

The goal of our analysis was to review the operation of the domestic energy trading companies. It was not our intention to draw general conclusions based on the presented data, but to process the data of the most notable participants within gas and electricity trading in order to describe the most important economic characteristics of the sector. The past decade has posed several new challenges to trading companies, most of which to survived by constantly adapting to the turbulent conditions and intensifying competition. By now domestic traders operate along various business models and strategies. This mounting diversification makes it increasingly difficult to directly compare the financial data of market participants. Despite all the methodological difficulties, analyzing the time series of specific data may help to provide a more accurate picture of the changing economic background of domestic energy trading, the capability of companies to adapt and the market and business challenges that they face.

**Figure 8 The net working capital need of energy traders as a share of their revenue**



# Enough room for renewables and nuclear energy? The Impact of renewables on nuclear power plants production and profit in Hungary

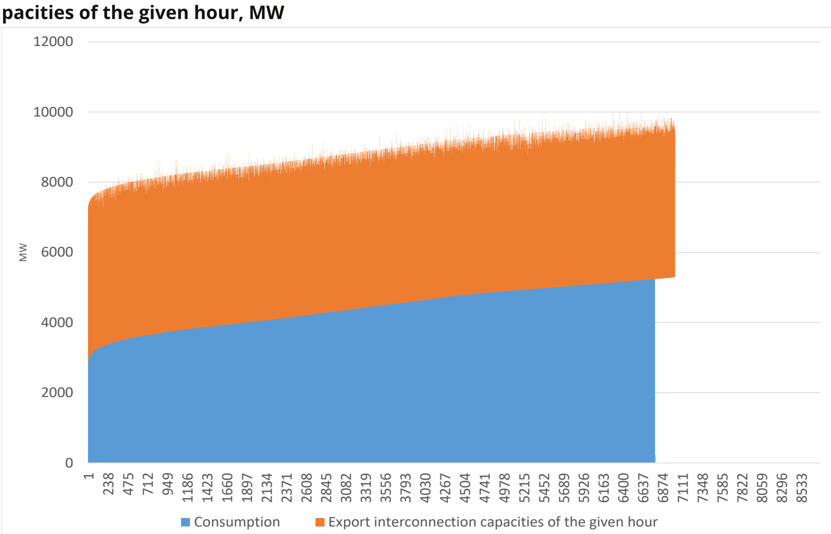
***Approved in 2011, Hungary's National Energy Strategy picked the ideal electricity mix over the next 20 years. The Energy Strategy analysed several power plant scenarios for the period until 2030, and determined that the so-called nuclear-coal-green scenario was the most promising. This scenario includes the construction of a new coal-fired block of 440 MW and two new nuclear blocks in Paks accounting for 1200 MW each, in addition to the 20-year lifetime extension of the existing Paks nuclear power plant blocks. For renewables, the scenario uses the National Energy Utilization Action Plan as a baseline counting with 1.4 GW renewable capacity by 2020 and 2.2 GW by 2030. However, one of the latest publications of REKK[1] estimates that an additional 2 GW solar – or equivalent renewable – capacity would be needed to complete the 2020 renewable targets. This analysis looks at the impact of the various renewable scenarios on the production and profitability of the existing and planned Paks power plant blocks.***

Domestic power plants can sell electricity to Hungary and its neighbouring countries. The domestic hourly consumption averaged 4650 MW in 2015. The minimum system load accounted for 2857 MW, while the maximum was 6106 MW as it is depicted in Figure 1. Sales to neighbouring countries are constrained by the Net Transfer Capacity (NTC). Hungary's electricity network is interconnected to all border countries except Slovenia (6 out of 7). In 2015, the average of hourly NTCs accounted for 4250 MW in other words, export possibilities to neighbouring markets are almost the same as the average domestic consumption. Meanwhile, the fluctuation of this value was significantly lower ranging between 3800 and 4850 MW in 95% of cases. Consequently, the potential market size of domestic power plants ranges between 7250 and 10360 MW.

The domestic power plant structure has a significant impact on how increased renewables will affect the future production and profitability of Paks Nuclear Power Plant. Domestic installed capacity was 8570 MW at the end of 2016 with constant losses of 1450 MW, (Tisza 2. – 900 MW, Oroszlány – 240 MW etc.), adding up to 7120 MW available capacity. This total consists of 2000 MW nuclear power plants (Paks), nearly 3000 MW natural gas power plants, and 936 MW coal power plants, with a relatively low share of renewables (740 MW) and oil-fired power plants (526 MW).

Since balancing energy and secondary reserves on the ancillary services market are provided by natural gas-fired power plants, these have to operate even if the produced electricity can be sold only with loss. Mavir procures 100-140 MW of secondary reserves for down-regulation, and 200-240 MW for up-regulation. In order to provide for the availability of reserve capacities, these power plants have to continuously operate. It is difficult to estimate the required capacity level, since the capacity level of the given power plant types differ. While large gas-fired power plants are not able to continuously operate under 30-40% of their installed capacity, small gas engines can operate at almost all capacity levels. Therefore, we analysed the hourly production figures of natural gas-fired power plants in 2015 based on 200 MW must-run capacity. In 15% of hours, the hourly load of natural gas-fired power plants in 2015 did not reach this level, meaning it should not be considered extreme.

**Figure 1 Duration curve of domestic consumption and sum of export interconnection capacities of the given hour, MW**




*1 Future frames of the renewable electricity support scheme (Megújuló villamosenergia-támogatási rendszer -METÁR) in Hungary, REKK Policy Brief, 2016/4*

**Table 1 Key assumptions in the given scenarios**

| | 2 020 | | | 2 030 | | |
|---|---|---|---|---|---|---|
| | REF | Overweighted wind scenario | Overweighted PV scenario | REF | Overweighted wind scenario | Overweighted PV scenario |
| Nuclear capacity, MW | 2 000 | | | 4 400 | | |
| PV capacity, MW | 500 | 500 | 2 500 | 1 000 | 1 000 | 4 000 |
| Wind power plant capacity, MW | 330 | 1 500 | 330 | 1 000 | 2 500 | 1 000 |
| Secondary reserves forced must run production, MW | 200 | | | | | |
| Gross electricity consumption, TWh | 41.2 | | | 44.8 | | |

However, this value may change in the long run as several factors influence reserves, some reducing and others increasing them. Demand on reserves will be increasingly reduced by the development of technology that make demand schedules more precise and reduce the probability of outages. Demand for natural gas-based reserves may also be lowered by the long-term development of renewables and new nuclear blocks that can take part in the ancillary services market, and also a certain level of international integration of ancillary services can be expected by 2030. At the same time, more renewables penetration could have the opposite effect on reserves. This analysis does not attempt to quantify this type of impact, therefore the assumption is that a natural-gas power plant must-run capacity is 200 MW in the long run.

In the analysis, REKK's European Electricity Market Model (EEMM)[2] was used to compare three simulations in 2020 and 2030. The first is the so-called reference scenario with low renewable capacities, and two others with over weighted wind and over weighted PV capacities, respectively (See Table 1). With the planned closure of old Mátra blocks, coal-based production in 2016 will decline further by 2020 and likely end by 2030 when Mátra power plant blocks reach the end of their lifespan. Cur-

**Table 2 Summary of model results**

| | 2020 | | | 2030 | | |
|---|---|---|---|---|---|---|
| | REF | Overweighted PV scenario | Overweighted wind scenario | REF | Overweighted PV scenario | Overweighted wind scenario |
| Wholesale price, €/MWh | 31.49 | 31.38 | 31.38 | 47.14 | 46.98 | 46.96 |
| Nuclear production, GWh | 15 536 | 15 536 | 15 536 | 34 179 | 34 179 | 34 179 |
| Coal-based production, GWh | 2 257 | 2 124 | 2 135 | 0 | 0 | 0 |
| Renewable-based production, GWh | 2 618 | 4 601 | 5 017 | 5 201 | 8 176 | 8 277 |
| Gas-based production, GWh | 5 601 | 5 598 | 5 580 | 9 020 | 8 936 | 8 939 |
| Net import, GWh | 15 233 | 13 387 | 12 978 | -3 725 | -6 614 | -6 717 |
| Consumption, GWh | 41 245 | 41 246 | 41 246 | 44 676 | 44 678 | 44 678 |
| Profit change at Paks, m€/year | - | -1.8 | -1.8 | - | -5.3 | -6.3 |

*2 EEMM models the hourly power markets of 40 European countries, where simulations are independent, in other words, exclude start-up and shutdown costs. Equilibrium (in price and quantity) is achieved simultaneously in the producer and transmission segment and 90 reference hours are included* rently there is not any sign that new blocks are planning to be constructed despite the fact that the Energy Strategy includes the construction of a new block.

Based on the simulation results in Table 1, each scenario contains the same utilization of Paks Nuclear Power Plant, meaning its production can never be constrained by the higher penetration of renewables. This is assumed both for 2020 and 2030, when both new Paks nuclear blocks are included in our calculations totaling 4400 MW nuclear capacity in total. Rather, the increased renewable generation primarily pushes out imports while its impact on coal- and natural gas-based electricity production is negligible.

Higher renewable penetration leads to slightly lower wholesale prices (certainly not affecting retail and end-user prices), however, the rate of decline is relatively small, ranging from 0.08 and 0.17 €/MWh in 2020 and between 0.16 and 0.18 €/MWh in 2030 in the two renewable scenarios. The lower wholesale prices have a negative impact on the profitability of both the existing and the new nuclear power plant blocks. However, the lost profit not significant in any of the years: it accounts for 1.8 m€/year in 2020, and grows to 5.3 m€ by 2030 with the commissioning of the new blocks. This is mostly due to the rise in nuclear capacities.

In conclusion, higher renewable penetration does not jeopardize the production of either the existing or the new blocks: there will not be any significant cut in nuclear power production even in the case of a very high renewable penetration. In our calculations, a minimum 600 MW drop in reserve capacity and 1000 MW drop in PV capacity may result in negligible fall in nuclear power production by 2030. If either of the two capacities falls to less than 600 and 1000 MW, the utilization of the nuclear power plant will not change. Certainly, there might be hours in the course of the year when it does happen, but it will be insignificant. Furthermore, our analyses show that renewables have a very small impact on the profit of the Paks nuclear power plant, meaning the two technologies are compliant, and the volume of available reserve capacities in Hungary is sufficient to provide for the safe operation of electricity network.

# Recent changes in European natural gas transmission tariffs – evolving tariff competition?

***Lowering demand and spread between natural gas prices calls for transmission tariff reduction.Latest natural gas transmission tariffs are published on the NRA and/or TSO websites in every October or every January, depending on the beginning of the gas year or the regulatory period. Thus in every December (seeing the October changes and most of the provisions for January) we have a look at new transmission tariff levels. This year the process was particularly interesting, as recent market developments had a significant effect on natural gas transmission.***

On one hand in the last few years demand decreased considerably. This led to lower amount of transmitted gas, thus lowering traffic for many TSOs.[1] Also decreasing oil prices resulted in shrinking price gap between more spot based Western European gas prices and more oil-indexed Eastern European prices. As this spread decreases, it is less and less worth to transport natural gas from one country to another.

Our hypothesis was that this may lead to an increasing "tariff competition" between TSOs[1] to get the traffic to their own pipelines, as in such an environment transmission tariffs have an important effect on the choice between alternative transmission routes. Although NRAs approve these tariffs, it is expected that they may take into account the proposals of TSOs, and at the end of the day cost recovery can be realized through lower tariffs and higher transportation volumes.

Calculating with the most up-to-date tariff levels available (when possible, tariffs effective from 1st January 2017 are used) the average cost of crossing a border within the modelled area[2] (thus the cost of exit + entry fees) is 2.276 €/MWh, from which 1.309 €/MWh is the average exit tariff and 0.967 €/MWh is the average entry tariff. Most of the countries apply higher exit tariffs than entry tariffs, or add the commodity fee to the exit points only.

## Without Ukraine's extreme tariff increase from 2016 to 2017, the European system experiences a 10-13 % tariff decline for the next year

The average year on year change shows a negligible increase in tariff levels: 0.025 €/MWh, but this is the sum of the 0.096 €/MWh decrease in entry tariffs and 0.121 €/MWh increase in exit tariffs. However it is also important to note, that changes in tariff levels of one single country is almost responsible for the

### BENCHMARKING METHODOLOGY

In order to make baseline comparisons, transmission fees are estimated as a standardized transportation service for each relevant cross-border point and expressed in a common measurement unit (€/MWh). The assumed standard transportation service has the following characteristics:

- The duration of transmission contracts is one year
- Contracts refer to firm transportation services
- The booked maximum hourly capacity is 10 000 kWh (/h/y)
- Applied load factor is 56.2%[3]
- Tariff are expressed in €/MWh

Using our assumed capacity reservation level of 10 000 kWh/h and load factor (56.2%) for the yearly firm transmission service contract, we calculated the overall transportation fee (in €) that would be incurred by a shipper at each interconnection point (IP), making all the necessary conversions regarding gas reference conditions and currency units. Once we have arrived at the total fee corresponding to the standardized service, tariffs can be determined on a per MWh basis, dividing total payments by the yearly transported volume (€/MWh). Where entry and exit tariffs apply, the fee consists of the relevant exit plus entry fees due at the two sides of the border (including the commodity fee at the relevant point).[4]

*1 for more details see EU cross-border gas flows in 2013, 2014 and 2015 in ACER/CEER Annual Market Monitoring Reports.*
*2 Load factor is calculated as: (Average flow)/(Average booked capacity). Average booked capacity utilization in Europe is reported in the Acer Market Monitoring Report 2015, pp. 251-252.*
*3 Where tariffs are set on an auction, reference price is included in the model, as there is no information on auction results.*
*4 The preconditions for market integration compatible gas transmission tariffs in the CESEC region*

**Table 1 Average tariff levels and recent changes in some selected countries from different regions**

| | Western-Europe* | | CEE ** | | Energy Community*** | |
|---|---|---|---|---|---|---|
| | average tariff (€/MWh) | latest change (2016/2017) | average tariff (€/MWh) | latest change (2016/2017) | average tariff (€/MWh) | latest change (2016/2017) |
| **Exit** | 0,74 | -3% | 0,99 | -24% | 2,67 | -6% |
| **Entry** | 0,68 | -7% | 0,79 | -11% | 1,66 | -9% |

*Source: REKK calculation;*
**Western-Europe: BE, DE, DK, ES, FR, IT, LU, IE, NL, PT, UK;*
***CEE – Central Eastern Europe: AT, BG, CZ, HR, HU, RO, SI, SK;*
****Energy Community: BA, MD, ME, MK, RS*

total increase in case of exit tariffs: the exit tariffs of Ukraine increased by 125-250%. If the average year on year changes are calculated without Ukraine, the total cost decreased by 0.270 €/MWh, from which 0.096 €/MWh comes from the decline of entry tariffs, and 0.174 €/MWh from the decrease of exit tariffs. This means a 10% and 13 % decrease respectively. The more detailed, regional breakdown is shown in the next table.

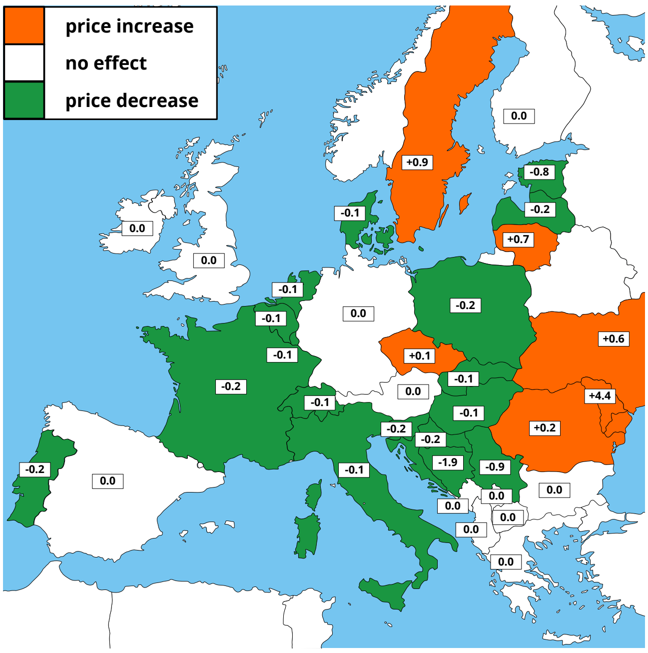
Transmission fees in Hungary declined by 40-50% on almost every border, same happened in Romania. In case of Hungary the decrease is the result of a scheduled asset and cost review in 2016, carried out by the Hungarian regulator. In case of the Romanian and Serbian border points a DCF (discounted cash-flow) model is applied for tariff setting that takes into account future costs and incomes and a predetermined WACC value. In case of all other border points a so-called ex post profit-cap regulation is applied, that takes into account operation and maintenance costs, cost of capital, inflation and also a yearly expected efficiency gain. For capacity fees fix costs are taken into account, the commodity part of the tariff is calculated with the help of variable costs. As a result much lower tariff levels are applied from 2017. Fortunately the tariff reduction is also in line with the intention of the TSO to foster more intense transportation through the region, and thus higher usage of its pipelines.

In 2016 also a preparation of an open season process took place – transmission capacities from Romania through Hungary to Austria will be auctioned. The announced reference prices are almost the same as the original transmission tariffs valid in the given borders – except that in the Austrian entry point a quite high, 0.67 €/MWh fixed supplement is applied.

All in all we can state, that highest or most radical tariff reduction is visible in the CEE region. That is in line with our earlier findings in our Discussion Paper about the CESEC region : that this is the region where there is room for tariff cuts, as highest transmission tariffs in the region were identified in Hungary, Romania, Ukraine and Croatia (and to some extend in Slovakia and Poland). It seems that a good process has started. In Croatia a new regulatory period will start from January 2017, new tariffs are not yet available, neither the 2017 tariffs for Slovakia are published yet. Thus it can happen that both of them will follow their neighbours' attitude, and bring the transmission charges further down. If it does, it can boost trading in the region, and may induce more competitive prices for the region and also for their southern neighbours.

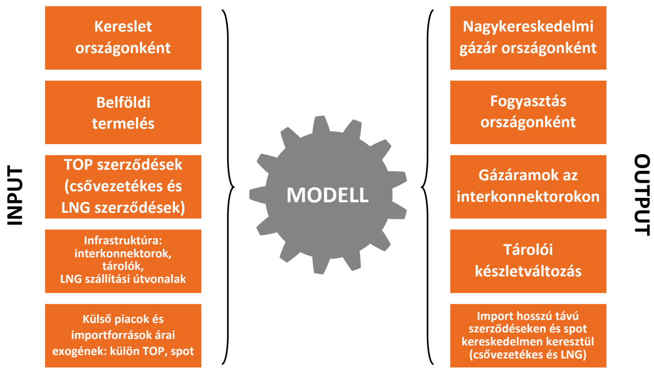
We have performed a modelling exercise comparing the 2016 and 2017 tariff levels to assess the effect on the wholesale prices of the region. The increase on the Ukrainian exit tariffs has no effect on prices in the CEE region, but cause a price increase in Ukraine. Tariff cuts on the Balkans have alleviated the high price level in Serbia and Bosnia. In Western Europe, price changes are negligible.

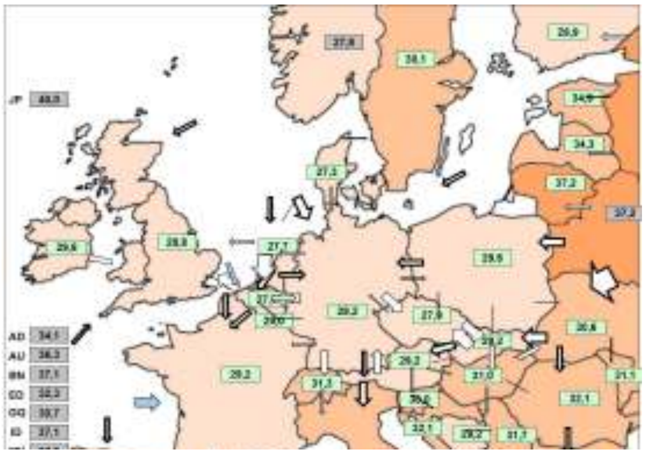
**Figure 1 The effect of tariff change on prices, €/MWh**



# EUROPEAN GAS MARKET MODEL (EGMM)

***EGMM is the natural gas market model of REKK developed since 2010 modelling 35 countries***



## ASSUMPTIONS

Perfect competitive market
Modelling period of one year (12 months)
LTC and spot trade in the modelled countries, pipeline and LNG suppliers
Physical constraints are interconnection capacities
Trade constraints: TOP obligation
Model includes domestic proiduction and storages
Model calculates with transmission nd storage fees

## USAGE

Provides benchmark prices for the region
Facilitates the better understanding of the connection between prices and fundaments. Eg. LTC market changes or storage changes.
Price forecasts
Allows analysing the effects of public policy interventions
Analysing trade constraints
Assessing effects of interconnector capacity expansion
Security of supply scenarion analysis

## RESULTS

Gas flows and congestion on interconnectors
Equilibrium prices for all countries
Source composition
Storage levels, LTC flows and spot trade
Welfare indices

## REFERENCES

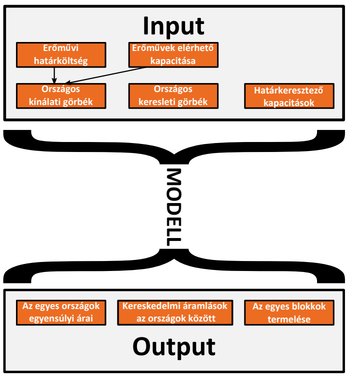
Ranking of Project of Common Interest (PECI) projects
Effects of the Ukrainian gas crisis
Welfare effects of infrastructure investments (TAP)
Regional security of supply scenarios and N-1 assessments
National Energy Strategy 2030
Regional storage market demand forecast

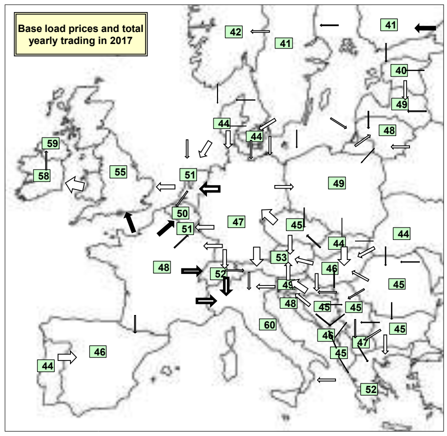
Contact: Borbála Takácsné Tóth

borbala.toth@rekk.hu

# EUROPEAN ELECTRICITY MARKET MODEL (EEMM)

***EEMM is the electricity market model of REKK developed since 2006 modelling 35 countries***




## ASSUMPTIONS

- Perfect competitive market
- The model calculates the marginal cost of nearly 5000 power plant units and the unique merit order for each country
- 12 unique technologies
- Includes future power plant developments
- Takes 85 interconnectors into account
- Models 90 reference hours for each year. By appropriate weighting of the reference hours, the model calculates the price of standard products (base and peak)

## USAGE

- Provides competitive price signal for the modelled region
- Facilitates the better understanding of the connection between prices and fundaments. We can analyse the effect of fuels prices, interconnector shortages, etc. on price
- Gives price forecast up to 2030: utilizing a database of planned decommissionings and commissionings
- Allows analysing the effects of public policy interventions
- Trade constraints
- Assessment of interconnector capacity building

## RESULTS

- Base and peakload power prices in the modelled countries
- Fuels mix
- Power plant generation on unit level
- Import and export flows
- Cross-border capacity prices

## REFERENCES

- Ranking of Project of Common Interest (PECI) projects
- Evaluating the TYNDP of ENTSO-E
- Assessing the effects of the German nuclear decommissioning
- Analysing the connection between Balcans and Hungarian power price
- Forecasting prices for Easterns and Southeast-European countries
- National Energy Strategy 2030
- Assessment of CHP investment
- Forecasting power plant gas demand
- Forecasting power sector $CO_2$ emmissions


Contact: András Mezősi

andras.mezosi@rekk.hu