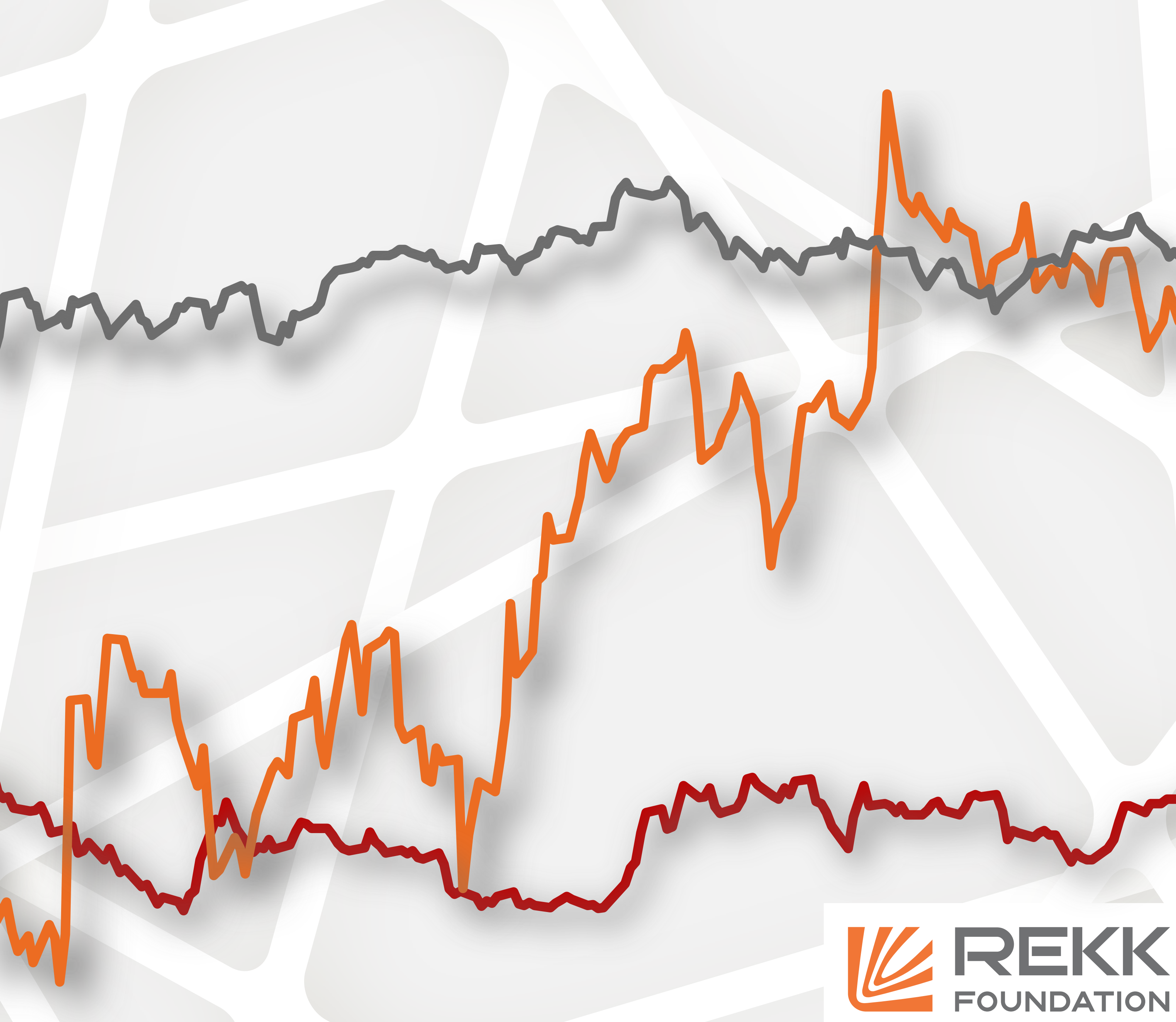

REKK FOUNDATION

HUNGARIAN ENERGY MARKET REPORT

Q2-3 2017

Dear Reader,

This is a special double volume report that inlcudes more articles that are more in-depth. After providing an overview of the energy market trends of the first half of 2017, the articles cover the topics of long-term capacity bookings of European natural gas networks, US climate policy, the recently adopted EU regulation on natural gas transmission tariff setting, the 2017 IEA country report on Hungary, and energy poverty.

The first article reflects on the outcomes of long-term capacity bookings held in spring 2017 at the PRISMA auction platform which covers most of the European natural gas transmission grid. This seemingly mundane action could have implications for Central Europe's natural gas supply for decades. An examination of post-2019 bookings reveals that a certain market participant reserved the capacities for the gas corridor bringing gas from Nord Stream 2 through Germany to Czech Republic, Slovakia to Ukraine for a long term. The article scrutinizes the geographical and chronological mapping of the bookings compared with long-term bookings made in past contracts by outside shippers.

The second article attempts to determine the possible consequences of the US exit from the Paris Climate Agreement. It is not the first time that the second biggest CO2 emittor of the world is accused of being maverick and free rider, but is it justified? Can global climate protection targets be met without the US? The article gives a brief overview of the US federal climate policy regulations and the important energy efficiency and climate protection measures taken at the state level. It compares US and EU GHG reductions and evalautes coal and gas market developments (two fuels playing a crucial role in US power production) and effects on investment decisions taken by market participants.

The third article introduces the Tariff Network Code that is harmonizing transmission tariff setting. The last network code were finally adopted, reducing cross-financing between various (domestic vs transit) system users and entry/exit points by introducing cost-reflective tariff calculation and mostly elminating distorting and often protectionist tariff settings. The article assesses the key elements of the regulation and gives an overview of the tariff settings between various countries.

The fourth article introduces the IEA's Hungary country report that was published in June 2017. The report reviews the inclusion of govermental preferences in long-term power plant investments positively, with nuclear and lignite-based power plant development plans benefiting supply security and decarbonation. The report is more critical of household electricity and gas price regulations and energy efficiency objectives, but appreciates the reform of the renewable energy support scheme and the realization of projects. The article provides a detailed overview and analysis of some of the key statements and recommendations of the report.

The last article deals with a phenomenon mostly ignored by domestic electricity and natural gas regulation, energy poverty. The article outlines the emergence of energy poverty in the European energy market regulations and clarifies its meaning. Then it offers indices of energy poverty and references Hungary's position therein. Lastly, it suggests possible measures and tools to ameliorate energy poverty problems and tasks and responsibilities of the regulator.

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Innovation in the energy sector: An academic approach and the GE's R&D strategy - REKK Energy Futures, opening event

REKK has hosted several events on the topic of innovation in the energy sector linked to the emerging "energy transition".

Still, more work is needed to update the mainstream methodological frameworks applied to the energy sector to better incorporate this changing dynamic. To help further develop this framework, we will invite prominent stakeholders to address the following topics: ensuring cost efficiency in energy storage; decarbonization of the transport sector; and the optimal integration of intermittent production in transmission systems.

The opening presentations will be held by:

- Mr. Balázs Muraközy, senior research assosiate, Hungarian Academy of Sciences
- Mr. Endre Ascsillán, Vice-President, GE Hungary

Further information: www.rekk.org

Energy market developments

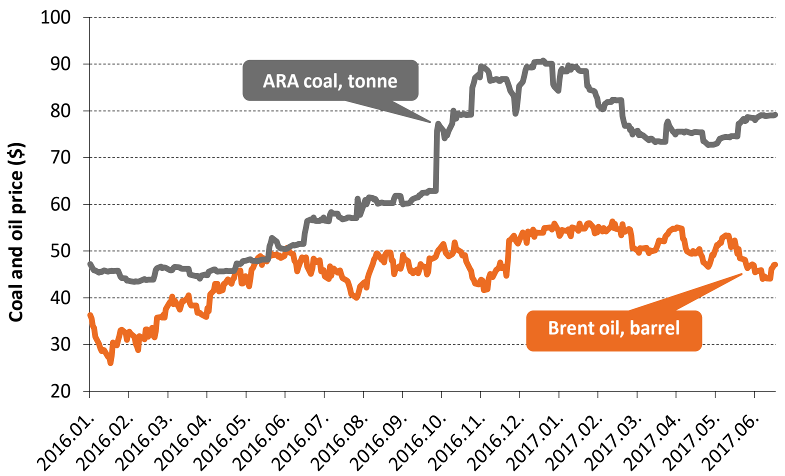
In the first half of 2017, the rapid rise of international coal prices reversed and Brent prices fell 10 USD within two months towards the end of the period. European gas and power markets were led by peaking demand during the irregularly cold weather at the beginning of the year which also resulted in more fossil-based electricity production. Power plant outages in Hungary made it a challenge to meet demand, resulting in day-ahead prices exceeding 100 EUR/MWh at times, fully splitting from the German market. From March, the Asian LNG premium declined enabling more European LNG imports and easing injections into European storages that dissipated by the end of winter. Hungary natural gas exports more than doubled to 2.1 bcm, primarily to Ukraine.

International price trends

The spectacular rise of international coal price came to a halt in the first half of 2017, after nearly doubling to 90 USD/t in the last 6 months of 2016 ARA prices fell below 80 USD/t by the end of June (Figure 1). Even so the average Q2 ARA price was 76 USD, 55% more than the same period of 2016. The announcement of OPEC's production cut did not cause any considerable change in Brent prices until the middle of April when it fell by 10 USD to 45 USD/barrel the following 2 months. The average Brent price of Q2 was about 10% higher than in Q2 of the previous year.

A combination of cold weather in January, peaking electricity prices, low European storage reserves and technical problems at Great Britain's biggest storage Rough led to a rise in British import demand. It significantly pushed up day-ahead TTF prices with peaks in February approaching 23 EUR/MWh (Figure 2). Although January saw a historical record of Europe's piped gas imports reaching 30.7 bcm, LNG cargoes were targeting Asian markets willing to pay much higher prices. In January and February, Japanese LNG prices exceeded 30 EUR/MWh, while Great Britain's, France's, Belgium's and the Netherland's January LNG imports lagged behind the previous year's by 56%.

Figure 1 Price of month-ahead EEX ARA coal and Brent crude oil spot prices from January 2016 to June 2017



Source: CME, IEA

However, declining Asian demand and prices have made European markets more attractive for LNG exporters. In March, European LNG imports grew by nearly 50% compared to the previous months, breaking a four-and-a-half-year record, while imports in April reached 4.3 bcm, the most since September 2012. First LNG cargoes from the US arrived in Northern Europe in June, at the Dutch Gate and the Polish Swinoujscie terminals. European LNG imports rose by 10% in the first half of 2017 year-on-year.

In the meantime, there was no decline in pipeline gas imports, and by the end of June, imports rose over nine months in a row primarily from Russia. The abundant supply left day-ahead TTF prices as low as 15 EUR/MWh by the end of March and into Q2, not far above prices one year ago. Much of these volumes filled storage reserves that had been depleted by the end of winter. In April, the net injection was reached a 3-year record of 4 bcm but by the middle of May lagged last year's level by 10 percentage points. However, problems around Rough reduced storage demand in Great Britain, leaving more exports to the Continent and falling gas prices. The last shutdown of Rough was announced by the storage operator in June.

In the first half of 2017, European gas imports from Russia grew by 13% at 83.5 bcm. The year-to year rise of shipments over Nord Stream to Germany accounted for a 44% rise in January with the decision of the European Commission allowing Gazprom to use more OPAL capacity. However, court decisions suspending the Commission's decision restricted the usage of OPAL in February.The competitiveness of Russian gas is evident by contract prices of German imports from Russia tracking spot TTF prices.

While at the end of last year European power market developments were affected by capacity outages of French nuclear reactors, the first months of this year faced low availability from German nuclear capacities. Production from German nuclear power plants in January and February was down 32% compared to the previous year with scheduled refuelling of several reactors taking place as part of a tax optimization programme following the expiration of fuel tax provisions. At the beginning of 2017, refuelling works caused a dramatic drop in available production capacity to levels not seen since the 1980's, resulting in a year-to-year 80% rise in day-ahead EPEX prices calculated on average for the first two months.

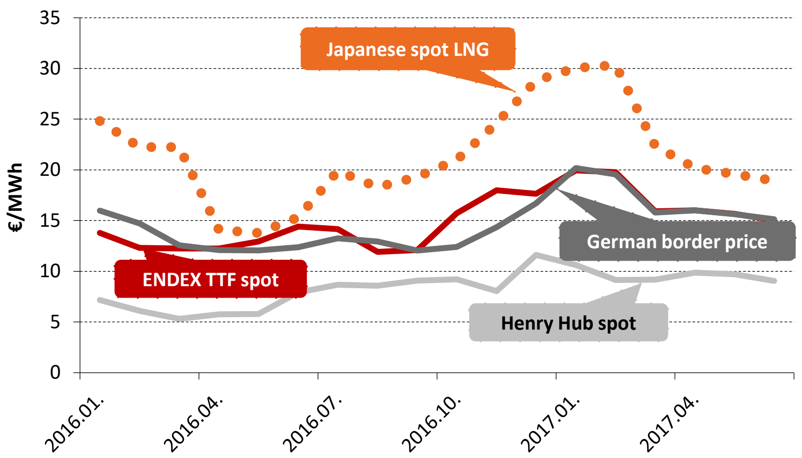
Although CO^2 EUA prices initially fell in January after a brief upswing in December, the unusually cold weather pushed up power prices similarly to gas and coal (Figure 3). The end of January saw a record in day-ahead prices breaking the 2008 one, and the production of German coal a gas power plants broke another 5-year record owing to nuclear outages, low wind production and cold weather.

Declining coal and gas prices and growing solar and wind production resulted in lower power prices in March. In addition, EUA prices trending up at the end of February and beginning of March due to the European Council decision on the reform of the EUA scheme after 2020 quickly run out of steam. EUA prices fell to nearly 4.3 EUR/t by the middle of May before de80

mand from fossil power plants pushed them up again as fossil plants attempted to raise their electricity production to capitalize on low gas prices and the strong EUR effectively offsetting some of the USD growth in coal prices. The quarterly average of EUA prices in Q2 fell 17% year-on-year, to 4.8 EUR/t, while German yearly baseload prices grew by 20%.

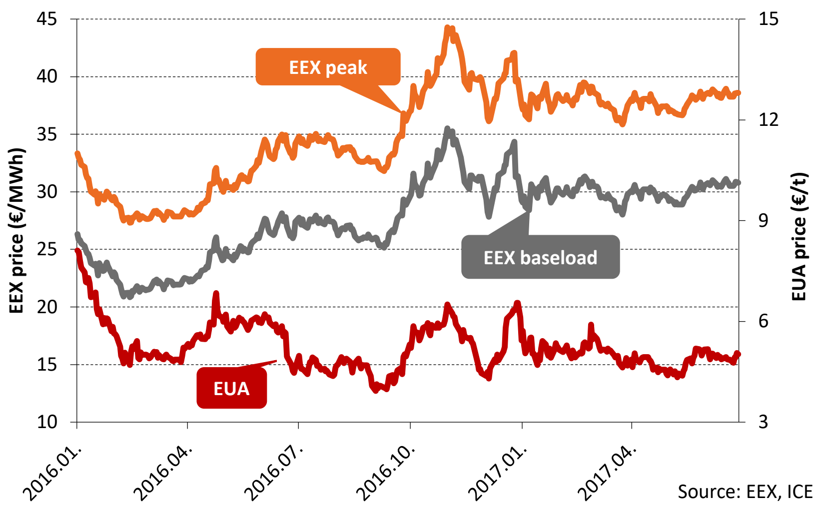
High power prices helped the clean spark spread in January, exceeding 10 EUR/MWh for the first time since 2012 (Figure 4), 40 EUR/MWh in Hungary. Nonetheless, the position of coal-fired power plants remained more stable in spite of high coal prices. The clean dark spread was at a 4 EUR/MWh premium to the clean spark spread on a half-yearly basis, narrowing from 7 EUR/MWh at the beginning of 2016.

Figure 2 Prices on select international gas markets from January 2016 to June 2017



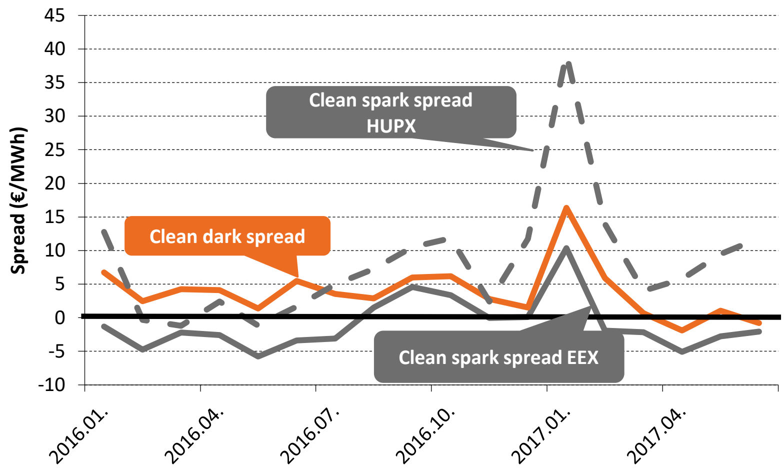
Source: Statistical Office of Japan, EIA, Gaspool, IMF

Figure 3 Prices of EEX year-ahead futures and CO_2 allowances (EUA) from January 2016 to June 2017



Source: EEX, ICE

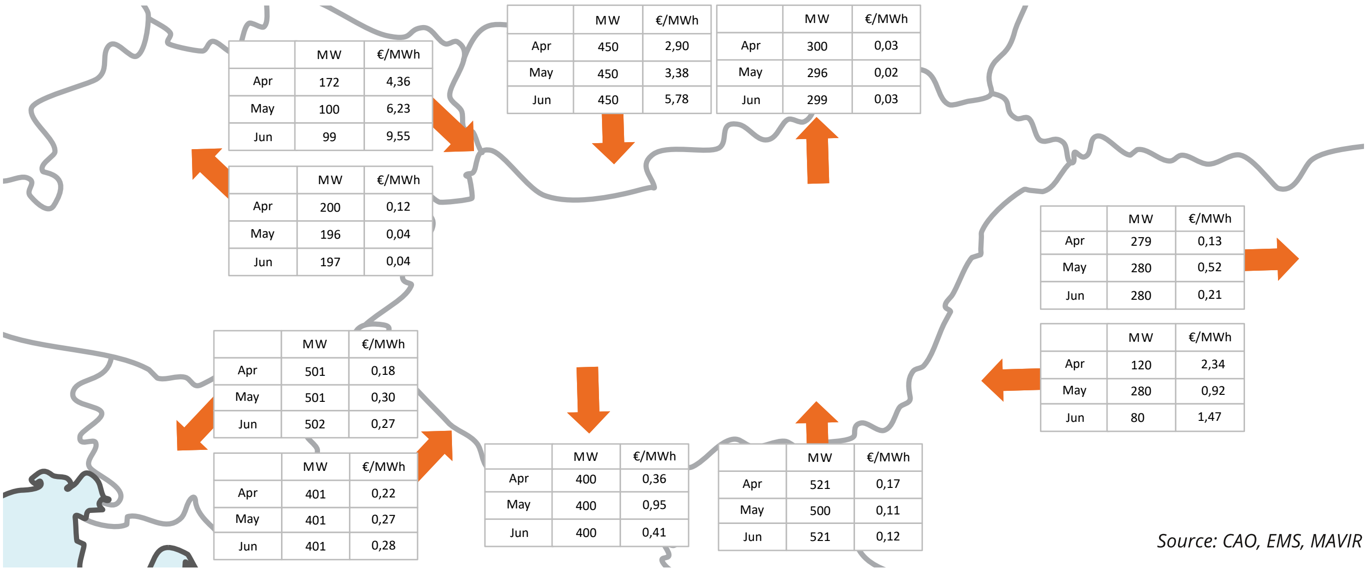
Figure 4 Clean spark spread (gas fired power plants) and clean dark spread (coal fired power plants) on German market from January 2016 to June 2017



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

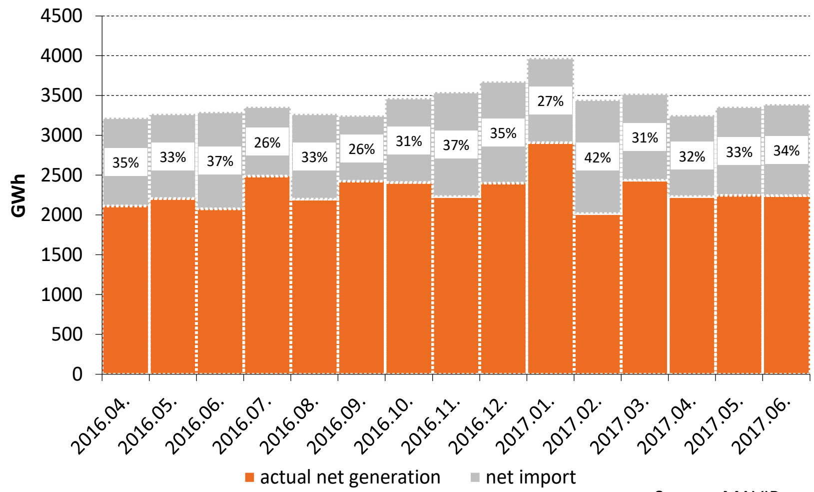
Note: Both indicators show the difference between electricity prices on exchanges and the cost of electricity generation, where the cost of production is added up by the cost of gas (spark spread) or coal (dark spread) needed for generating 1 MWh of electricity and the additional cost of CO_2 emission 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 ofthese 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, Q2 2017



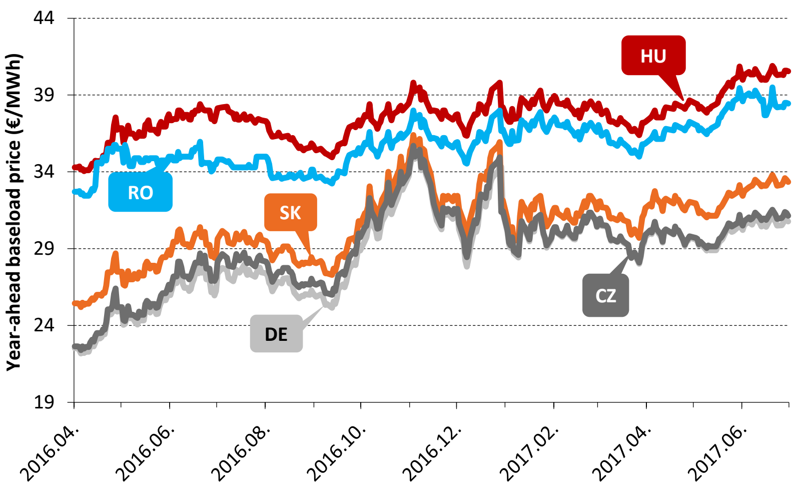
Source: CAO, EMS, MAVIR

Figure 6 Hungary's net electricity production and monthly net electricity imports between April 2016 and June 2017



Source: MAVIR

Figure 7 Year-ahead baseload futures prices between April 2016 and June 2017



Source: EEX, PXE

Overview of domestic power market

The cold weather and power plant outages at the beginning of the year resulted in peaking import demand that pushed up import capacity prices significantly, notably on the Austrian border. The 129 MW monthly import capacity was sold at 1.49 EUR/MWh last December, but peaked at 7.32 in January and 11.79 EUR/MWh in February even with higher demand (172 MW). Following a fall in March (4.35 EUR/MWh), capacity prices rebounded with declining availability from April to May (Figure 5). Meanwhile, import capacities from Slovakia peaked in February (8.41 EUR/MWh). In the second quarter, capacity prices gradually increased month-on-month despite the stable 450 MW of supply, still not reaching the heights of February in June. February also pushed up capacity prices for Romanian imports to 7.78 EUR/MWh compared to only 1-2 EUR/MWh in the second quarter.

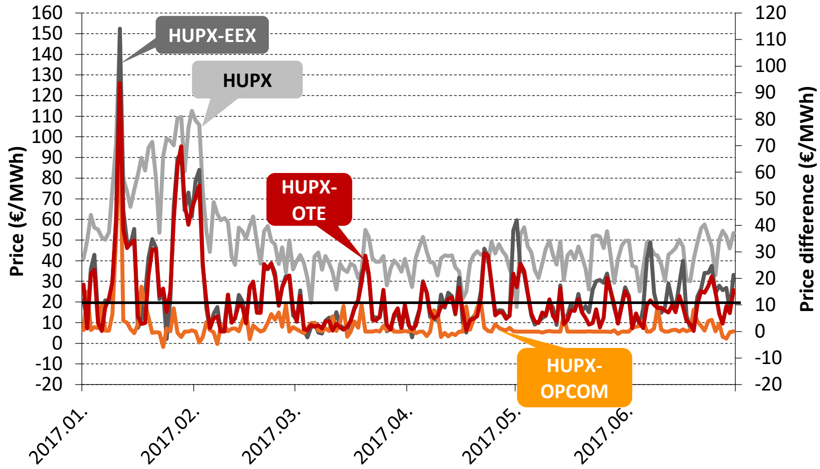
Outages at Mátra, Dunamente, Paks and Gönyű power plants (Figure 6) contributed to the extremely high share of net imports as a share of total consumption in February, reaching 42% of consumption. In the first half of 2017 slight increase in domestic electricity generation lagged behind demand growth, resulting in average import share of 33%. Yearly HUPX baseload prices were an average 7% higher than the same period of the previous year. At the same time, German exchange prices grew 32% between January and March and 20% between April and June year-on-year. This narrowed the HUPX premium to 9 EUR/MWh on average in the second quarter compared to 11.5 EUR/MWh the previous year (Figure 7).

The convergence of several demand and supply side factors led to Hungarian day-ahead prices in January exceeding 100 EUR/MWh (Figure 8). The tight conditions eased in the beginning of March with milder weather and improved supply with Paks and Gönyű gas-fired power plant coming back online. This was further supplemented by some domestic wind production and Balkan hydro power plants. In the beginning of May, day-ahead German EEX prices were at times higher than HUPX prices. Prices were supported by maintenance works that halved available Slovakian capacity. On May 1st, HUPX prices were nearly 42 EUR/MWh higher than German EEX for the first time since February. In June, heat waves and supply problems at Mátra, Dunamente and Paks Power Plants led to higher prices, but there was less volatility than earlier in the year.

In January, HUPX prices separated not only from the German market but also the other coupled countries: HUPX was at a premium of more than 10 EUR/MWh to OTE in two thirds of the hours. In February, HUPX premium compared to OTE remained 10 EUR/MWh in 47% of the hours. Alignment was closer in the March – May period, but in June rising Hungarian domestic power prices pushed the HUPX premium 10 EUR/MWh or more in 44% of the hours (Figure 9). In June, even the Romanian market separated slightly from the Hungarian one: periods of full alignment declined to 70% of the hours.

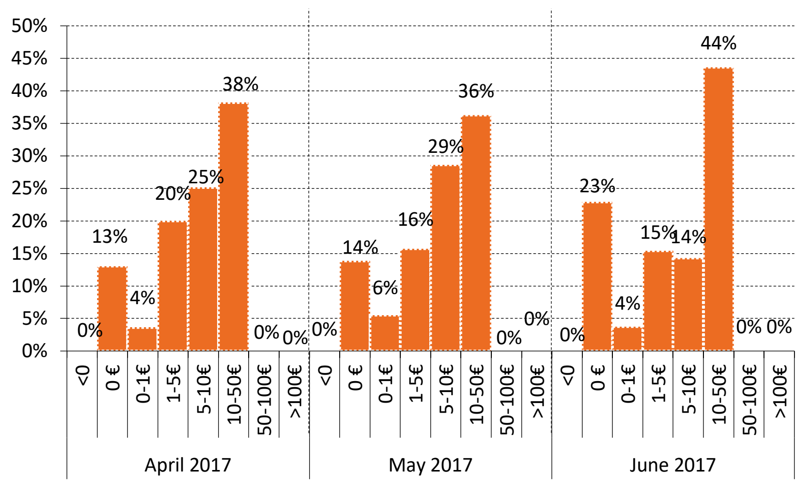
Since the system charges for balancing developed by MAVIR provide incentives for market participants to manage anticipated deficits and surpluses through exchange based transactions, the costs of the deviation from the schedule are largely determined by exchange prices. It follows that the price of upward balancing cannot be lower than HUPX price for the same period, while the system operator does not pay more for the downward balancing than the price at the exchange. Uncertainty over the domestic power market in January resulted in high positive balancing prices often exceeding 50 HUF/kWh (Figure 10).

Figure 8 Comparison of day-ahead baselaod prices on the EEX, OPCOM, OTE and HUPX exchanges between January and June 2017



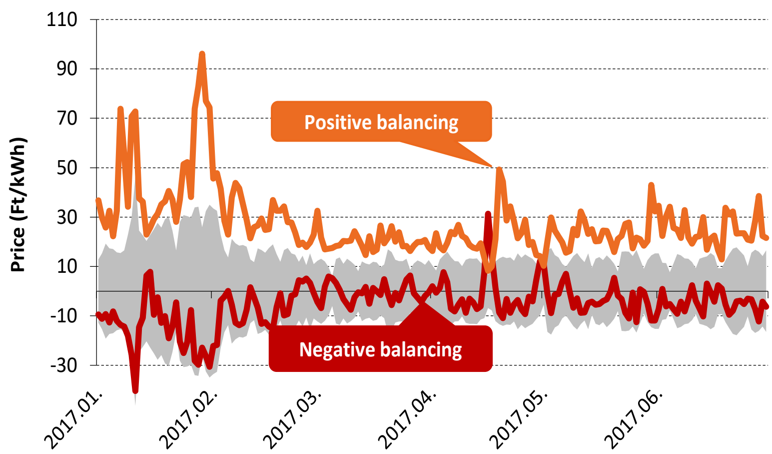
Source: EEX, OPCOM, OTE, HUPX

Figure 9 Frequency of various price differences between the Hungarian and the Czech exchanges between April and June 2017



Source: REKK calculation based on OTE data

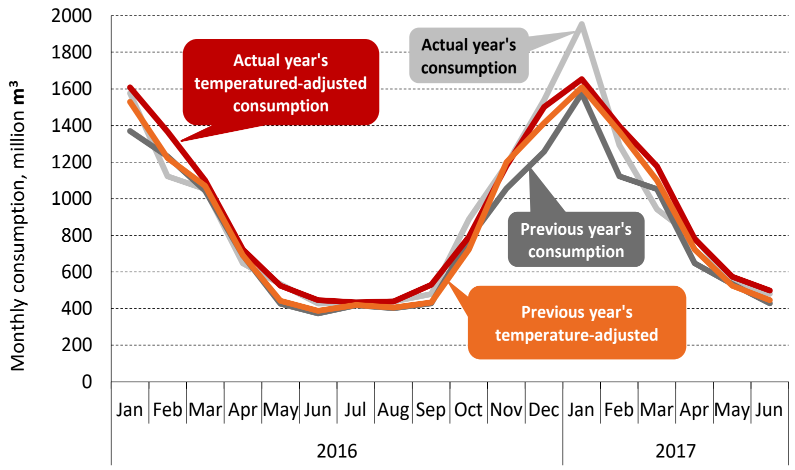
Figure 10 Daily average of balancing prices and spot HUPX prices, Q1-Q2 2016



Source: MAVIR, HUPX

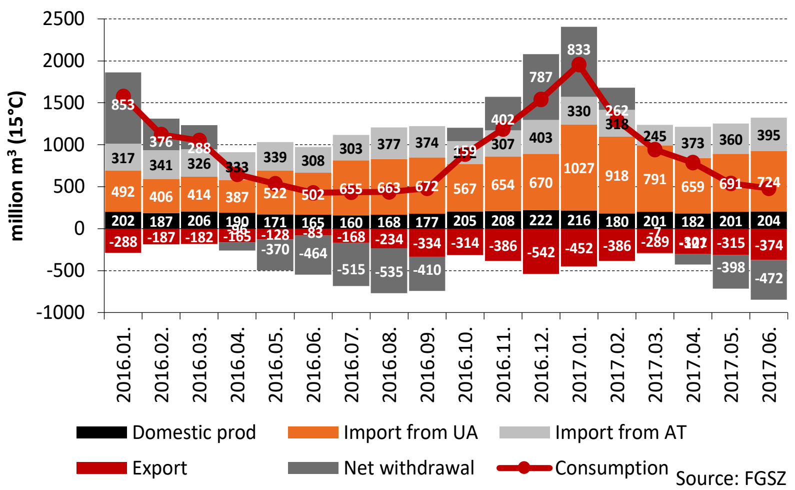
Note: The upper edge ofthe grey range in the figure is determined by the next day price ofHUPX, while the lower edge is the opposite ofthe same price. According to the Trading Rules ofMAVIR the rice of positive balancing power is limited to the next day price on HUPX, while the negative balancing power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

Figure 11 Raw and temperature-adjusted monthly gas consumption between January 2016 and June 2017 compared with the previous year



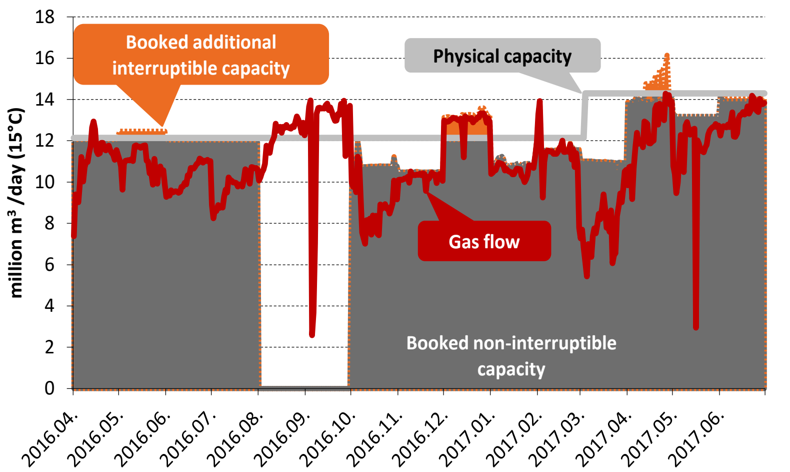
Source: FGSZ, European Climate Assessment & Dataset, and REKK calculations

Figure 12 Source structure of Hungarian gas market by month between January 2016 and June 2017



Source: FGSZ

Figure 13 Transmission at the Mosonmagyaróvár (Austrian border) entry point between April 2016 and June 2017 together with booked interruptible and noninterruptible capacities



Source: FGSZ

Note: Contracted capacity figures for August-September 2016 are not available on FGSZ's website

The average Q1 price of 32 HUF/kWh declined to 23 HUF/kWh in the period between April and June.

Overview of domestic gas market

Gas demand in the first half of 2017 was 6 bcm, 12% higher than the same period in 2016, owing to the cold winter. January consumption was up 24% year-on-year to almost 2 bcm. The gap between temperature-adjusted consumption figures, however, is much thinner less, only 3% higher in January and 5% over the period (Figure 11).

Flexibility to satisfy the outstanding January gas demand was primarily provided by imports from Ukraine, which doubled from the year before. Imports from Austria grew by only 4%, and withdrawal actually fell by 2% (Figure 12). Low storage levels prevented storage from playing a significant role in easing demand peaks. At the beginning of the year storage levels were at 25%, 6% behind the same period of the previous year. Ukrainian imports grew by nearly 80% over the half year period, while imports from Austria were up only 3%. Similarly to Q4 2016, Hungary played an important transit role during the period with exports more than doubling to 2.1 bcm. In the same period domestic production covered 20% of consumption, nearly matching the same period from the year before.

The Mosonmagyaróvár entry point was operating at only 88% of its technical capacity in January compared to 106% in December, and thereby did not help to ease January peak demand. This is due to low long-term Ukrainian import contract prices (Figure 13). The Hungarian Natural Gas Transmission Company , FGSZ, announced at the beginning of March that the technical capacity of the entry point would expand from 12 to 14.4 mcm/day. The 87% Q2 average utilization is nearly identical to the year before, which was 89%.

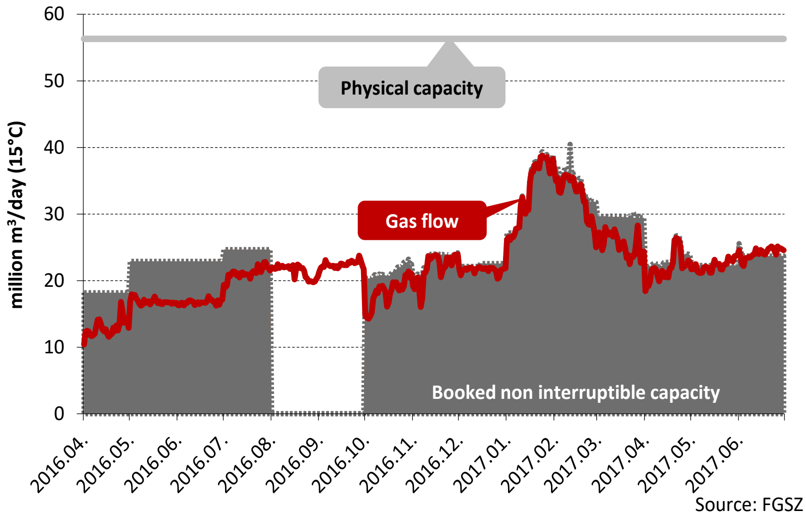
The high level of January imports from Ukraine are reflected by the utilization data from Beregdaróc entry point, which approached 60% (Figure 14). Although there was a slight drop in February, the year-to-year growth in February was even higher than January nearly 2.3 times higher. This could also be affected by Gazprom's cuts to Nord Stream transit in February due to restrictions on OPAL. For the whole six month period, Beregdaróc entry point operated at 47% utilization compared to 26% the year before. In the spring of 2017, the strong growth of Hungarian exports is mostly attributable to Ukrainian demand. This was facilitated by a decision by the Hungarian regulator MEKH in January to make a 70% reduction of commodity fee to payments at exit points, making Hungary an even more attractive transit route for companies shipping from EU to Ukraine. Hungary exported nearly 730 mcm of natural gas compared to 190 mcm in the previous year over the same period (Figure 15) with the share of Ukrainian exports growing from 18% to 34% over the same period. In addition, a new regulation adopted by Ukraine exempted EU traders from the import VAT and customs duty obligation in order to encourage use of its gas storage.

Hungary exported nearly 190 mcm of gas to Croatia in the first half of 2017, following a break without any transports in the first half of 2016. During this period there was a nearly 50% year-to-year increase in Hungarian exports to Serbia, reaching 1.2 bcm, but even so the share of Serbian exports fell from 80% to 57%.

Figure 16 illustrates how Russian gas was more competitive than TTF in meeting the surge in demand, with HUF prices lagging behind TTF spot prices in January and February. However, with some delay, increasing oil prices pushed Russian import prices in Q2 above TTF.

In January, a new regulation changed effective universal service prices by calculating them on the basis of the arithmetic average of the official daily EUR/HUF and USD/HUF exchange rates announced by the National Bank of Hungary in the period from the 1st to the 15th day of the second month of the quarter preceding the given quarter, replacing the former EUR and USD exchange rates set in a ministerial decree. Thanks to this change, the regulator is less apt to underestimate costs of gas purchases paid by universal service providers because of artificial exchange rates.

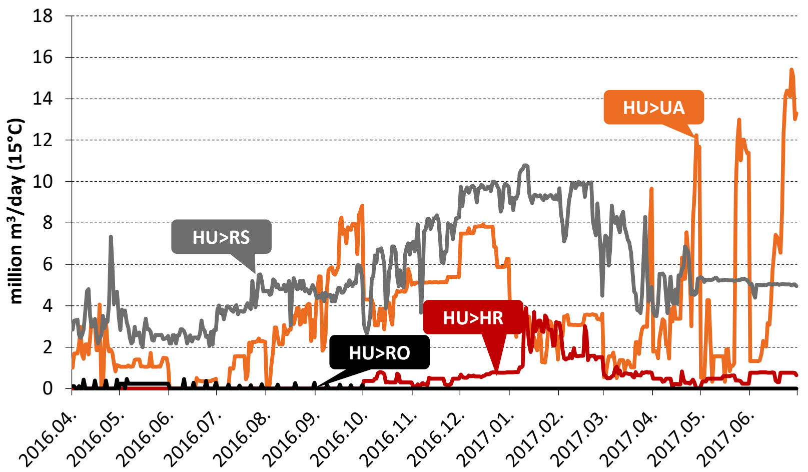
Figure 14 Transmission at the Beregdaróc (Ukrainian border) entry point between April 2016 and June 2017, together with booked interruptible and noninterruptible capacities



Source: FGSZ

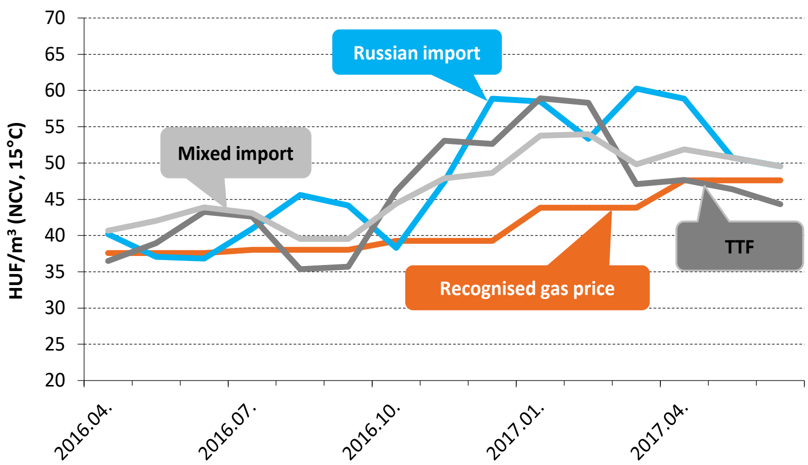
Note: Contracted capacity figures for August-September 2016 are not available on FGSZ's website

Figure 15 Hungary's natural gas exports to Ukraine, Croatia, Romania and Serbia from April 2016 and June 2017



Source: FGSZ

Figure 16 Recognised natural gas selling price of universal service providers and elements of the gas price formula between April 2016 and June 2017



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

Evaluating the 6 March PRISMA capacity auctions

The last building blocks of the European regulatory LEGO have just clicked into place with the missing network codes, underpinning the first coordinated European capacity auction and the race for fair and indiscriminate competition. However, the results are puzzling. Within one day, the network capacity usage was cemented for 20 years in favour of the dominant player. Market abuse and distortive practices in Eastern Europe run directly counter to the European Union's investment of billions of euros to strengthen security of supply and diversification by means of infrastructure development.

In early March 2017, long-term capacity bookings were held on the PRISMA auction platform, which covers most of the European Union's natural gas transmission grid. In this short analysis we highlight a market distortive phenomenon that may be the result of an information advantage of the dominant gas supplier in Europe. By paying about EUR 9 Bn capacity booking fees for the post-2020 period, Gazprom has again secured its control over the Central-Eastern European region and gas trade to the Ukraine.

By observing the auction results, two distinctive patterns for capacity booking can be observed. In the short term, one to two year period, only a small portion of offered capacities were booked by market players, with a more or less uniform distribution on the European gas grid. From 2019 on,[1] much higher bookings were carried out forming a distinctive route of transport: interconnection points lining up a west-to-east gas corridor after the expansion of Nord Stream to Eastern Europe. The 2017-2018 bookings were likely made by midstream traders active in the European market, while post-2019 bookings were made by Gazprom, its subsidiaries or partners – this is suggested by the pattern of bookings. The fact that European midstreamers have not at all booked post-2019 means that the dominant market participant obtained these capacities practically without any competition. And these capacities should be attractive to midstreamers considering the future expansion of Nord Stream and the change of flow patterns in Europe. In our view, the auction led to distorted outcomes. True competition took place among midstreamers only for the 2017-2018 gas years, while after 2019 only one market player booked capacities.

An auction at the RBP platform[2] took place concurrently with PRISMA, and just before the Hungarian Energy and Public Utility Regulatory Authority (HEPURA) announced that capacity bookings longer than 3 years for interconnector points Mosonmagyaróvár and Balassagyarmat would not be permitted.

These cross border points are the most important entries for Hungary and South-East Europe, representing the gateway to more liquid Western European gas markets. In its justification, HEPURA noted that long-term bookings crowd out short-term competitive flows and thereby restrict competition, noting that:

- The dominant flow along European gas infrastructure will be significantly altered upon the expansion of Nord Stream and the addition of other internal infrastructure.
- Market players in direct contact with upstream external EU producers may consider the long-term market developments for their bookings
- Midstreamers active on the Hungarian market prepare their business decision for a much shorter timeframe, and their capacity bookings are set accordingly
- Information asymmetry may lead to a situation in which market players with more information obtain capacities cheaper than midstreamers who optimise on a shorter timeframe. Thus the current capacity bookings on the long term lead to a competitive disadvantage for the midstreamers having less information.
- Therefore HEPURA will forbid long-term bookings as long as all information on internal European network developments connected to the expansion of Nord Stream are available to all market players.

In this article we assess the bookings on PRISMA and offer policy advice for the future.

1 The currently active gas transit agreement between Russia and Ukraine expires in 2019.

2 The RBP is the capacity booking platform of eight Eastern European TSOs (Bulgartransgaz (BG), Desfa (GR), Eustream (SK), FGSZ (HU), Gas Connnect Austria (AT), Magyar Gáz Tranzit (HU), Plinacro (HR), Transgaz (RO))

Analysing the auction results

The capacity auctions were unique in the sense that the same methodology and rules were applied to all interconnector points in Europe. According to the rules, if there is no congestion on an interconnecting point (total capacity bids do not exceed the offered capacity at the interconnecting point), then all the bids are accepted and bidders pay a pre-defined regulated tariff for the capacity. If scarcity emerges, then the capacities are marketed at auction and market players pay more than the regulated price for infrastructure access. TSOs can offer 90% of technical capacity for long-term bookings, with the remaining 10% retained for short-term trade.[3] Winners of the bid book non-interruptible capacity on the interconnector points. The TSOs may allow for the winners of the bid to cancel their bookings and be relieved from payment obligations.

For some IPs, capacities may be booked as long as 2043, but the usual timeframe for bookings is to 2031.[4]

Altogether 2,165 unique auctions took place on 6 March for each point and each year, with capacity bookings performed for 345 auctions.

Two-thirds of accepted bids were precisely equal to the offered capacity and the remaining one-third of accepted bids were below the offered capacity. This signals that market players were happy to obtain all of the offered capacities but not willing to pay a premium. It also means that there was no real competition for the capacities, as only one bidder took 100% of the IP's capacity.

Timing of bookings

Capacity bookings for 2017-2018 are notably lower than long term bookings. In the 2020-2031 time period, average booking was 150 GWh/day, while for 2032-2038 bookings averaged 110 GWh/day. For 2017, yearly bookings were only 39 GWh/day, and in 2018 only 6 GWh/day. This implies that long-term (post-2018) bookings are carried out by different market players than those in the near term (2017-2018), which is further corroborated by the geographical location of bookings.

Figure 1 Share of total booked capacity compared to total offered capacities, GWh/day

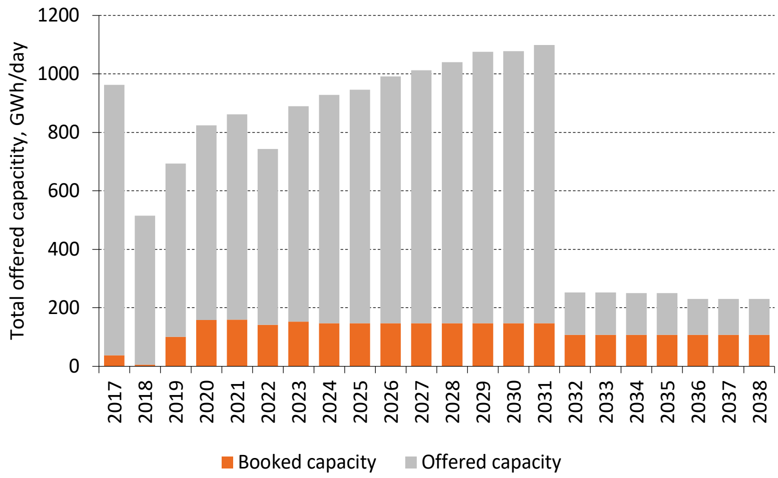
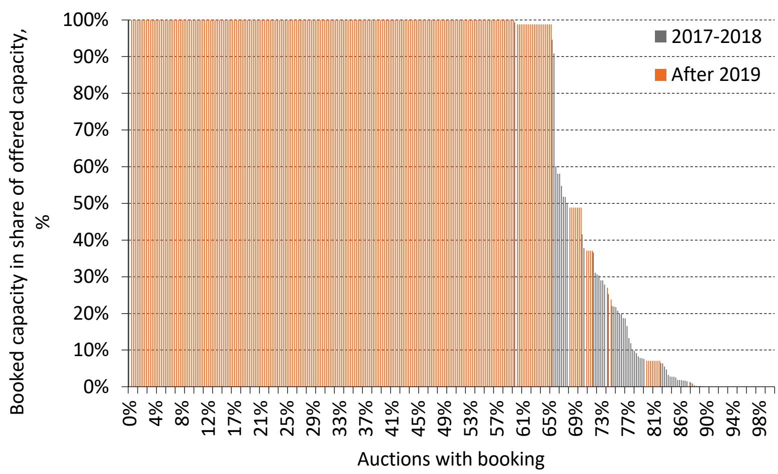


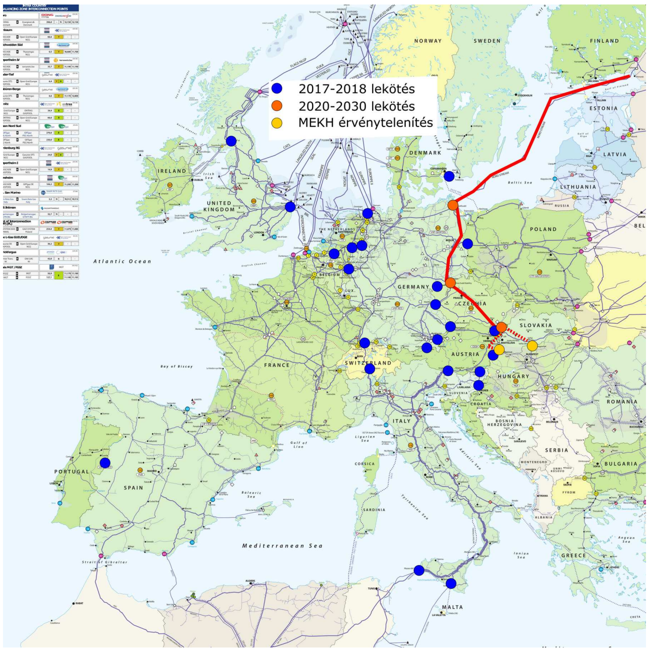
Figure 2 Booked capacities compared to offered capacities in successful PRISMA auctions, %



3 Commission Regulation (EU) 2017/459 of 16 March 2017 establishing a network code on capacity allocation mechanisms in gas transmission systems and repealing Regulation (EU) No 984/2013 set the rules for capacity bookings. Paragraph (6-7) of Article 8 stipulates that:
"An amount at least equal to 20 % of the existing technical capacity at each interconnection point shall be set aside and offered in accordance with paragraph 7. If the available capacity is less than the proportion of technical capacity to be set aside, the whole of any available capacity shall be set aside. This capacity shall be offered in accordance with point (b) of paragraph 7, while any remaining capacity set aside shall be offered in accordance with point (a) of paragraph Any capacity set aside pursuant to paragraph 6 shall be offered, subject to the following provisions:
(a) an amount at least equal to 10 % of the existing technical capacity at each interconnection point shall be offered no earlier than in the annual yearly capacity auction as provided for in Article 11 held in accordance with the auction calendar during the fifth gas year preceding the start of the relevant gas year; and
(b) a further amount at least equal to 10 % of the existing technical capacity at each interconnection point shall first be offered no earlier than the annual quarterly capacity auction as provided for in Article 12, held in accordance with the auction calendar during the gas year preceding the start of the relevant gas year."
This implies that for 2018-2020 gas years only 90% of the technical capacities could be booked, while after 2020 80%. In case of new infrastructure, only 10% shall be retained for short-term trade.

4 Post 2031: Deutshneudorf EUGAL I , Deutshneudorf EUGAL II , Deutshneudorf EUGAL III ,Deutshneudorf EUGAL IV, Murfeld AT-SI, Cersak SI>AT, Lanzhoz II CZ>SK, Greifswald Entry, Vierow Entry; Post 2039: Vierow Entry, Greifswald Entry

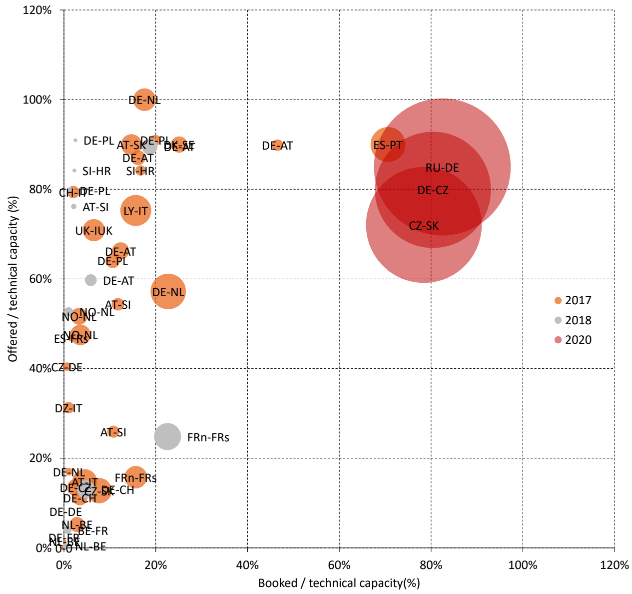
Figure 3 Location of booked IP sin 2017-2018 and after 2020



Location of bookings

From 2019 on, only the entry point of Nord Stream 2 and the new and already existing IPs connected to Nord Stream on the gas corridor from Germany via the Czech Republic and Slovakia to Ukraine were booked. This covers multiple IPs, but relates to three distinctive borders: the entry of Nord Stream to Germany (RU-DE), the OPAL pipeline on the German-Czech border (DE-CZ) and the Czech-Slovakian point at Lanzhot.[5]

Figure 4 Offered and booked capacity compared to technical capacity in 2017, 2018 and 2020, %



In 2016 and 2017 there are considerably lower bookings on the same IPs: in 2017, around one quarter of the 2020-2030 average bookings were made, while for 2018 only 4% is booked. The geographical pattern is far less concentrated: the 39 GWh/day bookings made in 2017 were made at 20 distinctive points, while the 2020-2030 bookings concentrated on three borders (RU-DE, DE-CZ, CZ-SK) establishing an easy-to-recognise gas corridor. This new gas transmission route was partly financed by the European Union after the 2009 gas crisis to improve diversification and ensure security of supply in Central-Eastern Europe, opening potential trade of new gas sources to compete with the long-term contracted Russian gas.

It is worth comparing technical capacity at IPs with offered capacity at the auction. Since PRISMA does not publish the technical capacity at the IPs, ENTSOG transmission capacity maps and network development data were used.

The figure below shows booked capacity against technical capacities on the horizontal axis. The size of the circles indicates the magnitude of booked capacity. According to current capacity allocation regulation in the EU, not all capacities can be booked on the long term, with at least 10% retained for yearly bookings and an additional 10% for intra-year short term bookings. It is apparent that all TSOs complied with this regulation. Most bookings were made in relation to the future Nord Stream 2, from its planned entry point to subsequent European internal IPs booked at 80% for the 2020-2030 period. For this timeframe, no other IPs were booked at all, which can be explained by midstreamers optimising their portfolio using short-term capacity products. This result is supported by ACER's 2016 Market monitoring Report: "A comparison with prior MMR results shows however a decrease, on a yearly average, in aggregated technical capacity being contracted and a change in capacity utilisation trends. Shippers increasingly contract capacity for a shorter term to cover needs associated with high seasonal demand (profiling of bookings). In addition there could be a slight increase in confidence to acquire capacity as CMP measures are gradually applied (i.e. triggering the release of unused capacity). In general, capacity seems progressively more accessible for shippers."

This is underlined by the fact that for 2017-2018 (orange and grey points) different IPs were booked at a much lower share of offered capacity. The preference of market players for the shorter term is reflected by the fact that 2018 bookings are much lower than 2017 bookings. To summarize, for 2020-2030 we find 20% free capacity while on all points in 2017 close to 80% of offered capacities is available for short term trade.

5 RU-DE: Lubmin II, Greifswald, Greifswald Entry, Vierow, DE-CZ: Deutschneudorf, Oldbernhau 2, CZ-SK: Lanzhot, Lanzhot 1, Lanzhot 2, Offered capacity compared to booked capacity on existing European IPs shows a high variance.

On the west-to-east gas transmission corridor analysed above, less than 20% of capacities were booked for 2017-2018 by midstream market participants. This capacity will be available after 2020 for yearly bookings, which could prove problematic for traders that ensure the bulk of their trades with short term deals. The bulk of this gas trade is made by short term bookings, with booked capacity in 2017 making up only 10% of annual European gas consumption (for these IPs there may be already long-term bookings present unreported by PRISMA).

After 2020, 80-90% of capacities offered on the west-to-east gas corridor (entry of Nord Stream, DE-CZ border and CZ-SK border) are fully booked.

Bookings for the Hungarian entry points Mosonmagyaróvár and Balassagyarmat are organised on the RBP platform, which would complement and complete the gas corridor mentioned above. Under resolution 1858/2017, HEPURA blocked the possibility for booking this capacity in the 2020-2030 period. Still, bookings at Mosonmagyaróvár in 2017 reached 80%, and in 2018 40%.

Long-term bookings for Balassagyarmat were also constrained, although there were not significant bookings for the next two years.

Long-term bookings of major EU exporters on the European transmission network based on previous contract structure

On the Trans-Balkan pipeline, which transports Russian gas via Ukraine, Moldova, Romania, Bulgaria, Macedonia, and Greece to Turkey, long-term capacity bookings and the lack of third-party access crowd out potential market entrants (eg. Romanian domestic production on the Bulgarian market). The long-term contract in force is partly to blame for the lack of third party access on the gas transmission network, and some capacity offers are expected upon the expiry of long-term contracts (2024-2029).

A similar but considerably smaller corridor transits from Ukraine to Serbia and Bosnia via Hungary. On this route, a long-term booking exists at the Hungarian exit to Serbia at Kiskundorozsma. Although it is technically possible to utilise the remaining . Capacity on the pipeline, the current relatively high cross-border tariff makes it commercially unfeasible, effectively closing the market for other entrants (until 2024).

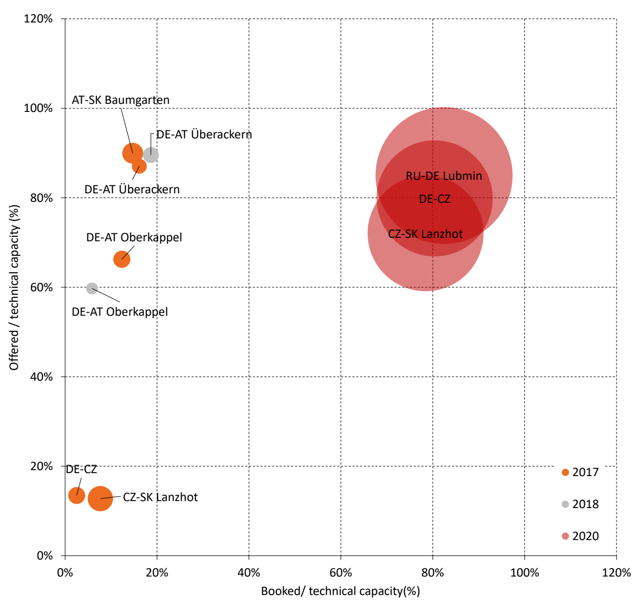
Traditional routes of Russian gas transit to Western Europe cross through Slovakia using the Brotherhood pipeline, or via Belarus and Poland on the Yamal. The Slovakian and Austrian entry point is booked until 2028 for 47 bcm/year while the Czech-German exit at Waidhaus is booked for 30 bcm/year. It is intriguing that no long-term bookings are present on the Slovakian-Czech border, possibly because the long-term supply contract was simply converted for the entry-exit system. On the TAG pipeline, which transmits gas from Austria to Italy, bookings are made only up to 2023. Bookings of 32.6 bcm/year on the Polish entry point of Yamal are made until 2020 with 29.5 bcm/year on the German entry at Mallnow. After 2020 only 3 bcm/year is booked on Yamal pipeline, and from 2025 the main routes of supply are reversed: at Mallnow 10 bcm/year is booked from Germany to Poland until 2032, then 4 bcm/year to 2035.

Other pipeline exporters supplying Europe, such as Norway and Algeria, follow a different strategy by not booking any capacities on the internal EU network.

Target markets for the Algerian pipeline exports are Italy, Spain and Portugal, and it booked long term (2020-2024) capacities at the Italian and Spanish entry points.

For Norwegian entry points, high booking capacities were made for the next 1-2 years (17 bcm/year), but on

Figure 5 Bookings in 2017-2018 for the highly booked IPs, %



the longer term to 2025 these bookings (at Emden and Dunkerque) are withdrawn, with the exception of bookings on the Belgian-French border (15 bcm/year) for 2020-2023.

For the TAP pipeline that will transit Azeri gas via Turkey and the Balkans to Italian, Greek and Bulgarian markets, tier 1 capacities have been booked at 90% for ten years.

Based on this information and the PRISMA auction results it can be concluded that the Russian supplier has booked capacities which are more than sufficient to supply the South East European region for the 2020-2028 period, either from the West or from the East. This might not be problematic per se, but the long-term bookings make it impossible for other competing sources of gas to reach the region, something only possible from the West. Moreover, other suppliers do not book capacities on the internal European network, only at the entry points to the EU.

Conclusions

The last building blocks of the European regulatory LEGO have just clicked into place with the missing network codes, underpinning the first coordinated European capacity auction and the race for fair and indiscriminate competition. However, the results are puzzling. Within one day, the network capacity usage was cemented for 20 years in favour of the dominant player, Market abuse and distortive practices in Eastern Europe run directly counter to the European Union's investment of billions of euros to strengthen security of supply and diversification by means of infrastructure development.

Regulatory harmonisation of the European gas market is a lengthy process, and through the industry-wide consultation compromises made to get the deal through may shift the original vision of the Commission in favour of the market participants. In this case, new auction rules allowing and even favouring long-term bookings as predictable revenue streams for TSOs is favoured, even though by definition the regulations grant full recovery of investments via tariffs. Support for this particular interest could end up costing the consumers dearly by inadvertently solidifying the dominant position of incumbent importers to Europe.

Even though greater volumes of bundled capacity products are traded in a more transparent manner thanks to the implementation of CAM NC, in 2015 only 5% of capacities regulated by the CAM Network Code were traded on a bundled basis.[7]

Although the 2016 ACER market monitoring Report proudly declared that market based capacity bookings have shifted to the short-term, from the results of the 2017 capacity auctions this conclusion seems premature - bookings for the peak days increased while physical flows have not changed.

Long-term capacity bookings for pipelines under construction is an important tool to mitigate risk for investors, and in some but not all cases it may be a prerequisite for the construction of new pipeline infrastructure. However, social benefits derived from long-term bookings on existing pipelines that have already recovered their investment are non-existent. Moreover, these bookings may further restrict market access to other players seeking the cheapest routes and sources of gas, which ultimately raises prices relative to the most efficient market outcome.

Commission Regulation 459/2017/EU gives clear and comprehensive authority for NRAs against market constraining long-term capacity bookings.[8] Even so, up to 2016 there were only three cases when short-term booking volumes had been raised or long-term bookings were constrained.[9] Based on the potential impact of long-term bookings presented in our article, the limitations placed on long-term bookings of Hungarian IPs are well reasoned. It is regrettable that only the Hungarian regulator took steps to prevent market distortive long-term bookings while the German, Czech and Slovakian regulators did not take such actions.

This capacity auction shows that information sharing should be improved within the framework of ACER and CEER. An alternative would be a drastic increase of the 10+10% short term capacity reserve. To determine exactly how much this should be, further analysis is needed taking in to account the market participants (traders and consumers), and accompanied with a detailed analysis of capacity booking methodology. It should be noted that European TSOs are operating in heavily regulated business environments, therefore their focused lobby for long term bookings is perfectly understandable but not necessary reasonable since the recovery of their costs is ensured by the tariff itself.

7 ACER (2016) Implementation Monitoring Report on the Capacity Allocation Mechanisms Network Code, http://www.acer.europa.eu/official_documents/acts_of_the_agency/publication/implementation_monitoring_report_on_the_capacity_allocation_mechanisms_network_code.pdf

8 Article 8, paragraph 9: „The exact proportion of capacity to be set aside pursuant to paragraphs 6 and 8 shall be subject to a stakeholder consultation, alignment between transmission system operators and approval by national regulatory authorities at each interconnection point. National regulatory authorities shall in particular consider setting aside higher shares of capacity with a shorter duration to avoid foreclosure of downstream supply markets."

9 Slovenian regulator allowed 21% for annual bookings, and the Spanish decided to maximise capacity bookings in 5 years. ACER (2016) NC CAM Implementation Report p.75

The Paris climate agreement without the USA

Donald Trump, the president of the United States of America, promised during his election campaign that, if elected, he would remove the United States from the Paris Climate Agreement. The Presidential Executive Order „Promoting Energy Independence" on 28 March 2017, aiming to reverse the climate policy initiatives launched by the Obama administration, provided the first indication that he would fulfil his promise. Soon after, in the beginning of the summer, he publicly announced his intention to leave the Agreement, and on 5 July he informed the United Nations in an official letter. Although the rules of the agreement do not allow an exit before 2019 and the process may be completed only shortly before the end of Mr. Trump's term, the announcement provided a signal to market participants, while also making it clear that the government seeks to terminate support to the Green Climate Fund. This is the fund through which developed economies provide voluntary support to enable the achievement of the climate policy goals of developing countries as well as their adaptation to the adverse environmental impacts of climate change. It is debatable if, by keeping his promise, Mr. Trump was attempting pander to voters, since surveys show that 71% of registered voters view global warming as a real problem, 58% agree that climate change is anthropogenic, while 77% would like policymakers to take steps to limit emissions[1].

The historic responsibility of the United States (present) and its climate policy (absent)

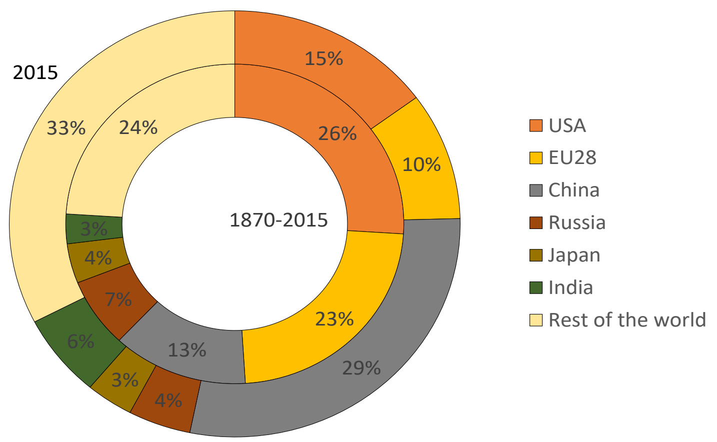
Climate change is widely acknowledged to be caused by greenhouse gases (GHGs) that accumulate in the atmosphere for decades, which is mostly attributable to the most developed countries that were among the first to industrialize. Based on the statistics of historical energy production, researchers are able to provide long-term retrospective estimates of the total volume of carbon-dioxide that has been released by specific countries as a result of their fossil energy use. These cumulative carbon-dioxide emissions duly indicate the extent to which individual countries are responsible for the current atmospheric concentration of greenhouse gases. As the pie charts of Figure 1 show, between 1870 and 2015 the US emitted the largest share (26%) of the CO_2 that is accumulated in the atmosphere, and even today it is the second most significant carbon dioxide emitter, following China. In other words, the country most responsible is failing to take multilateral action with other countries to fight climate change – and this already happens for the second time.

The first "let-down" occurred in 2001 when the administration of George W. Bush rejected the ratification of the Kyoto Protocol following its endorsement by the Clinton administration, claiming that participation would be "too costly for the USA" while China, a rapidly growing competing economy, was exempt from the obligations. These two factors also played a key role in Trump's rhetoric.

The fact that China, India and other developing countries did not have to take part in the reduction of emissions for the 2008-2012 period was justified by their minor historic emissions relative to the developed countries, while being the most affected by the adverse impacts of climate change. During the post-1990 period China exhibited striking economic growth matched by rising GHG emissions, but today it considers a transition to renewable energy, participation in the renewable industry and contribution to international efforts towards emission reduction as an important strategic path.

Although for the last two decades several attempts have been made to set federal climate policy targets, these initiatives all failed during the legislative process. In his second presidential term, President Obama came closest to establishing national targets.

Figure 1 Distribution of cumulative (1870-2015) and annual (2015) carbon-dioxide emissions among countries



SOURCE: GLOBAL CARBON PROJECT 2

1 Leiserowitz, A., Maibach, E., Roser-Renouf, C., Rosenthal, S., & Cutler, M. (2017). Climate change in the American mind: May 2017. Yale University and George Mason University. New Haven, CT: Yale Program on Climate Change Communication; http://climatecommunication.yale.edu/publications/climate-change-american-mind-may-2017/

He introduced a Climate Action Plan in 2013, the three most important pillars of which were the reduction of GHG emissions, adaptation to climate change and a leading position in the fight against global climate change. Since the failure of federal climate policy legislation that would have introduced an emission trading scheme and efficiency and renewable targets in 2009 and 2010[2], the Obama administration used presidential decrees to create rules for emission reduction. In addition, he took advantage of a 2007 Supreme Court ruling that greenhouse gases classify as air pollutants and are therefore subject to the Clean Air Act, allowing the US Environmental Protection Agency (EPA) to impose legal limitations on them.[3] Although the decision referred to new vehicles, it served as the basis for EPA's 2013 decision to set emission limits for newly built power stations whereby newly built gas fired plants were allowed to release a maximum 1000 lb (453 kg) of carbon-dioxide per MWh and new coal fired plants 1400 lb (634 kg) of CO_2 per MWh. This measure virtually eliminated the possibility of building new fossil fuel based power plants without the application of carbon capture and storage (CCS) since, according to International Energy Agency data, the specific GHG emissions attainable by the most up-to-date coal based technologies, still under development, are at around 670 kg per MWh.[4]

Through the so-called Clean Power Plan, introduced at the end of 2015, Obama would have finally ensured federal emission cuts and control of future emissions from power plants. The plan set state-specific emission reduction targets, reducing the 2030 emissions of the power sector by 32 percent compared to 2005, while allowing the states to devise their own emission abatement methods. According to the original plan, by 2018 at the latest each state should have developed its own emission reduction plan, but in February 2016 the Supreme Court suspended the regulation as several states appealed. Fully implementing the plan would also have greatly contributed to the fulfilment of the US commitment under the Paris Agreement, representing a 26-28% emission abatement by 2025 compared to 2005 levels.

Through the above mentioned Executive Order, in addition to the Clean Energy Plan, Trump ordered the review of a number of other climate policy regulations that had been enacted by the Obama administration. These include, inter alia, the emission limits set for new power plants, the mandatory monitoring of methane emissions from oil and gas production, and the consideration of the social cost of carbon-dioxide emissions in government decisions. The abolition of the rules, however, does not automatically happen with the publication of the new presidential decree. Instead, like any legislative process at the federal level, it will take many months or years for the entire process to be repeated, including the publication of draft legislation, the conduct of a social debate and the defence of the final, published legislation in court. The latter will almost certainly be needed, as environmental and climate organisations will, predictably, launch a series of lawsuits against the changes.

Is the US the biggest free rider?

It is not surprising then that the United States is often referred to as the free-rider of climate protection, but it is still worth examining whether the US is indeed only a beneficiary of the efforts made by other countries. Although explicit climate policy goals are absent at the federal level, initiatives to curb carbon dioxide emissions as well as energy efficiency and renewable energy targets exist at the state level. California and 9 northern states (RGGI) operate an emission trading system, and both at the state and federal level multiple incentives help to facilitate the penetration of renewables and energy efficient solutions. To mention only the most common incentives for renewables: of the 50 states, 29 have a compulsory and 7 a voluntary Renewable Portfolio Standard, 18 states employ trading schemes for renewable energy certificates (REC), and the penetration of small scale photovoltaic equipment is promoted by 47 states by providing the option of net metering.[5] At the federal level, fiscal incentives – the renewable electricity production tax credit and the energy investment tax credit – are the most important drivers for renewable investments. The former provides a specific amount of tax relief after each kWh of produced and sold renewable electricity, while the latter allows both companies and individuals to deduct 30% of the value of their renewable investment from their tax. In addition, according to the 2005 Energy Policy Act, a certain percentage of the federal government's energy use needs to come from renewable sources and the energy efficiency and renewable investments of government buildings are also supported.

3 The 2009 bill on American Climate and Energy Security Act (ACES) and the 2010 bill on American Power Act.

4 Massachusetts vs. EPA, 2007, https://www.justice.gov/enrd/massachusetts-v-epa

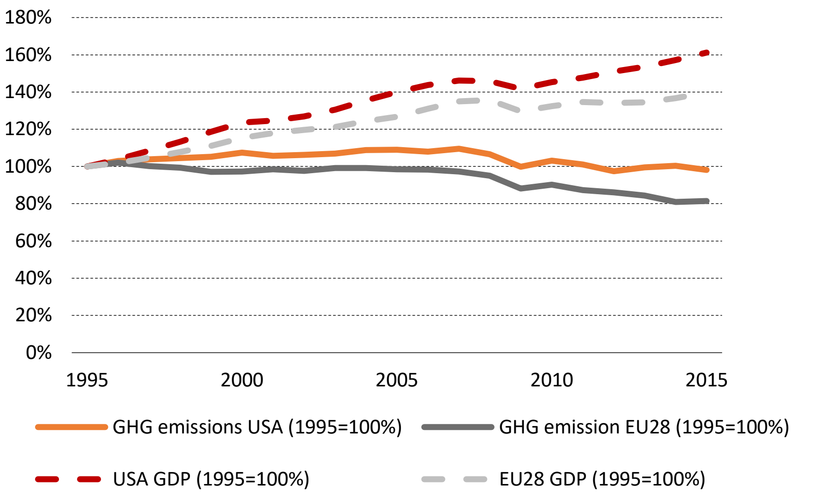
5 Advanced ultra supercritical (A-USC) coal-powder fired and integrated gasification combined cycle (IGCC) technologies. Source: IEA (2015) Projected costs of generating electricity

5 Detailed information on state level renewable and energy efficiency incentives is available in the DSIRE database, see http://www.dsireusa.org

Although these long-standing incentives were originally devised to enhance the energy independence of the US rather than out of a concern for the environment, it is unquestionable that the United States (as the country with the 2nd highest renewable capacity in the world) has also contributed to the cost reduction of renewable technologies. However, due to the lack of specific climate policy goals, there is a significant gap in the evolution of GHG emissions compared to the EU, both in terms of trends and underlying factors, as shown in the following figures.

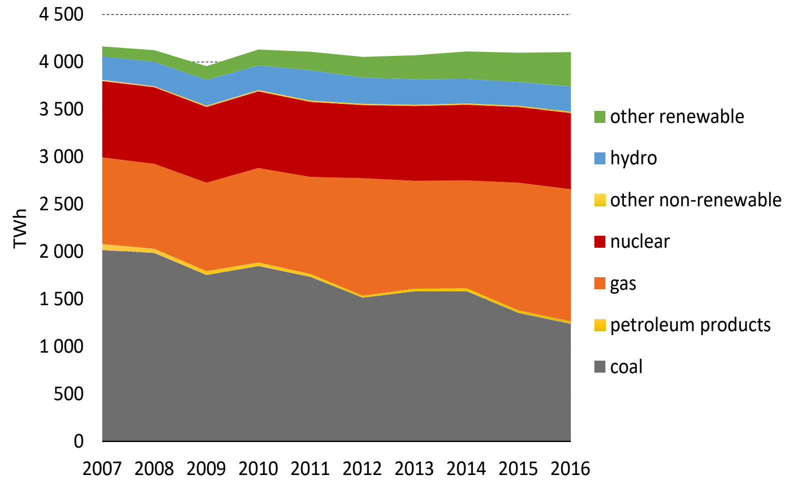
Based on the annual GHG emission inventories submitted to the UNFCCC, the GHG emissions of the US in the baseline year of the Kyoto Protocol (1990) were 6.4 billion tonnes of carbon-dioxide equivalent and displayed an upward trend until 2006, topping at 7.3 billion tons in 2006 and declining subsequently in the wake of the economic crisis to 6.6 billion tons by 2015. Figure 2 shows the evolution of the US and EU28 GHG emissions and gross domestic product (GDP). Compared to 1990, US emissions increased by 3.51%, while in the EU a decline of 23.66% took place.[6] Before the years of the crisis the more dynamic economic growth in the US led to increasing emissions, followed by a decline later, while the slower GDP growth of the EU – especially after the crisis – led to a bigger fall in emissions.

Figure 2 The trends of carbon-dioxide emissions and GDP in the US and the EU28, 1995-2015



Source: UNFCCC and EUROSTAT

Figure 3 The composition of net electricity production by energy sources in the US, 2007-2015



Source: US ENERGY INFORMATION ADMINISTRATION

The decoupling of GDP growth and GHG emissions is evident in both regions. The crisis is likely to have generated some structural change in the economies of both regions, but while the decline in EU GHG emissions can probably be more closely attributed to the achievement of explicit climate policy goals, for the USA experts claim that the positive shift is mainly due to the shale gas revolution. The abundant volume of natural gas, available at a low cost, replaced large amounts of coal based production, while also implicitly contributing to the growth of GDP. As the figure below depicts, gas based electricity generation replaces an increasing share of coal based generation in the US, while renewable energy use also continues to grow relentlessly. Compared to 2007, by 2016 coal based production fell by 40 percent, while gas-fired power stations generate 50 percent more electricity and the output of renewable producers increased by 12 percent.

The illusion of "really clean coal"

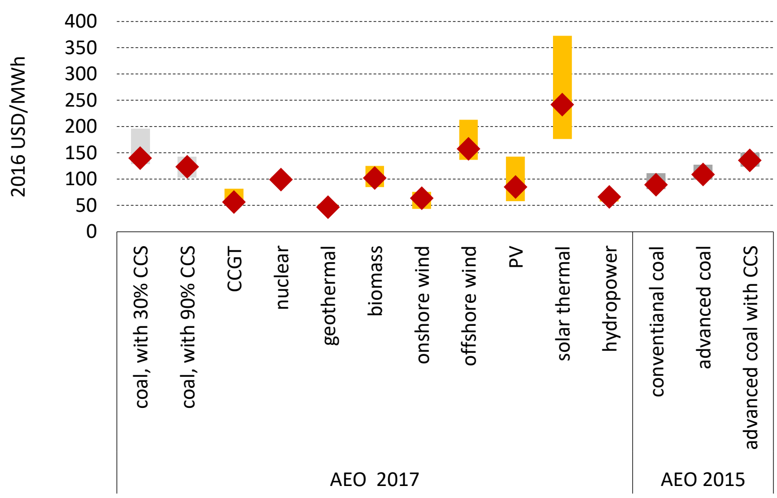
The rate of decarbonisation of the economy is determined primarily by power plant investment decisions driven by market processes, not the statements of the president. When Trump announced the Executive Order of 28 March, he declared that he would put an end to the war on coal, as the US needs "coal, really clean coal". In spite of Trump's commitment to fossil energy, however, no dramatic change in the market trend of energy prices is foreseen, and the expectations of energy market players who typically decide on long-term investments are not necessarily altered by Trump's presidency. The decline in the production of coal was not caused by Obama's decrees, but by the low price of natural gas, the falling cost of renewables, and more modest economic growth compared to previous periods.

6 Without land use, land use change and forestry (LULUCF).

The following figure shows the levelized cost of electricity (LCOE) of energy generating units under construction in 2016 and expected to become operational in 2022, based on the Annual Energy Outlook (AEO, 2017) of the US Energy Information Agency (EIA). Since only CCS-equipped power plants are capable of meeting the 2015 emission standards for new coal fired power plants, the latest publication includes cost data only for such power plants, and notes that in 2016 no coal based power plants were constructed. To understand how much the situation may change as a result of Trump's actions, the cost data of coal fired power plants without CCS, published in the 2015 study, are also displayed on the right side of the figure (converted to 2016 USD values). This shows that even conventional pulverised coal power plants have higher levelized costs than combined cycle gas power plants, and they also must compete with the cost of renewable technologies, mainly PV and on-shore wind (the displayed LCOE values are without support).

According to the investment information provided by the EIA, the fuel mix of newly installed capacities has changed significantly over the last 15 years. During this period, a total of 20 GW of coal and 228 GW of gas fired capacity was created while nearly equivalent (53 and 54 GW) capacities were phased out from both technologies. Between 2002 and 2006, most newly installed generating capacities were gas based, and since 2006 renewables have risen to the top. In 2016, 60 percent of the new capacities were renewable (mainly wind and solar) and 33 percent were gas-fired.[7]

Figure 4 The levelized cost of electricity of new power plants in the US



The availability of renewable subsidies and the decline in technological costs have also facilitated the greening of corporate energy use. The example of several large corporations further dirven by their customers, has been followed by industry competitors and other large companies. The group of companies targeting the procurement of one-hundred percent renewable energy, the RE100 group, for instance, counts 101 members now, and many of the Fortune 100 and Fortune 500 companies have also set sustainability targets. The growth of corporate demand promotes the penetration of renewables not only in the US but also in other regions. To supply its data centres, Google, for example, has assisted in the completion of renewable projects in North and South America as well as in Europe, mainly through long-term power purchase agreements (PPAs). The "virtual" version of long-term power purchase agreements also proliferates. In this case the corporation makes use of the renewable energy certificate of the financed project to prove that it obtained its energy use from renewable sources. The most committed companies also work to green their supply chain, pressuring suppliers to use renewable energy. For renewable power purchase agreements globally, the US corporations are in the lead position.[8]

The domestic political dissatisfaction with the exit is reflected by the fact that at the initiative of the governors of Washington, New York and California, 13 states, several major cities, regions and companies have joined to reaffirm commitment to the Paris goals. Members of the group, called America's Pledge, have initiated at the UNFCCC a position from which they could submit their commitments and emission reports independently.

NOTE: DATA FOR POWER PLANTS ENTERING INTO OPERATION IN 2022 (AEO 2017) AND COAL FIRED PLANTS ENTERING INTO OPERATION IN 2020 (AEO 2015), 2016 USD VALUES. SOURCE: EIA, ANNUAL ENERGY OUTLOOK, 2015 AND 2017egjegyzés: 2022-ben üzembe lépő erőművek (AEO 2017) és 2020-ban üzembe lépő szemen erőművek adatai (AEO 2015), 2016-Oos USD értéken. FORRÁS: EIA, ANNUAL ENERGY OUTLOOK, 2015 ÉS 2017

7 *https://www.eia.gov/todayinenergy/detail.php?id=30112*

8 *Source: We've got the power, Big business sees the promise of clean energy, The Economist, Print Edition, 10 June 2017.*

The possible consequences of the us withrawal from the Paris climate deal

Interestingly, both the Kyoto Protocol and the Paris Agreement were heavily supported by the America's active participation before subsequent adminstrations left the agreements. The withdrawal of the second largest polluter and most influential country from the process is detrimental to further rounds of international climate change negotiations and sends the wrong signal to other countries that may be more inclined to ignore their non-binding reduction targets. States ratifying the Agreement should make new commitments in 2020, and there are concerns that the absence of the US may adversely impact the ambition of some developing countries, especially those with incomplete infrastructure and immature energy supply. The financial support of the US will also be missed from the Green Climate Fund, which can hinder emission abatement and the sustainable development of developing countries. The exit of the US could also influence the feasibility of the plans to reform the European emissions trading system. Indirectly, the price of carbon may decline, and the EU may be inclined to prolong the free allocation of emission allowances for sectors exposed to competition. This would also have a negative effect on the volume of trade and the carbon price. A more equitable, but also cumbersome option is the introduction of a carbon duty on US imports to maintain competitive advantage, but this may trigger a commercial trade war.[9]

To summarize, the decision of the Trump administration may negatively affect international cooperation and seems to be an ill-considered step from the point of view of both domestic and foreign policies. Abandoning the agreement will likely hamper global emission reduction efforts to some extent due to the loss of financing and the likely decline in the engagement of some countries. At the same time, Trump cannot overcome the US legislative machinery to fully reverse existing climate policy measures, and his influence over markets is even less. If the decline in cost of renewable technologies continues and the cost advantage of natural gas-based power generation persists, one can hope that global climate policy goals will be attainable despite the withrawal of the US.

9 The burning question - Climate change in the era of Trump, The Economist, print edition, 26 November 2016

What will the Tariff Network Code bring? Changes in gas transmission tariffs

The last Network Code enforcing the harmonised and transparent transmission tariff regulation of the European gas market was published in March 2017. This put an end to a nearly 10 year process, with the preparatory work of the first Network Codes starting in 2007. The Tariff Network Code (TAR NC) itself is also a sustained undertaking after first consultations regarding tariff formation started in 2011. The first version of the document was the 'Framework Guidelines on rules regarding harmonised transmission tariff structures for gas', published in 2013. It included the main changes and directions for the new regulation, allowing NRAs and TSOs to start to prepare for the regulation that finally came into force this past spring.

However, the finalization of the document was not easy. ENTSOG submitted the first version to ACER in 2014, and another version with significant changes was submitted in July 2015. The final network code includes a less restrictive framework on tariff calculation methodologies. The aim of the regulation is the same, but as it is presented in this paper, NRAs have more freedom to decide between the applied methodologies.

The most important elements of the Tariff Network Code

The main objective of the TAR NC is to create cost-reflective, non-discriminatory and objective tariffs, that minimise cross-subsidization and facilitate cross-border trade. Cross-subsidization should be eliminated between intra-system and transit use, and also between the users of different entry and exit points.

Tariffs tended to be higher at points where high flows were expected, for example long-term contract/transit routes, exit points to "dead-end" countries, and domestic exit points. Another common distortion, which will be presented in the second half of this paper, follows a "let the gas in cheaper than let it out" principle, by which exit tariffs were typically higher than entry tariffs on average, and the commodity elements of the tariff were mostly paid at the exit points. In order to ensure the termination of cross-subsidization different indicators and tests are selected and applied to confirm that tariffs are cost-reflective.

A cost-reflective tariff calculation is one of the key elements of the new Network Code. In previous versions, six different reference price methodologies were presented in detail for NRAs to choose from and apply as the basis of their tariff calculation. In the final version, there is only one reference price methodology, the capacity weighted distance related (CWD), and NRAs are not necessarily bound by it–any other methodology that applies the above principles (cost-reflectivity, no cross-subsidization) can be used with sufficient justification. However, CWD tariffs serve as benchmarks for alternative methodologies, with results compared and differences explained.

The methodology is applied for the calculation of reference prices, those of the yearly firm capacity product for all entry and exit points. The Network Code contains additional rules for the calculation of reserve prices[1] for short-term (quarterly, monthly, daily) and seasonal products. For multipliers and seasonal factors, precise ranges are given to help avoid unreasonably high, extreme tariff settings. The new regulation also includes tariff principles for incremental capacity and rules for interruptible product pricing.

There are some special infrastructure characteristics where discounts can be applied. For transmission entry and exit tariffs to and from storage facilities, this is not a suggestion but an obligation: at least 50% discount should be applied from the reference tariff price methodology in order to avoid double charging and to facilitate storage use. Storage that directly competes with IPs or DSO entry/exit points are exempted from this obligation. Interconnection points that can help to increase security of supply can also be discounted, such as entry points from LNG regasification terminals or singular entry points to "dead-end" countries. Here the document does not specify an appropriate discount level, thus with sufficient justification NRAs can decide at their own discretion.

Furthermore, NRAs are allowed to use three adjustment techniques: benchmarking implies that the reference prices are adjusted at an entry or exit point so that the resulting values meet a competitive level. Equalisation offers the possibility to set one tariff for all (or a group of) entry or exit points of the system, while rescaling can take into account the profits and losses of the last few years, with tariff levels be adjusted accordingly.

1 The reserve price is the starting price of the auction for the given product.

In the end, the final version of the document allows NRAs to influence tariff formulation, but tariffs differing from the benchmark CWD levels must be detailed, publicly available and explained to, all of which is monitored by ACER.

The transparancy of tariff setting is an important criterion. All information and assumption in connection with reference and reserve price calculation should be published for system users, so they can recalculate (cross-check) tariff levels themselves and anticipate future tariffs. Although tariff calculators were mostly available on TSO websites already, the exact calculation method behind tariffs were not published. According to the Network Code the calculations and assumptions behind them should be published, including predictions for future capacity booking and flows (in peak conditions separately). Also the target revenue of the TSO and different cost elements should be available, including detailed asset evaluation and operational expenditures.

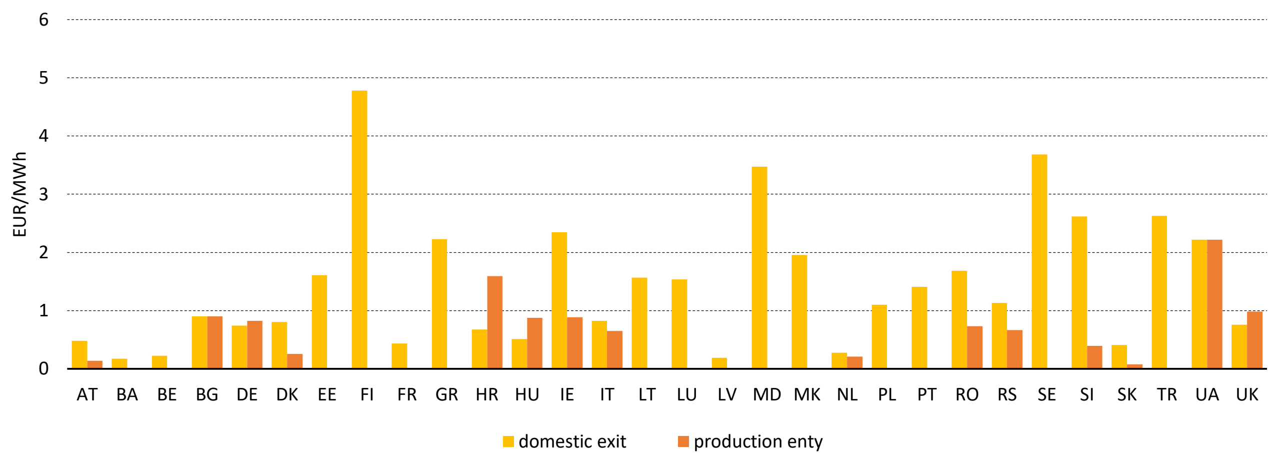
The NRA decides whether it or the TSO will be responsible to publish the information. These rules on publication requirements come into force October this year, while the development of reference price methodologies and the calculation of seasonal factors and short-term multipliers should be finished by 2019 March.

Transmission tariffs on domestic exit and production entry points

In light of the new rules, we evaluated the current domestic exit and production entry point transmission tariffs in Europe. Excluding the extremely high Ukrainian tariffs, the average tariff on domestic exit points (1.31 EUR/MWh) is almost double of the average tariff on production entry points (0.69 EUR/MWh). This latter only exceeds 1 EUR/MWh in case of two countries from the observed fifteen tariffs. Consumption is much higher than production in almost all European countries, thus it is possible, that the difference can be explained by the costs. In comparison, the average exit tariff on IPs in Europe is 1.29 EUR/MWh, while average entry tariffs on IPs is only 0.94 EUR/MWh, taken into account whole Europe. Also if the commodity price is paid on top of the capacity tariff, it is typically allocated at exit points rather than to entry points. This difference between entry and exit IP tariffs is more significant in non-EU countries, where the Tariff Network Code is not yet a legally binding document.

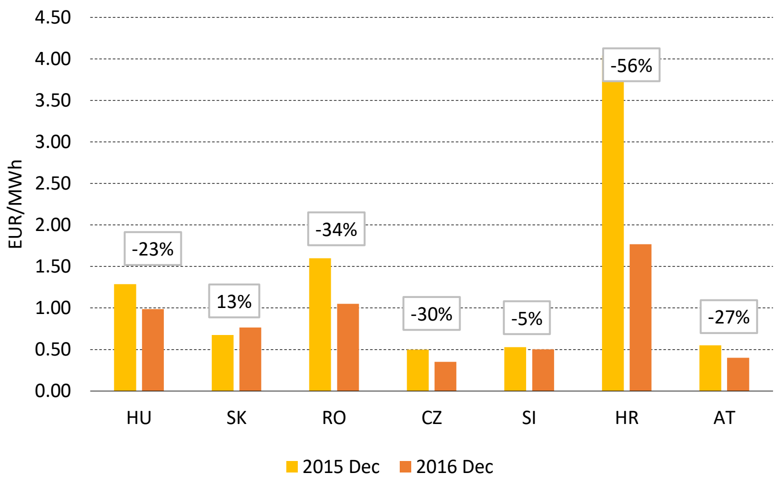
Tariff setting in the past few years appears to exhibit protectionist tendencies: make it cheap for the gas to come in and make it expensive to go out. In the Network Code a 50/50 entry-exit split is set as baseline (thus 50% of the revenue has to come from entry points, and 50% from exit points), however NRAs can choose other ratios if they are sufficiently justified. It is equally important to terminate cross-subsidization between intra-system and cross-system network use (transit) so every network user pays for what is used. In previous systems higher tariffs were typically applied to the busiest points (such as transit routes or domestic exit points), while for points competing with other IPs lower tariffs were levied. Th new tariff regime should be cost-reflective to eliminate these kinds of distortions.

Figure 1: Transmission tariffs on domestic exit and production entry points, in Europe



Source: REKK-calculation, based on TSO and NRA data; latest available information in 2016 December

Figure 2: Average IP tariffs by country in the region



The Hungarian tariffs were much higher than the regional average, but were reduced significantly last October (by 25-30%). Tariffs in other countries in the region reveal similar tendency, especially the more expensive ones (e.g. Romania and Croatia). With the implementation of the TAR NC not only will transparency grow, but extremely high tariffs are likely to fall as well unless NRAs can justify their existence.

It is still uncertain whether the TAR NC, allowing quite a level of discretion to regulators, will achieve its main objectives: cost-reflective, non-discriminatory, objective and transparent transmission tariffs throughout Europe. However, so far tendencies are promising. In the case of extremely high tariffs, the regulation can have a significant effect in lowering them to facilitate cross-border trade in the absence of sufficient justification. Although many countries already apply transmission tariff discounts for storage facilities, new tariffs can be favourable for both storages and LNG-terminals.

New Hungarian transmission tariffs from 2016 October

Although the deadline for developing the new reference price methodology is the latter part of 2019 and the final document was only published this spring, NRAs have been preparing for the new rules for years. In case of the Hungarian tariffs, TAR NC played an important role in the new tariff calculation[2], including for the reference prices, the seasonal factors and the short-term multipliers. Short-term product multipliers were set lower than the possible maximum, set by the TAR NC. Differences between seasonal factors are also moderate, but they are based on forecasted flows - also in line with the TAR NC - and contrast more than the ones applied prior. The Table below could only be reconstructed from the presentation of the Hungarian NRA held in June. In the Regulation[3] seasonal factors and short-term multipliers are not presented separately, and instead only the final, merged multiplier is provided for the products.

Table 1: Short-term multipliers and seasonal factors in the Hungarian tariff system and in TAR NC

	Product	Hungarian	TAR NC range
Short therm	quarterly	1,07	1-1,5
	monthly	1,17	1-1,5
	daily	1,85	1-3
	intra-day	1,85	1-3
Seasonal	monthly (10.01-03.31)	17%	0-200%
	monthly (04.01-09.30)	3,5%	0-200%
	daily / intra-day (10.01-03.31)	1%	0-200%
	daily / intra-day (04.01-09.30)	0,13%	0-200%

Source: presentation of Farkas Zoltánné (MEKH), IIR conference, 2017 June

2 New regulatory period started in 2016 October; the latest tariffs, published in 2017 July will come into force in 2017 October
3 Decree 8/2016. (X. 13.) MEKH on framework rules for setting gas network tariffs

Presentation of IEA country report 2017

In June 2017, the International Energy Agency (IEA) published its analysis on the Hungarian energy sector. The report gives an overview about the current state of the country's energy markets and recommends further policies for the Hungarian government to implement. The last such report was published by the IEA in 2011, so it is worth presenting and examining the main findings of the study. Although the report makes several recommendations for future improvement, overall it finds that the energy situation in Hungary has improved in many aspects since 2011.

The IEA study consists of three parts. The first is a general evaluation about the state of the Hungarian energy sector, focusing on regulatory issues relating to energy security, the extent of environmental pollution and energy efficiency measures. This is followed by a more detailed sectoral analysis about the electricity market, nuclear power, renewable energy sources, oil, natural gas, and coal markets. The focus of the final concluding section is innovation and research and development programs in the field of energy. All three sections of the country report begin with a description of the past and present, followed by an evaluation and concrete policy suggestions. In this analysis, we are not able to comment on all of the ideas that are presented in the IEA country report, so instead we review only those which we find to be the most relevant in professional and social discussions pertaining to energy in Hungary.

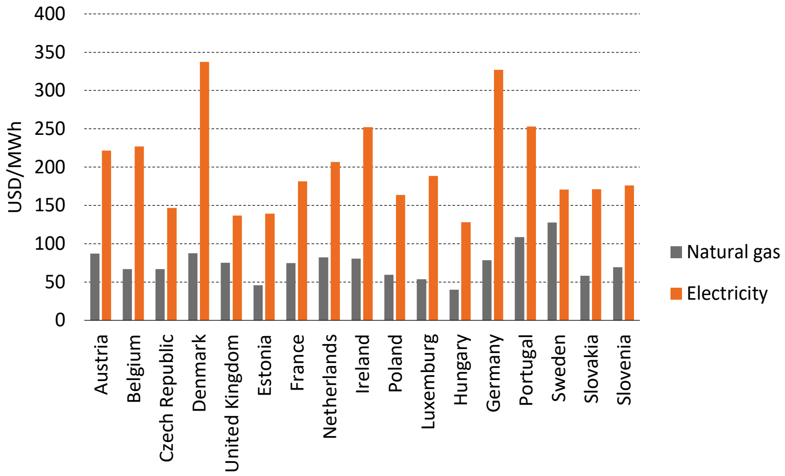
One of the main critiques of the 2011 report was that Hungary did not have a clear vision about which technologies it would base its energy supply on in the long run. Now, the IEA commends Hungary for having an energy strategy in place, committed to the "nuclear-coal-green" scenario. The IEA finds that Paks 2 fits perfectly into this framework as the new nuclear power plant would be an important tool of energy security and maintaining low carbon dioxide emissions.

The country report does not investigate the question of whether the selected "nuclear-coal-green" option itself is the best choice for the country or whether an alternative strategy would lead to a better outcome. The formulation of an energy strategy is clearly an improvement, but several questions emerge in relation to the lifetime extensions of the existing nuclear block and the construction of the new nuclear power plant. On top of that, there is also the question of maintaining of coal based capacities in the energy mix is compatible with decarbonization goals.

The arguments for Paks 2 are mostly based on the concept of addressing energy security and clean power generation simultaneously, similarly to renewable energy sources it can be an important tool of decarbonization. It would also significantly decrease Hungary's electricity import dependence. However, the concept of energy security is not equivalent with self-sufficiency. An important alternative consideration to Paks 2 is the expansion of renewable energy capacities. The "Green (+)" scenarios of the energy strategy considers higher renewable penetration than the European Union target for the country, but since the cost of wind and solar technology has been continuously falling throughout the 2010s. Then there is the issue of consistently low electricity wholesale market prices in Europe, making it questionable whether building a new nuclear power reactor would be economically suitable (for more details on this topic see our analysis from 2014). Finally, the IEA report highlights that in order to, comply with all security restrictions, the Atomic Energy Authority should be completely politically independent.

With respect to coal the energy strategy assumes 440 MW capacity in the long run. When the energy strategy was formulated, the possibility of clean coal power generation (Carbon Capture and Storage) supported the idea of having coal power capacities in the energy mix. The IEA report also notes that Hungary's carbon dioxide storage capacity theoretical potential is 26 billion tones. After 5 years, however, CCS technology is still in its infancy and thus it cannot be considered a viable alternative in the middle run. For this reason, the carbon dioxide emissions can only be reduced by the reduction of coal generation and not by clean coal technologies. This statement even more confounding considering the fact that IEA suggests the introduction of a carbon tax in the non ETS sector.

Figure 1 Average household electricity and natural gas prices in 2015 in European countries



Source: Energy Polices of IEA countries, Hungary 2017; IEA Key World energy statistics, 2016

The most powerful recommendation of the IEA study is related to the regulation of household natural gas and electricity prices. In both cases the country report recommends the elimination of administratively determined end-user prices. According to the opinion of IEA, the three-step end user price reduction (called: "Rezsicsökkentés") relieved the financial burden of the consumers to an extent in the short run, but this could lead to several negative consequences in the long-run. One example is that that low end-user prices disincentives investments into energy efficiency by reducing the returns of these investments. Figure 1 shows the end-user price levels in 2015 in several European countries.

The study recommends that Hungary develop a clear strategy for the elimination of end-user prices and support low income consumers with social policies rather than through end-user price regulation. It is difficult to argue that a well operating, competitive end-user market generates higher welfare than a tariff which is kept at an artificially low level. On the other hand, in stating that Hungary should convene a strategy to reach this goal, the IEA report does not offer any ideas how to do that.

Anyway, the question of how to implement full market liberalization is more pertinent than the decision between regulated or non-regulated end-user tariffs. The elimination of regulated tariffs is hindered by several factors in the Hungarian markets. First according to the principles of the National Energy Strategy, and the unexpected and drastic cut in end-user prices marked the expansion of the role of state. Since January 2017, the entire regulated segment of the natural gas consumers is supplied by Főgáz, owned by NKM National Utilities, while Démász (which is also owned by NKM National Utilities and currently supplies 775 thousand consumers) received a national license in June 2017 to supply electricity on the whole regulated market. Second, Hungarian household consumers typically did not change energy suppliers, which makes competition difficult. And third, the energy prices for households are at the center of Hungary's political debates, so in practice considerations of alternatives would be difficult to implement.

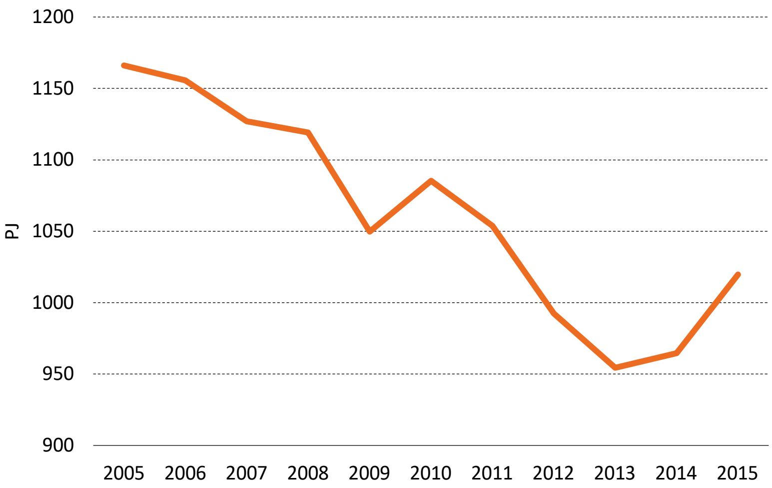
With respect to the above factors, the key question for household electricity and gas markets in the current Hungarian environment is not necessarily the existence or non-existence of regulated tariffs, but to provide a transparent and predictable environment for all current and potential market players. To achieve this, the regulated tariffs should track the changes of wholesale prices and private and state-owned service providers should operate under the same market conditions. Achieving these goals can serve as a basis for the elimination of regulated tariffs in the long run.

The IEA country report analyzes energy efficiency issues in detail. The main takeaway of the study is that Hungary's energy efficiency goals should be more ambitious. In the last Energy Efficiency Action plan published in 2015 Hungary set 1009 PJ primer and 693 PJ final energy use target for 2020.

The relatively low energy saving goals are noteworthy because future scenarios anticipated in the action plan are not completely in line with the historical values of the country's energy consumption. The "sitting and waiting" scenario which can be considered as a reference, forecasts 1001 PJ primer energy use, yet according to Figure 2 the primer energy use between 2005 and 2013 was constantly decreasing from 1166 PJ to 954 PJ. It is true however that in 2015 there is a larger jump to 1020 PJ. It is not possible to know whether this was just a one year event or the start of an increasing trend. It is also difficult to identify that the extent to which the precipitous decline until 2013 is attributable to implemented energy efficiency measures, but regardless the reference scenario envisions significantly growing energy consumption. Even the "joint effort" scenario (the mentioned 1009 PJ) envisions stagnating energy consumption relative to the outstanding value observed in 2015. Considering this information, the recommendation of IEA to formulate more ambitious energy saving goals seems to be a realistic suggestion.

At the same time, the country report notes that several improvements occurred in energy efficiency of the household and commercial sector. In the former, energy consumption decreased by 10% since 2010 while in the latter it fell by 23%. These two sectors were the main drivers of the trend in energy consumption as they account for approximately half of the energy consumption. The IEA opinion is that the artificially low end user energy prices can hinder household energy efficiency investments in the future. It would be also important, according to the study, to make operative plans about the implementation of National Building Energy Performance Strategy whereby the government secures the long-term financing of household energy efficiency programs.

Figure 2 Primer energy use in Hungary between 2005 and 2015



Source: Hungarian Central Statistical Office

Unlike the household and the commercial sectors, energy consumption in the industrial and transportation segments are on the rise. For industry, final energy use grew by 27% between 2010 and 2015, while in transportation it grew by 2%. The IEA recommendation for industry is to use energy audits for large companies that comply with European Union regulation. On top of that introduce energy efficiency programs for small and middle size enterprises. In transportation the report highlights the implementation of Jedlik Ányos electromobility program as the most important challenge.

The IEA study presents a mixed evaluation about renewable energy. The report highlights the importance of the start of METÁR in January 2017 which is the new feed in premium support system for renewables. METÁR can be a more predictable and cost-efficient form of renewable electricity support than the previously existed feed-in tariff (KÁT) system. It also mentions the expansion of PV capacities since 2010 can be considered a positive outcome.

On the other hand, the report clearly states that the renewable potential of Hungary is not being exploited, as overall penetration of renewable power sources in the 2010s has slowed relative to the second half of 2000s. In the electricity market, out of all the IEA countries the share of electricity production from renewable sources was the second lowest to South-Korea in Hungary.

The report recommends that Hungary should extend its wind, solar and geothermal capacities instead of biomass and biogas which have much less untapped potential. On top of that it identifies several factors hindering renewable penetration, such as the strict decree that makes wind turbine installations very difficult if not impossible, the environmental tax on PV which is set at a too high level, and the high realization time and cost associated with grid connection for renewable producers.

To increase the share of renewable sources other than biomass, the most important tool is not support of selected technologies with targeted aid but implementation of conditions which incentivize technology neutral support closest to real market conditions for all types of renewable energy sources.

To summarize, the IEA's Hungary country report is a very thorough analysis which presents a detailed description about the current state of the Hungarian energy markets and policy. The study also formulates recommendations for the government which are mostly relevant but in some cases too general.

Energy poverty: a bad dream or reality?

The issue of energy poverty received more than its typical share of attention in the energy regulatory package published at the end of last year. While this should not be considered a breakthrough, the Commission continues to soften its traditional view that energy market regulation should be considered separately from social policy. The amended Electricity Directive would require member states to define energy poverty, measure the number of affected households, and regularly publish the measures applied. The proposed amendment to the Energy Efficiency Directive also articulates that a certain proportion of energy efficiency measures should be implemented in households that are classified as energy poor. In order to coordinate the measures implemented among the member states, the European Commission has announced that it will publish regular reports under a 'European Energy Poverty Observatory' in order to monitor energy poverty and support member state actions.

Indeed, the earlier directive has already stipulated a modality for Member States to address energy poverty: to develop an action plan, to help the needy through the social care system, or to support investments in energy efficiency. The domestic regulations, nevertheless, still do not treat energy poverty as such, and instead leave the responsibility to protect socially deprived consumers with service providers.

The European Commission's approach to energy poverty has been rather compartmentalized, and until the most recent draft amendments it denied energy market regulation a role in alleviating the problem. Energy poverty was categorized as a purely social issue to be handed within the apparatus of the social welfare system. The Committee supervising energy market liberalization represented a firmly market-based logic, according to which the application of energy policy instruments would distort competition in the energy market.

The European Parliament, the European Economic and Social Committee and the Committee of Regions, on the other hand, have urged stronger regulatory intervention to protect consumer interests from the outset. When negotiating the third energy market package of 2009, the Parliament proposed definitions for energy poverty and affordable prices that would have imposed specific measures on Member States. These proposals, however, have failed due to the resistance of the Commission, and only watered down provisions were incorporated into the directives.

Research and resolutions addressing energy poverty and vulnerable consumers grew tremendously during the 2010's. As a result of the pressure,, the Commission's official advisory consortium Insight E published a comprehensive report on energy poverty in 2015, encouraging the Commission to take stronger action.[1]

A year later the all-encompassing "Energy Poverty Handbook" was published by MEP Tamás Meszerics, the preamble of which, quoting William Wilberforce, a British politician with a lasting legacy in banning slavery, adequately reflects the awkward position of the Commission: "Having heard all of this you may choose to look the other way but you can never again say that you did not know."[2]

What is energy poverty?

The most accepted definition of energy poverty comes from the European Economic and Social Committee (EESC): a household can be viewed as energy poor when it has difficulty heating its dwelling to a suitable temperature or using basic energy services at an acceptable cost. Generally, 21 °C is considered to be a suitable temperature, which is a threshold value set by the WHO, under which the risk of developing certain diseases significantly increases. The definition of acceptable costs, on the other hand, is more controversial. Typically, energy expenditures are considered as acceptable up to a certain percentage of the households' total income: the question is exactly how much this proportion should be?

According to literature, 10% is a commonly cited threshold from the earlier English and the current Irish practice; actually, it is twice the English energy cost ratio typical for the 2000's. The current English method is slightly more sophisticated, whereby the level of acceptable energy costs should be less than the size of a payment that would drag the income of the concerned household below the poverty threshold (which is typically set at 60% of the average income).

The advantage of using the ratio of energy costs is that it is based on accurate, available data, however, its evaluation and the assessment of the energy poverty threshold is rather arbitrary. In addition, households in need are typically unable to purchase

1 INSIGHT_E (2015): Energy poverty and vulnerable consumers in the energy sector across the EU: analysis of policies and measures
2 Katalin Csiba (2016): Energy Poverty Handbook

all the energy that they require, so their expenditures generally underestimate actual needs and therefore also the extent of energy poverty.

The Eurostat indicator that examines the proportion of households unable to heat their home to a suitable temperature aims to measure energy needs that are in effect unmet. The indicator, according to some, better describes the more difficult aspects of energy poverty (e.g. deprivation and related social exclusion), but it can be subjective. This may also be related to the extremely large variation around the 10% EU average: while in Norway only 0.4% of the population report that they are unable to heat their homes to a suitable temperature, the same figure is nearly 40% in Bulgaria.

Targeted research can measure energy poverty indirectly according to the consequence of inadequate heating by correlating excess winter mortality (EWM) with energy poverty. According to these studies, EWM is partly (between 20-50%) explained by households unable to heat their homes to the accepted temperature of the health threshold, leading to hypothermia or fatal illness. During the period between the winters of 2002/2003 and 2010/2011, the average death rate in Europe was 14% higher through the winter months than during the rest of the year.[3] If 20% of these deaths are attributed to underheated homes, this correlates to 40-50 thousands annual deaths in Europe related to energy poverty.

The above indicators typically capture only one aspect of energy poverty, the financial burden on households or the consequences of inadequate energy consumption. Some researchers, therefore, attempt to estimate the weight of the problem by combining several indicators: in addition to the proportion of energy related expenditures and the share of people struggling with heating, these complex indicators take into account the share of households that accumulate public utility debts and the ratio of apartments with poor energy related features (leaking roofs, damp walls and rotting window frames).

Energy poverty in Hungary

The concept of energy poverty began to trickle into the Hungarian energy policy debate in 2010, after the adoption of the third energy package. During the preparation of the National Energy Strategy (NES 2030), it was already mentioned among the most important energy policy objectives, while the adopted document discussed the problem in a separate chapter. According to NES 2030, energy poverty can be addressed in the medium-term by fine-tuning the system of block tariffs and applying preferential tariffs for vulnerable consumers. In the long run, however, it proposes "the management of social aspects independently of energy goals", which can be achieved by increasing consumer awareness and energy efficiency.

However, only two major research projects have been undertaken to address the issue of energy poverty in Hungary: detailed reports have been published by Ürge-Vorsatz's research team in 2010 and the Energiaklub in 2012.[4] Although both publications received great attention, in particular Ürge-Vorsatz's estimate of energy poverty victims, soon after public interest in the topic declined.

The estimates of the above research projects on the number of households affected by energy poverty varied widely depending on the type of indicators selected and the value of the thresholds applied. From 2008-2010 data, between 5% and 80% of Hungarian households (0.2-3.0 million households) would be classified as energy-poor. It can be concluded, nevertheless, that energy poverty is essentially a multidimensional phenomenon, when social issues (income poverty and deprivation), high energy prices and high energy consumption pile up. To estimate how much of the Hungarian population may be affected, it is better to inspect more data and indicators.

Low income households are likely to suffer from energy poverty since payment of utility bills combined with securing adequate housing conditions is challenging. However, since poverty alleviation is considered to fall under social policy, it is typically ignored in energy policy discussions. It is, therefore, practical to briefly summarise the extent to which energy poverty is a problem in present-day Hungary.

The generally accepted indicator of poverty in the European Union includes those who live in households with a per capita income less than 60% of the national average, are materially deprived or include family members of working age that are unemployed. Based on these indicators, the proportion of people at risk of poverty or social

3 Fowler et al (2015): Excess winter deaths in Europe: a multi-country descriptive analysis

4 These studies are: Tirado Herrero and Ürge-Vorsatz (2010): Energy poverty in Hungary (prepared by the Center for Climate Change and Sustainable Energy Policy Center (3CSEP), Central European University (CEU) in co-operation with the Environmental Justice Working Group;
VÉDEGYLET - Protect the Future, Dénes Fellegi and Orsolya Fülöp (2012): Poverty or energy poverty? Defining energy poverty in Hungary and Europe (prepared by the Center for Methodology at the Energy Club Policy Institute)

exclusion in Hungary exceeds 28% of the total population, which is high in its own right compared with the EU average. The scale of this problem is magnified by the fact that more than a third of Hungarian children under the age of 16 fall into this category; only Romania, Bulgaria and Greece are in a worse position. It is worth mentioning that there are serious regional disparities behind poverty-related national indicators: in less developed regions the per capita GDP is less than one-third of the Budapest GDP figure, while the unemployment rate is three times higher than that of Western Transdanubia.

At the same time, it is important to stress that poor households do not necessarily suffer from energy poverty. For the elderly pensioners living in an obsolete house, it is often more difficult to pay the heating bill than for a poor family living in a small apartment. The obvious solution is to compare the ratio of the apartment's utility bills to family income.

The share of energy expenditures of Hungarian households is currently a little above the EU average of 4%. According to data from Eurostat and the Hungarian Energy and Public Utility Regulatory Authority, in 2015 the average Hungarian household spent about 5% of its disposable income on buying electricity and natural gas, an improvement compared to the 2012 figure of 7.5%, but still high in an EU comparison.

The data published by the Central Statistical Office measures the ratio of energy expenditures differently: instead of the income of the average household, the ratio of energy expenditures is compared to the per capita expenditures, while energy expenditures also include the expenditures on solid fuels (coal, firewood) and district heating, in addition to electricity and gas. This results in much higher values than the previous figures, although improvements are equally observable. Between 2012-2015 the share of total expenditures per capita on electricity, natural gas and other heating fuels decreased from 17% to 13%. The average, however, hides substantial regional differences: while this value in Budapest is only 9%, in less developed regions (e.g. in Northern Hungary) the share of energy expenditures per capita is still 15% (and 16% in villages).[5]

When further analyzed, the statistical data also reveals that 80% of the population live in households where the share of energy expenditures exceeds the national average. If, according to the Irish methodology, those households were considered to be energy-poor, where the per capita energy expenditure exceeds 10% of the disposable income, then about 80% of the domestic population would be considered as energy-poor. Since there is no well-founded theoretical background behind the application of the above threshold for Hungary, it is worth examining some other indicators as well.

The proportion of households claiming that they are unable to heat their homes adequately is presently about 9.6%, slightly above the EU average and considerably less than the 15% in 2012.[6] Only very rough and indirect estimates are available on the health consequences of this situation. According to the 2010 research of Ürge-Vorsatz "in Hungary annually about 1400 to 2400 people die due to poor housing and living conditions associated with energy poverty."[7]

One important component of energy poverty is the housing stock with obsolete heating systems, poor insulation and high energy consumption. In this area, Hungary has exceptionally bad indic

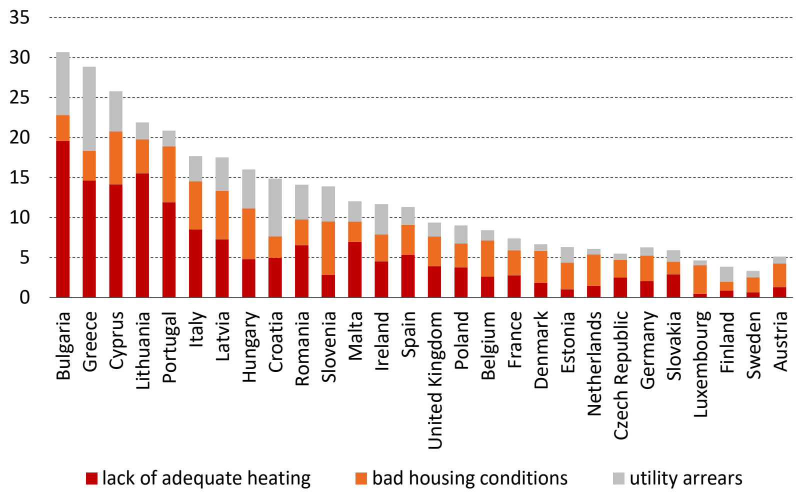
ators compared to the EU: in 2015, more than 25% of the population lived in homes with particularly bad conditions (leaking roof, damp walls, rotting window frames, etc.)[8] The state of the domestic housing stock is the fourth worst within the EU. And the proportion of households struggling with utility debt reveals a similar value of nearly 20%, barely outside the “top three”.

Based on the above indicators there can be an appreciation for how much of the population suffers from one component of energy poverty. What is still unknown, however, is the number of people living under increasingly difficult conditions, energy poverty in a strict sense. Some researchers therefore approach the question by using complex indicators: the figure below shows the values of the indicator proposed by Bouzarovski, which takes into account the proportion of households unable to heat their home (with a 50% weight), and assigns a 25% weight to households in poor housing conditions and 25% to households struggling with a utility debt. The above indicators can be considered as a percentage ratio only with strong reservations, but it can be asserted that 10-25% of the population suffer from one or more factors that are important indicators of energy poverty.

5 Source: Central Statistical Office
6 Source: EUROSTAT
7 Source: Tirado Herrero and Ürge-Vorsatz (2010)
8 Source: EUROSTAT

This overall picture suggests somewhat lesser conditions than the EU average, although compared to the early 2010s, this can be considered as a significant improvement. Regarding the number of households suffering from energy poverty, the lowest estimate is the nearly 10% level of those households that are unable to heat their homes. Since many other attributable features of energy poverty (e.g. living in poverty, poor housing conditions and unpaid public utility bills) burden a much larger share of the population, the proportion of households that are in need of help is certainly higher.

1. ábra Complex energy poverty indicator for EU Member States in 2015 (%)



Source: REKK calculation based on EUROSTAT data

What can we do?

The research so far has clearly shown that energy poverty is a multi-factor phenomenon: in itself, neither low income, nor high energy expenditures, nor the obsolete, energy-wasting real estate is suitable to classify energy poverty. Generally, the cumulative presence of these factors (aggravated by social immobility) can lead to a situation that exacerbates social exclusion and leads to health risks resulting from inadequate energy consumption. According to Energiaklub, energy poverty burdens mainly those households that live in villages or other sparsely populated settlements, usually in individual houses, consisting of a single person, or multi-person households with either unemployed or retired members.[9]

The information needed to identify the target groups is largely understood; data on the social status of households, their energy consumption habits and the energy efficiency of their properties. However, sufficiently detailed household-level data is currently unavailable, and therefore it is imperative to set up and maintain a reliable database. As most of the consumers living in energy poverty do not use natural gas to heat their homes, neither the database nor any subsequent measures should be restricted to consumers of electricity and natural gas.

While the database is developed, it is also necessary to agree on the use of an indicator that can identify the threatened group of consumers closely enough. Using the wide range of available foreign and domestic literature and research results, selecting an acceptable indicator is not the problem. However, collecting and validating this data and identifying the affected consumers is an extremely difficult task. In the United Kingdom, for example, when evaluating the Warm Front energy efficiency programs, it turned out that only 20% of the consumers selected for the program in 2001 were affected by energy poverty.

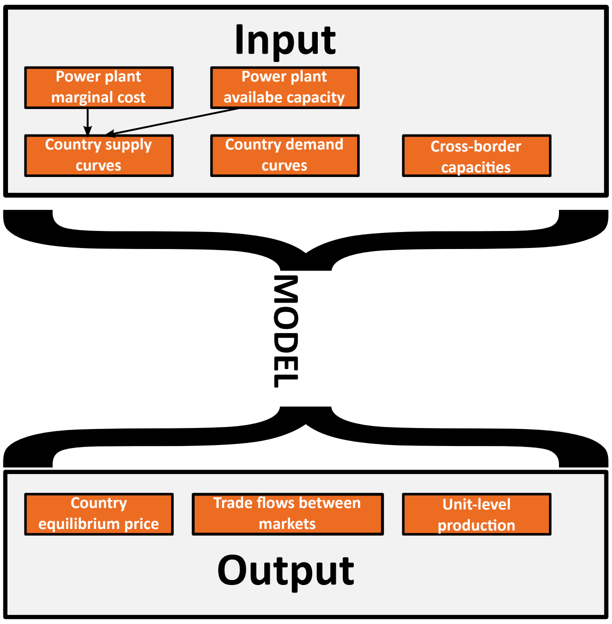
When defining vulnerable consumers, the target groups for energy efficiency improvement projects, or when differentiating benefits in the absence of consumer level data, other more easily accessible data may also be applied. For example, when defining socially deprived consumers, the Electricity Act specifies the recipients of social benefits (e.g. elderly allowance, home maintenance allowance, nursing fee, or child protection allowance). Subsidies can also be narrowed or differentiated on the basis of simple demographic, social or territorial criteria (e.g. retired people, consumers in disadvantaged regions).

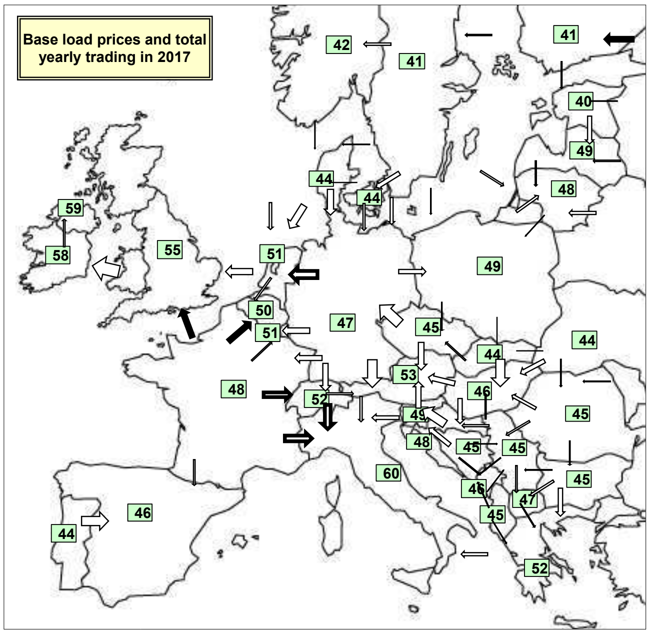
In the management of energy poverty, it is not enough to refer to mature, proven, widely applied methods, although Member State have used this to support protected consumers defined as such. Most of the relevant reports attach special importance to energy consultancy programs and energy efficiency investments focusing on these households (typically low-income, often severely disadvantaged households living under poor housing conditions), since in the long term the energy consumption parameters of homes can be improved. The key issues for the coming years are, for one, the development of a database and indicator system to identify the relevant consumer groups and, on the other hand, the support of multi-party (public bodies, service providers and local governments and civil society organizations with experience in providing social support) pilot programs to deliver targeted assistance.

9 Source: *Fellegi, Dénes and Orsolya Fülöp (2012)*

EUROPEAN ELECTRICITY MARKET MODEL (EEMM)

EEMM is the electricity market model of REKK developed since 2006 modelling 36 countries EEMM





ASSUMPTIONS

- Perfect competitive market
- The model calcu lates 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 calcu lates the price of standard products (base and peak)

USAGE

- Provides competitive price signal for the model led 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
- Al lows analysing the effects of public policy interventions
- Trade constraints
- Assessment of interconnector capacity building

RESULTS

- Base and peakload power prices in the model led 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

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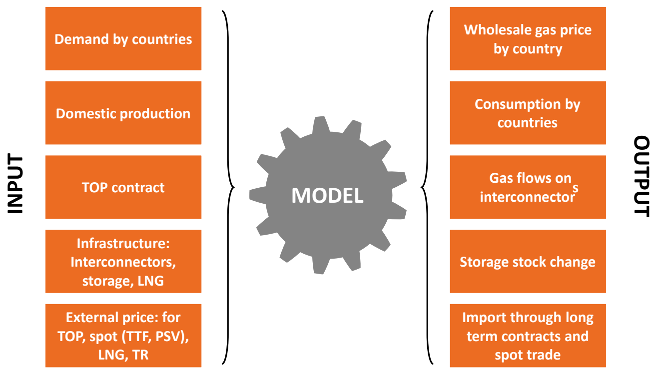
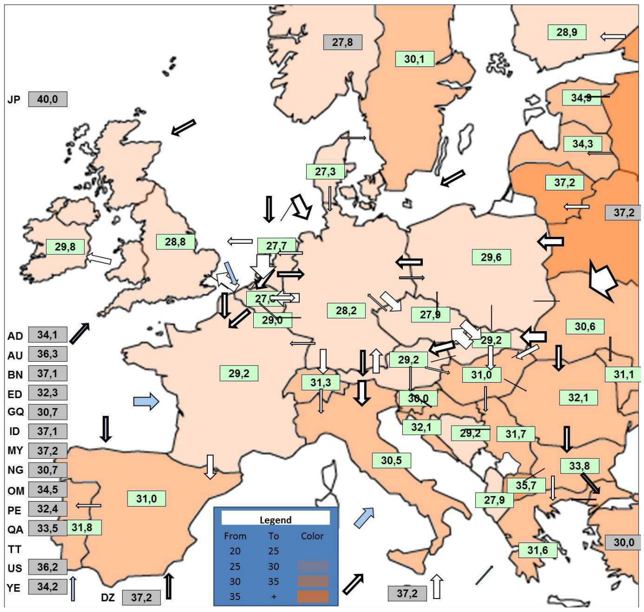
EUROPEAN GAS MARKET MODEL (EGMM)

EGMM is the natural gas market model of REKK developed since 2010 modelling 3 countries





ASSUMPTIONS

- Perfect competitive market
- Model ling period of one year (1 2 months)
- LTC and spot trade in the model led countries, pipeline and LNG suppliers
- Physical constraints are interconnection capacities
- Trade constraints: TOP obligation
- Model includes domestic proiduction and storages
- Model calcu lates 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
- Al lows analysing the effects of public policy interventions
- Analysing trade constraints
- Assessing effects of interconnector capacity expansion
- Security of supply scenario analysis

RESULTS

- Gas flows and congestion on interconnectors
- Equilibrium prices for al l 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

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