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FOUNDATION FOR REGIONAL POLICY CO-OPERATION IN ENERGY AND INFRASTRUCTURE

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# REKK POLICY BRIEF

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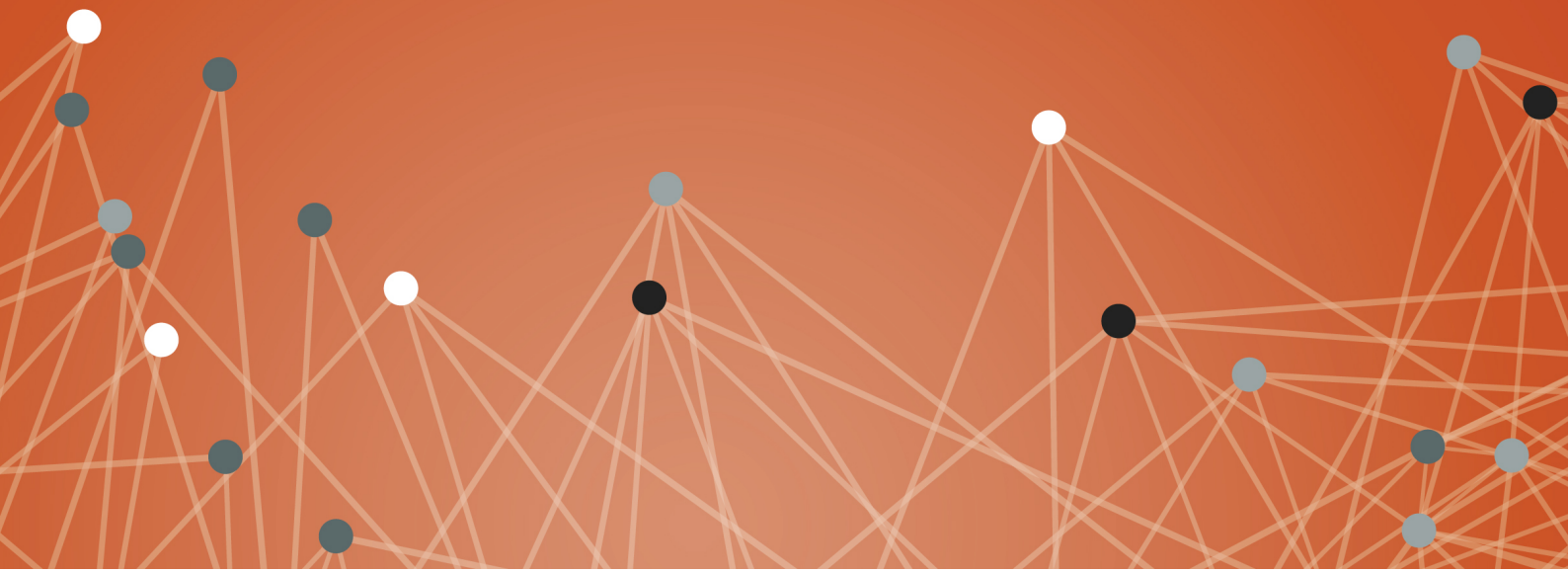

ENIKŐ KÁCSOR - ANDRÁS MEZŐSI - ALFA DIALLO - ÁGNES TÖRŐCSIK

## TWIN PEAKS?

*The high summer HUPX prices and the potential price effects of higher PV penetration in Hungary*

For the second time this year after January's wholesale electricity prices rose to unexpected heights they did so again in late July/early August when hourly day-ahead prices went up above 100 €/MWh many times in the most critical week, while German wholesale prices remained near 40 €/MWh in the same period.

This can be largely attributed to a confluence of high demand, a few days' reduction of Austrian import capacities, the protracted draught period in the Balkans and the scheduled maintenance of several power plants in the region (including some blocks of Paks nuclear and Mátra lignite power plants).

While the frequency of extreme price spikes has not reached the critical threshold to induce new private investments according to market participants, it can be enough to facilitate investment into existing power plants for extended operation.

As a result of increasing PV penetration, the highest prices on the German market moved from the middle of the day to the morning and late afternoon hours. The result is a new price curve with two peaks instead of one.

Different levels of PV penetration in Hungary were modelled in case of the highest priced summer day to test the price effect: the addition of 600 MW resulted in a reduction of some 20 €/MWh during midday, 1000 MW brought 40 €/MWh reduction, and with 2000 MW penetration Hungarian prices fall to the level of the German prices in the middle of the day.

At the end of 2016 the Hungarian Energy and Public Utility Regulatory Authority (HEPURA) received PV licence applications for around 2000 MW capacity which could significantly reduce summer prices and flatten price spikes. This can beckon a new era of business models for both traders and power plants.

## PRICE SPIKES – A REEMERGING TREND?

In recent years we grew accustomed to consistently lower electricity prices compared to pre-crisis levels before 2008, a period also marked by an absence of price spikes in most of the European wholesale markets. However this changed in January 2017 with the European-wide cold spell (for details see REKK Policy Brief 2017/2) and repeated in in July and August. Although summer consumption peaks still lag behind winter peaks, and neither reach 2007-2008 consumption levels, the 2017 summer was not extreme as far as weather or demand and thus in the long-term price spikes are to be expected. In this paper the effect of intermittent production on wholesale electricity prices is investigated, particularly the effect of PV penetration on the expected frequency of price spikes.

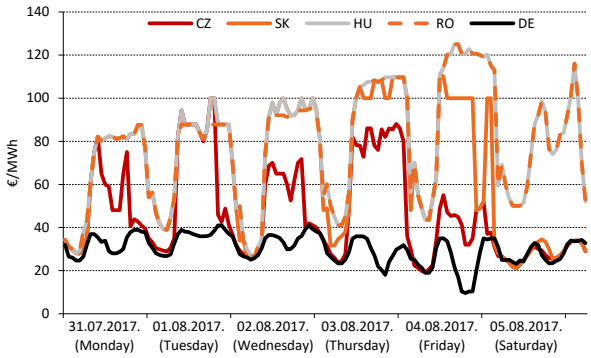


FIGURE 1. REGIONAL HOURLY ELECTRICITY PRICES ON THE WEEK WITH THE HIGHEST HUNGARIAN PRICES (2017.07.31-2017.08.05)
source: REKK calculation based on ENTSO-E

### The background of the high Hungarian prices of the past summer

The subsequent sections of analysis are focused on the week around August 4th when the highest HUPX prices were registered. As can be seen on the next figure, all participants from the 4-Market-Coupling experienced very high prices; Romanian prices closely trailed the Hungarian market while the Czech and Slovak prices tended to be lower but also diverged from each other.

While peak consumption was still 350 MW (5%) lower than the extreme winter peak in January, persistently higher Hungarian prices could be explained by the intersection of increased demand, a reduction of Austrian import capacities and the protracted draught period in the Balkans. At the same time, the scheduled maintenance of some blocks of Paks nuclear power plant and Mátra lignite power plant added to the price effect during the critical weeks, occurring at the same time as other scheduled maintenance in neighbouring countries.

### The effect of PV generation on daily price curves

For the analysed week, German prices were much lower, remaining mostly under 40 €/MWh. One explanation is the high PV generation occurring precisely in the hours of highest consumption. In the summer consumption peaks are usually realised at midday, so also prices reach highest levels at that time of the day. This holds for Hungary and the other countries in the region, but in Germany where PV generation can add up 20-30% of total production during the day, the daily residual load curve (residual load is calculated as total consumption minus PV and wind generation) changes significantly pushing down prices. PV utilisation rates are low in the morning and late afternoon with maximum production at midday, meaning that the residual load curve has two peaks: before and after midday instead of one peak in the middle of the day. The price curve follows these movements leaving the highest prices in the morning and in late afternoon.

## HOW MIGHT HIGHER PV PENETRATION EFFECT HUNGARIAN ELECTRICITY PRICES?

Following the German market, it can be observed that PV generation has a significant impact on prices. But as a consequence, suppressed midday prices could shift price peaks to other hours. With high PV production in the middle of the day, coal and/or lignite based production are crowded out, meaning these blocks will neither produce electricity in the evening hours due to high ramp up costs. This leads to even higher prices in these hours than the market would bear with less PV generation but more lignite/coal based generation.

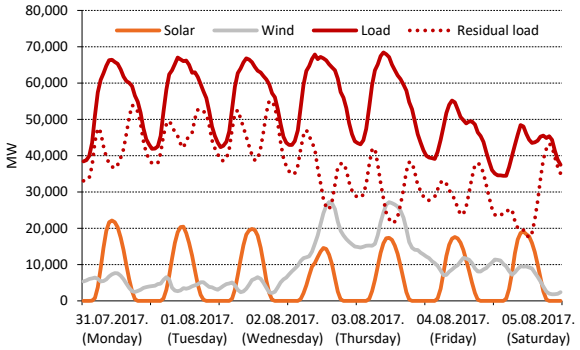


FIGURE 2. LOAD, RESIDUAL LOAD, SOLAR AND WIND GENERATION IN GERMANY (2017.07.31-2017.08.06)
source: REKK calculation based on ENTSO-E

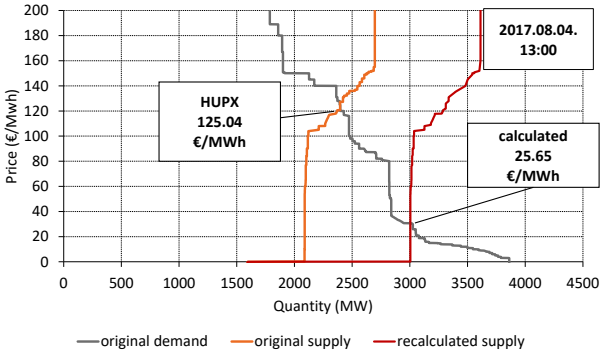


FIGURE 3. THE EFFECT OF PLUS 2000 MW PV CAPACITY, 2017.089.04, 13:00, REKK ESTIMATION
source: REKK calculation based on HUPX, MAVIR and MEKH data

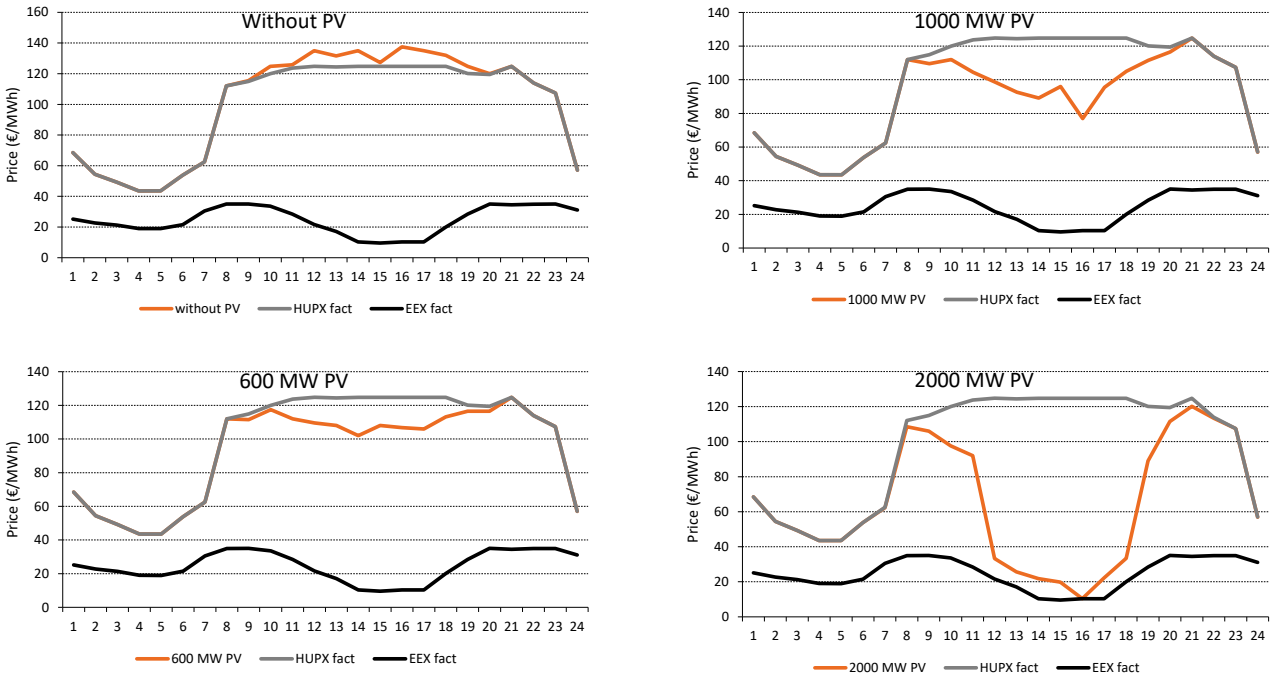


FIGURE 4. EFFECT OF DIFFERENT LEVELS OF PV PENETRATION ON THE HUNGARIAN PRICES ON THE DAY WITH THE HIGHEST SUMMER PRICES (2017.08.04)
source: REKK calculation based on HUPX, MAVIR and MEKH data; EEX

We assessed the potential effect of significant PV penetration on Hungarian wholesale electricity prices, something not unreasonable considering the volume of applications for PV licences (for around 2000 MW capacity) submitted to HEPURA at the end of 2016. HUPX bid-ask curves, historically available on an hourly basis, were used as a starting point for our analysis. The original supply was adjusted with the estimated PV generation for the given hours, assuming a price of zero. This is a simplified approach as trader behaviour would likely change with larger PV capacities in the Hungarian system, but the analysis still clearly demonstrates how differently 1 MW PV capacity can affect prices at 1 p.m. or 7 p.m.

From MAVIR data for hourly Hungarian electricity mix (including FiT PV generation) and HEPURA data on monthly FiT PV capacities, we calculated the average production/MW on August 4th from PV plants for all 24 hours and the adjusted supply in the different PV penetration scenarios.

The adjusted price curve was estimated in four scenarios, with the installation of 600 MW, 1000 MW and 2000 MW additional PV capacity and also with the complete absence of the currently operating 250 MW PV capacity. According to our calculations, the removal of all currently operating PV capacity would add 15-20 €/MWh to HUPX prices in the highest priced hours, while an additional 600 MW would lead to an equivalent price reduction. In the 1000 MW scenario, the highest price reduction would reach close to 40 €/MWh and produce the dual-peak curve. The 2000 MW scenario would flatten midday prices to German levels. However, in the morning (7-8 a.m.) and evening (9-10 p.m.) an 80 €/MWh spread would remain as a result of unavailable PV generation and high demand. The shape of the Hungarian price curve in this scenario would be very similar to Germany, with some separation remaining between volatility and price levels.

## CONCLUSION

While prices topping out at 100-120 €/MWh for the second time this year appears insufficient to elicit investment in new (fossil) capacities according to market participants, it could encourage procurement of existing plants. Growth in RES penetration can affect wholesale prices and market functioning significantly, posing great challenges to market participants. From the aforementioned volume of applications for PV capacity in 2016, the market estimates 600-800 MW to be actualized in the coming few years. This would bring profound changes to the Hungarian market that would necessitate new business models both from traders' and power plants operators.

## AUTHORS

**Enikő Kácsor** is working on projects related to electricity markets and renewable energy policies (ancillary services, international price comparison, monitoring, regulation, support schemes). She has also participated in the updating and developing of gas market and electricity market models. She studied Economics and Actuary at the Corvinus University of Budapest and started her PhD in 2015, in the same university, from Economics.

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## REKK FOUNDATION

*The goal of the REKK Foundation is to contribute to the formation of sustainable energy systems in Central Europe, both from a business and environmental perspective. Its mission statement is to provide a platform for open-ended, European-wide dialogue between government and business actors, infrastructure operators, energy producers and traders, regulators and consumers, professional journalists and other interested private entities. The REKK Foundation develops policy briefs and issue papers with forward-looking proposals concerning challenges posed by energy and infrastructure systems and organizes regional forums allowing stakeholders to become familiar with the latest technological and regulatory developments within the industry.*

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