Hungarian Energy Market

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CONTENTS

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Dear Reader!

This is the last issue of our *Energy markets report* for 2012. I would like to draw your attention to a number of important market developments and four short analyses.

The most important event in the electricity market during the third quarter of 2012 has been the market coupling that took off on the Slovakian-Hungarian border. This measure essentially connected the next day Czech, Slovakian and Hungarian markets. As a result, the price premium on the Hungarian next day exchange substantially declined, while the premium for futures baseload power has not yet contracted.

Two of our articles deal with market coupling: in our flash report we analyse the developments and impacts of the Slovakian-Hungarian market coupling, and this is also the topic of our newly launched "Revue" column. We select from the most important professional publications released in international journals and provide a concise summary of those analyses on market coupling that are currently most relevant for readers with an interest in Hungarian energy markets.

In the natural gas sector stockpiling ends in the third quarter. Therefore we collected data on the natural gas storage facilities and to our surprise realised that as we approach the end of the injection period, the stock level of the storage sites is unusually low, much below the rate that is typical for the same period of the previous years. We researched and analysed this incident and wrote an article on it.

In this issue we also explore a topic related to energy efficiency: the most likely final version of the text of the EU energy efficiency directive has become available, to be published in the Official Journal at the end of the year. This regulation prescribes energy efficiency measures not only for national governments, but indirectly also for many companies. Besides the requirements of the EU, in our article we also describe the instruments that can be used for compliance.

We continue to look forward to your remarks and questions. We would be delighted if our report was of service to you in your work. If you are not a subscriber yet, please let us know of your interest through email, phone or by filling in the order form on our home page.

Péter Kaderják, *director, REKK*

ENERGY MARKET DEVELOPMENTS

During the third quarter of 2012 commodity exchanges have been characterised by rising oil prices and a quiet coal market. During the quarter the price of Brent crude increased by 20 dollars, while the price of coal did not move much. The price of futures electricity with 2013 delivery declined moderately, by 1-2 EUR. December 2012 emission credits continued to trade below 10 EUR.

During the quarter more or less the same volume of electricity was used as during the third quarter of last year, but this is still 2.5% below pre-crisis levels. Compared to last year the share of imports in electricity use noticeably increased, 30% of the consumption was satisfied from foreign sources. In July and August the Hungarian and Romanian next day wholesale markets departed from the prices quoted on the German and Czech exchanges: with the average price spread rising to 20 EUR. By September the Hungarian and Romanian prices once again started to gravitate toward the German and Czech markets, the premium fell to 3-5 €/MWh, primarily as a result of the market coupling process that began on the Slovakian-Hungarian border section in September (For a deeper analysis of this topic please turn to page 18. of the current issue). Despite this favourable development the 2013 Hungarian futures baseload power was 9 € more expensive than the German product, breaking further away from German, Czech and Slovakian prices, suggesting that markets are somewhat cautious when they consider the outcome of market coupling.

As we approach the end of the injection period, the commercial gas storage facilities are 53% filled, substantially less than in previous years. 1.6 billion m^3 of natural gas has been imported, two-third of that from the Western direction.

International price trends

During the third quarter of 2011 the price of Brent oil increased, while futures coal prices did not move much. After the mostly uninterrupted decline all through the previous quarter, the price of oil reversed from the low below 90 USD/barrel, slowly crawling back above 110 dollars, and staying above there afterwards. The slow price erosion in futures coal markets during the previous quarter now came to a halt. During the months of July and August prices stayed within the 96-102 dollar range, a ton of coal fetching 100 dollars on average.

The price of the 2013 futures baseload and peak electricity traded on the EEX for delivery in Germany decreased slightly, by 1-2 EUR, with low

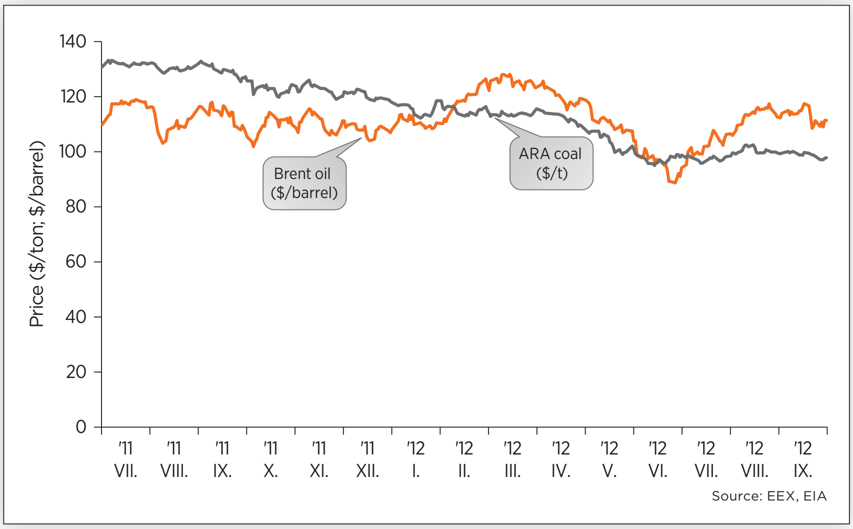


Figure 1. **The price of 2013 ARA coal futures traded on EEX and the spot price of Brent Crude between July 2011 and September 2012**

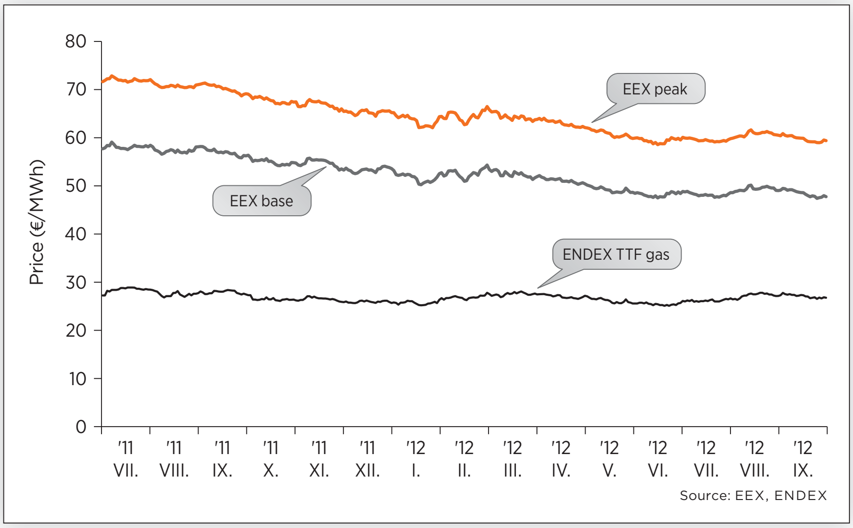


Figure 2. **The price of 2013 futures electricity and natural gas between July 2011 and September 2012**

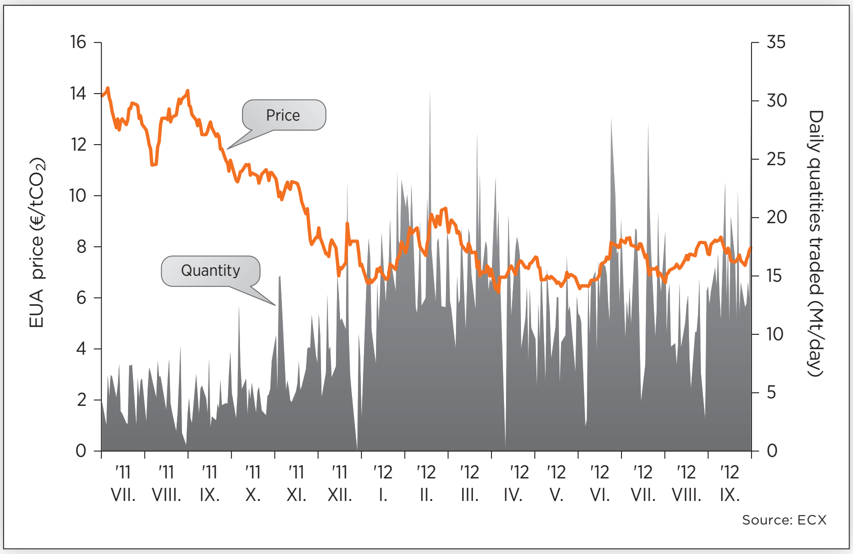


Figure 3. The price of CO_2 credits with December 2012 delivery and the daily volume traded on ECX between July 2011 and September 2012

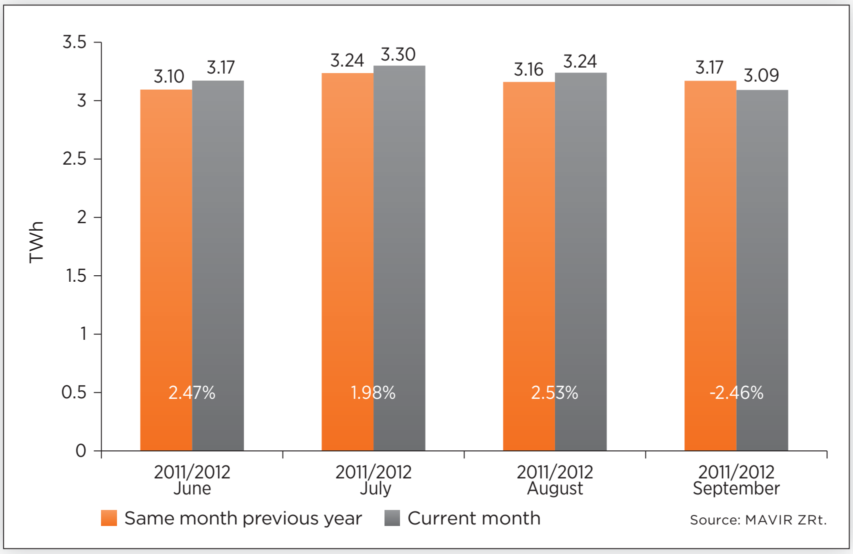


Figure 4. Temperature and working day adjusted electricity consumption between June 2012 and September 2012 relative to the same period of the previous year

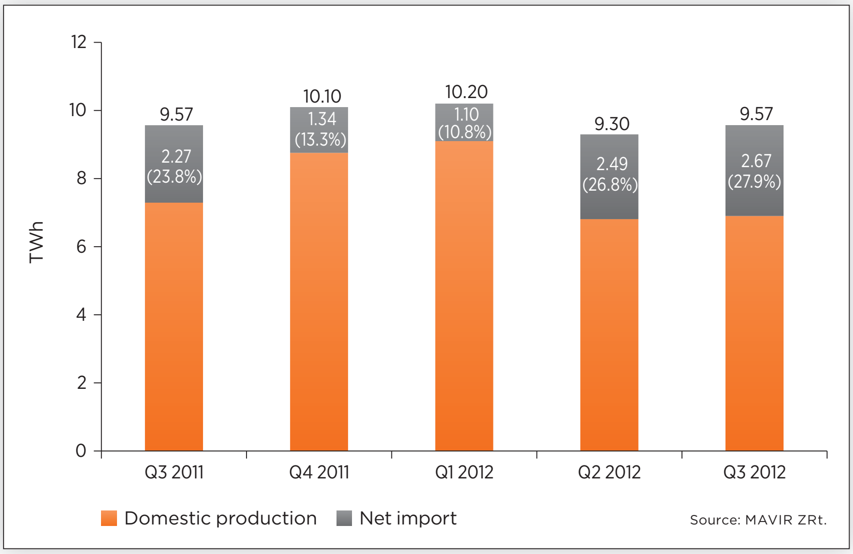


Figure 5. Quarterly domestic electricity production and net imports between Q3 2011 and Q3 2012

summer volatility. The price of the baseload product settled a little below 50 €/MWh, while the peak product closed more than 10 EUR higher, at around 60 €/MWh. At the same time the price of gas with next year delivery increased from 25 €/MWh to 27 €/MWh on the Dutch exchange.

Based on the above we would like to point out an important trend: the margin from natural gas based electricity generation constantly declined. Assuming that the energy efficiency of a gas based power plant is 50%, selling power as baseload electricity with next year delivery has clearly been a loss making activity since May, as between July and September the margin turned negative, sinking to –5 €/MWh. During the quarter even if the hypothesized plant had sold its electricity as peak product, its realised margin would only have been 5 €/MWh.

During the quarter the price of emission credits with December 2012 delivery was 7.5 EUR/ton on average, a moderate price increase could be witnessed on the market. 870 million tons of CO_2 was traded during the quarter, a little more than during the second quarter of 2012, and three times as much as the trading volume of the same quarter a year ago. The price decline of last year, therefore, does not seem to continue, and the price of EUAs is becoming more stable, even if at a low price level.

Overview of the domestic electricity market

The third quarter temperature and working day adjusted electricity demand was hardly 1% higher than the Q3 2011 consumption. While consumption

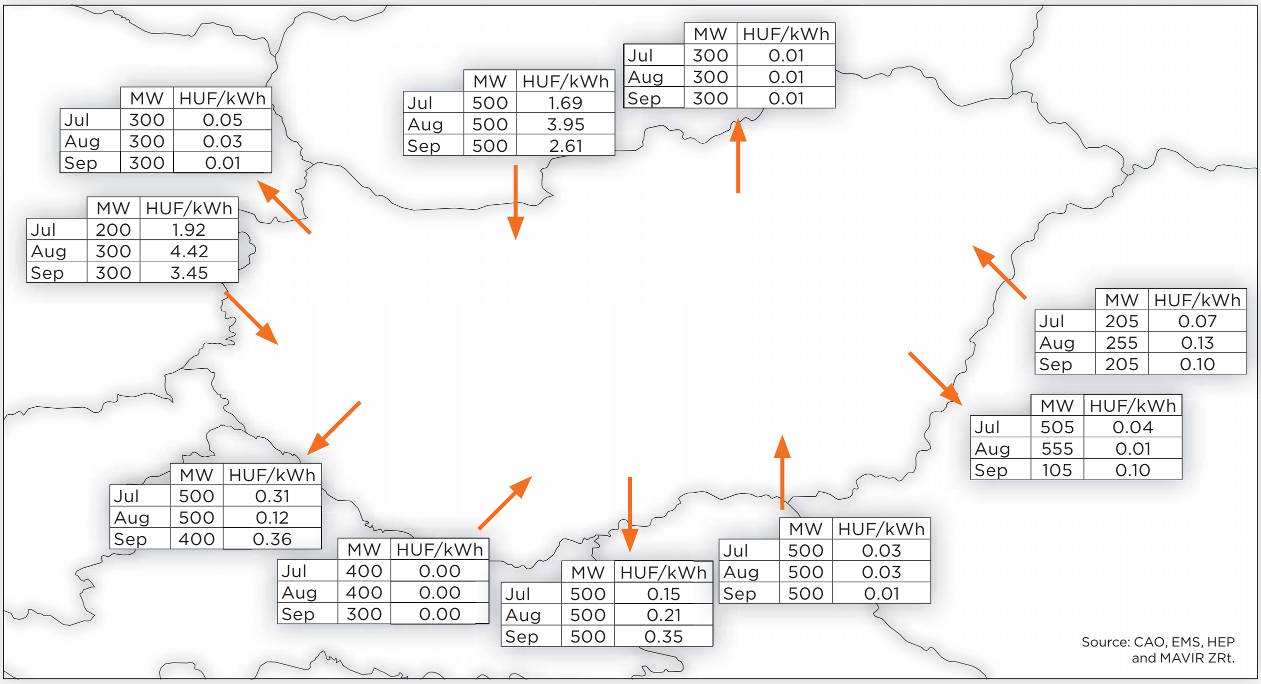


Figure 6. **Results of monthly cross-border capacity auctions in Hungary, Q3 2012**

Capacities in the figure mean capacities offered for auction. Capacities were not sold fully in the period under review in the event of over-subscription at a specific price, because in such cases the system operator considers the next highest price as the auction price.

in July and August was 2-2.5% above the figures from last summer, electricity demand in September was 2.5% lower. Even today, electricity use is 2.5% below pre-crisis levels.

The share of net import, which had typically been 20-25% for the summer months of the previous three years, is now close to 30%. While domestic consumption was almost identical to the figures from the third quarter of 2011, the share of import grew by almost 5 percentage points compared to the same quarter last year. During the third quarter of 2008 the ratio of import was below 15%. Domestic generation was also held back by the fact that large power plant maintenance in August and September took more time than in 2011 – one of the units of the Paks Nuclear Power Plant was down for the whole quarter.

During the quarter once again the import capacities from Austria and Slovakia were the most expensive: in August the price of the Austrian monthly cross-border capacity approached 4.5 HUF/kWh, while the Slovakian capacity cost almost 4 HUF/kWh. The price of export capacities on the Serbian and Croatian border sections slightly exceeded the typical values.

Recently a substantial price increase was observable on the regional exchanges. Compared to the preceding quarter, in July and August the price of next day baseload power was 2-6 EUR higher on the German and Czech exchanges, and 10-20 EUR higher on the Romanian and Hungarian exchanges. Hydro power generation in the Balkan plummeted again in July and August, and the consumption of the region was partly satisfied through imports from Hungary (for an assessment of the related impacts please see the article The impact of the Balkan drought on the Hungarian wholesale electricity price, published in the 2/2012 issue of the Energy market reports). Moreover, as a

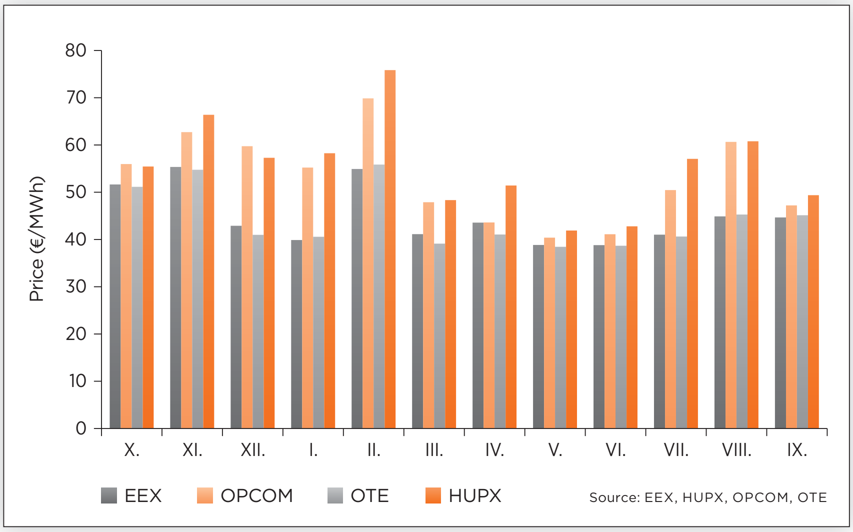


Figure 7. **Comparison of next day baseload power prices on EEX, OPCOM, OTE and HUPX between October 2011 and September 2012**

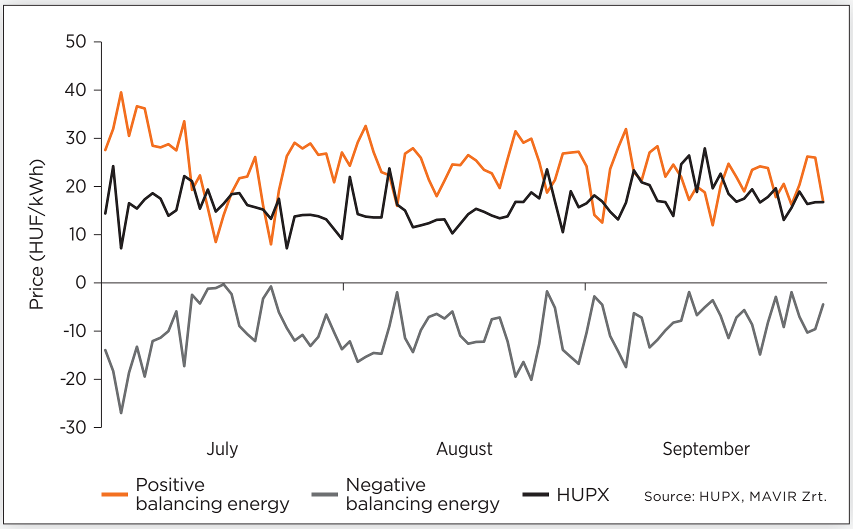


Figure 8. **Daily average of the balancing energy prices and the spot HUPX price, Q3 2012**

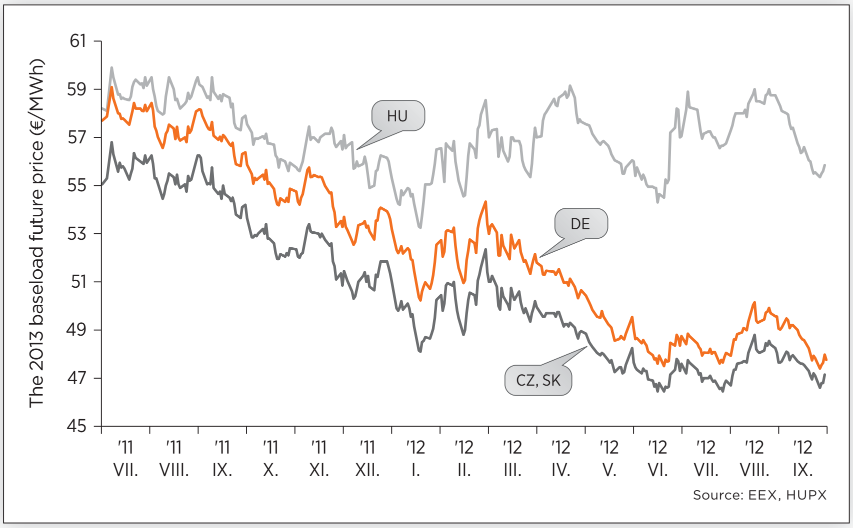


Figure 9. **Baseload futures prices quoted for 2013 delivery in the countries of the region between July 2011 and September 2012**

result of a warmer than usual summer and the July restrictions on the Slovakian-Hungarian cross-border capacities, as well as the relatively low level of domestic production due to maintenance works, prices in Hungary spiked several times in the first week of July, once even exceeding 110 EUR. In Romania Hidroelectrica terminated its long term contracts citing force majeure – low water levels and adverse forecasts of precipitation-, which resulted in a substantial price increase on the Romanian power exchange. The summer price difference discontinued in September, the German and Czech markets were 3-5 EUR cheaper than the Romanian and Hungarian exchanges. The convergence of prices can be explained by milder temperatures and the Czech-Slovakian-Hungarian market coupling (for a detailed analysis of the latter please see our article The evaluation of the Czech-Slovakian-Hungarian market coupling based on the results of the first five weeks, published on page 18. of the current issue). The 12-15 €/MWh price advantage of the German and Czech markets that was typical for the first two months of the quarter, shrank to 2-5 €/MWh in September.

The wholesale price of electricity is influenced by the costs of deviations from the schedule and the balancing energy prices as well. The system operator sets the settlement prices of daily upward and downward regulation based on its procurement costs of energy from the balancing market. The financial costs of balancing for the balance circles are determined by the balancing energy prices and the spot price of electricity in the settlement period. The higher the difference between the price of upward and downward regulation and the spot wholesale price, the more it costs to acquire the required amount from the balancing market. During the quarter the price of positive balancing energy was 23.8 HUF/kWh on average, which is higher than the quarterly average of the spot price on the exchange, but as a trend the improving efficiency of the balancing market seems to prevail, as indicated by the strengthening convergence of the positive balancing price and the price of the spot product during the last month of the quarter.

The price of the 2013 futures baseload product slightly declined in July, before bouncing 2-3 €/MWh in August. In September German, Czech and Slovakian prices returned to the sub-50 €/MWh range again.

The Hungarian market followed the price pattern on the rest of the regional exchanges, only with larger swings. The price of the 2013 futures product with physical delivery traded on HUPX moved back and forth within the 55-59 €/MWh price range. The Czech and Slovakian markets enjoyed an average price advantage of 1 €/MWh relative to the German exchange, while the Hungarian futures product with physical delivery was almost 9 €/MWh more expensive than the German one. The consequences of market coupling cannot (yet) be observed in the futures markets, but too little time has passed to develop meaningful conclusions, anyway.

Overview of the gas market in Hungary

Third quarter gas consumptions was 120 million m^3 below the figure from the July-September period of 2011.

The heating degree days (hdd) on the right axis indicate the heating requirement. To calculate the hdd we look at the daily mean temperature. If it is below 16 degrees Celsius, then the daily hdd is the difference between the 16 degrees and the daily mean temperature. The monthly hdd is the sum of the daily hdds. By comparing the actual monthly hdd to the value from the previous year and the average hdd values we can determine how cold the given month is in relative terms. Thus positive values stand for lower temperatures and higher gas consumption, and negative values stand for higher temperatures and lower consumption.

Driven by the extraction activities of MOL, domestic production slightly increased during the quarter relative to the previous three months. Even this, however, was not enough to lift domestic natural gas production above the monthly average of 240 million m^3. Our export to Romania and Croatia soared: compared to the July-September period of 2011 it grew by almost half. Natural gas imports declined compared to both the previous quarter and the summer months of last year: 1.6 billion m^3 of natural gas arrived through the pipelines, in contrast with the 2.2 billion m^3 of the preceding three months and the 1.8 billion m^3 during last year.

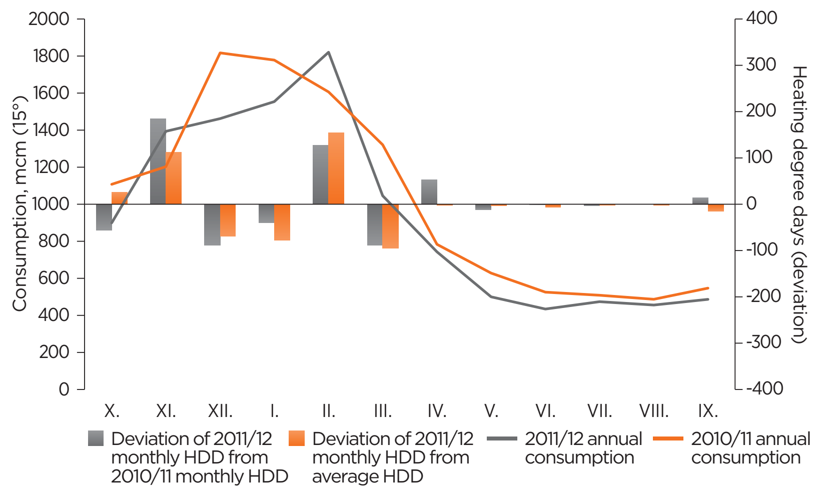


Figure 10. Monthly natural gas consumption between October 2011 and September 2012 compared to the natural gas consumption in the same months of the previous year, and compared to the difference between the monthly heating degree days and the multi-year average hdd figures and those of the previous year

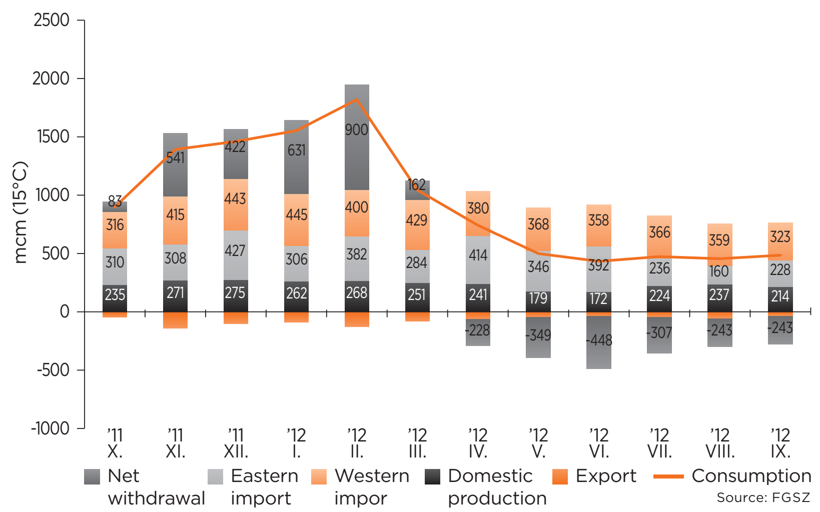


Figure 11. The source structure of the gas market of Hungary by month between October 2011 and September 2012

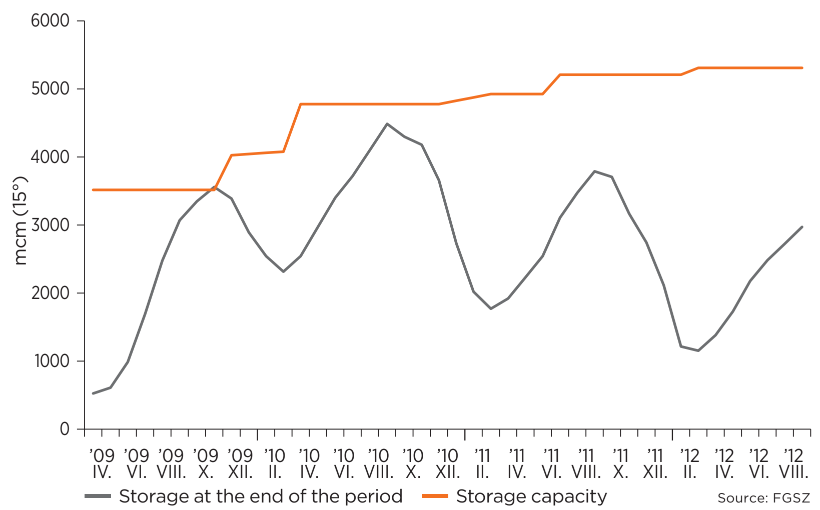


Figure 12. The mobile gas storage capacity of commercial storage facilities and their stocks by month

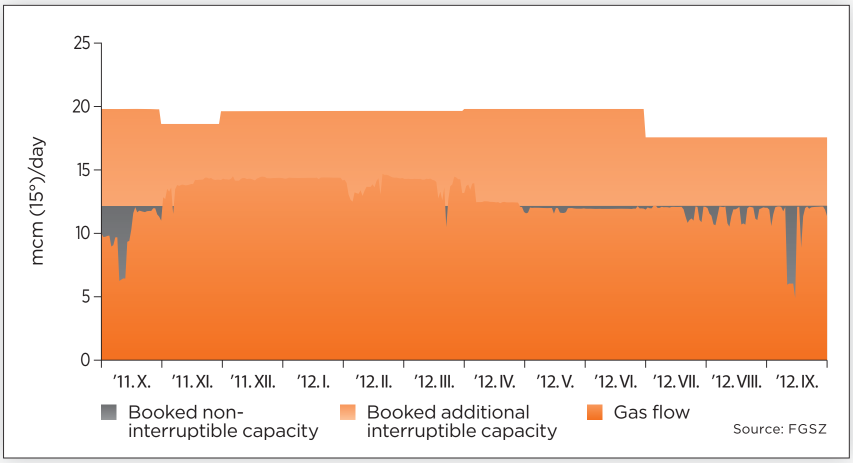


Figure 13. Transmission at the Baumgarten entry point between October 2011 and September 2012, together with booked interruptible and non-interruptible capacities

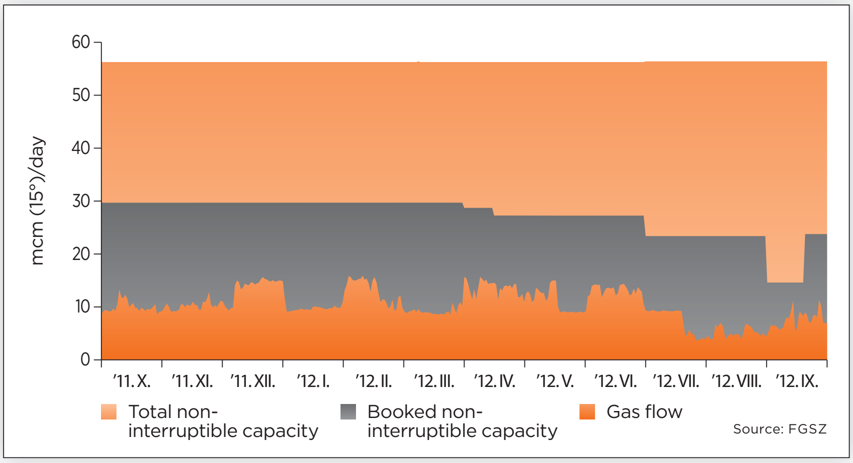


Figure 14. Transmission at the Beregdaróc entry point between October 2011 and September 2012, together with total available capacity and booked non-interruptible capacity

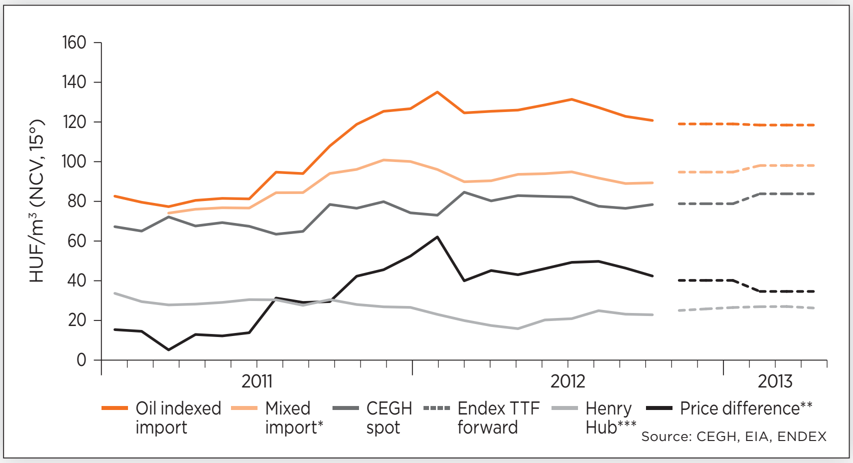


Figure 15. Past and forecasted future international and domestic wholesale gas prices

* *Weighted average of the oil indexed and the ENDEX TTF gas price on the power exchange, 60:40 weight until September 2011, 30:70 weight afterwards.*

** *The price difference between the oil indexed and CEGH for past prices, and the oil indexed and corresponding quarterly futures ENDEX TTF prices for future gas prices. The spread between the spot prices at the Dutch and Austrian exchanges has become very small recently. This is why the futures ENDEX gas prices are considered relevant for the Austrian market as well.*

*** *Cubic meter price of the Henry Hub wholesale gas price, exchanged at the medium exchange rate of the Central Bank of Hungary. The source of the forecast is the Short Term Energy Outlook.*

Nearly two-third of the import arrived to Hungary through Baumgarten.

At the end of the injection period 53% of the capacity of the commercial storage facilities was filled. The capacity utilisation of the storage facilities has been gradually decreasing for the last three years: this ratio was close to 90% in 2009 and 2010, and 70% in 2011. The 1 July 2012 re-establishment of the strategic reserve has been postponed by Decree 17/2012 of the Ministry of National Development all through until the 2014 gas year, with an interim reserve of 815 million m^3 until then.

63% of the natural gas import, 1 billion m^3 of gas arrived from the Western direction. 70% of the transmission capacities were reserved by market players, on average over 90% of the capacity of the pipeline was utilised during the quarter. (On page 9. in this issue you can read our analysis of the natural gas flexibility market and the low capacity utilisation of the storage facilities.)

Between July and September 620 million m^3 of gas was imported from the East. 40% of the capacities were reserved, and over 30% was actually utilised. Apparently, only the Western border section is congested (Figure 13), market participants try to secure as much gas from this direction as possible, while the Eastern pipeline is considerably underutilised (Figure 14).

During the third quarter of 2012 the average price of oil indexed import was 124 HUF/m^3. The price difference between the oil indexed import charged to universal service providers and the Baumgarten CEGH decreased to 40 HUF/m^3 by the end of September, in comparison to the 50 HUF/m^3 value during the previous quarter. This decline can be explained by the lower CEGH spot prices.

ENERGY MARKET ANALYSES

Half empty or half full? Developments on the Hungarian natural gas storage market

A noticeable tendency from the last few years has been the lower and lower capacity utilisation of the Hungarian natural gas storage facilities at the beginning of the withdrawal period. Even though the volume of gas withdrawn from the storage sites to satisfy the demand of winter months has essentially not changed (around 34-37%), the utilisation rate of the capacity of domestic facilities fell from almost 100% in early October 2009 to 50% by October 2012 (see Figure 12 of the article on Energy market developments). In absolute terms, nevertheless, there was 3 bcm of natural gas in non-strategic storage facilities, the same order of magnitude as the 2009 inventory. In our article we seek to explore the processes that are behind the severe decline of the utilisation of storage space.

Before we uncover why storage facilities are so under-utilised, we need to make an introduction to the operation of the storage market. Natural gas storage sites provide three important services: they supply intra-year seasonal storage, offer flexible capacities to the natural gas market on a daily basis, and create an opportunity for intertemporal arbitrage.

The seasonal distribution of natural gas consumption is not even. In Hungary, for instance, winter consumption – based on the average use from the last three years – is typically 2-2.5 times summer consumption. Compared to our neighbouring countries this value is a bit high, only the Czech Republic has a larger swing. Coping with such a high variation in consumption is technically difficult, or at least very costly, through other sources such as building a pipeline with increased capacity or boosting domestic gas production. The seasonal fluctuation of consumption is, therefore, satisfied with natural gas that is injected into subsurface storage sites. For the last three years on average a quarter of the annual natural gas use was supplied from storage facilities, but other withdrawal ratios are not unusual in the region either. Unsurprisingly, gas storage sites have been constructed in countries with increased seasonal variation of gas use (see Table 1).

Besides seasonal flexibility, natural gas storage sites are also capable of providing daily flexibility, sharply increasing or decreasing withdrawal in a short interval of time. There is a real need for this service, since a one degree Celsius drop in temperature during the heating season raises the daily natural gas use by about 2 mcm. In the winters of 2010-2011 and 2011-2012 the temperature difference between two consecutive days was more than one Celsius on two-third of the days, it was over 2 Celsius in 40% of the days and over 3 Celsius in 25% of the days. Temperature driven daily demand fluctuations of 4-6 mcm are, therefore, not rare at all. Instead of storage facilities, such a demand for flexibility can also be satisfied with domestic production or flexible transmission of imported gas. Data from the winter of 2011-2012, nevertheless, indicates that daily fluctuations are

			Storage capacity***		
	Relative swing (winter consumption / summer consumption)*	Withdrawal / annual consumption (%)**	Mobile gas capacity, mcm	Daily injection, mcm/day	Daily withdrawal, mcm/day
AT	1.96	26%	7176	67.27	85.35
CZ	2.49	18%	3277	39.5	55.5
HR	1.50	10%	550	3.8	5.8
HU	2.40	23%	5515	79.9	46.05
RO	1.42	7%	3100	24.27	24.27
SI	1.60	0	0	0	0
SK	2.38	18%	2952	30.35	38.05
RS	2.03	n.a.	450	3.5	5

Source: REKK calculations, Eurostat, ENTSO-G, Blue Fuel, corporate websites

Table 1. Consumption patterns and storage capacities in the region

Notes: At present Slovenia does not have a natural gas storage facility. In Hungary we have not considered the 915 mcm of strategic reserve.

* *When calculating the relative swing we compared the April-September gross domestic consumption of 2009-2011 to the November-March consumption.*

** *When calculating the ratio of withdrawal / annual consumption we compared the monthly withdrawal of 2009-2011 to annual gross consumption.*

*** *Storage capacity data applies to standard gas at a pressure of 1.01325 bar, at 15 degrees Celsius for year 2012.*

generally managed through the storage sites. In the inspected years the daily flexibility of export and production was at around 1 mcm each, this figure was 5 mcm for import, while withdrawal could deviate from the previous day's value by as much as 8 mcm.

The third service provided by the storage facilities is intertemporal arbitrage, that is, enabling the trader to fill the facility or downscale withdrawal at low natural gas prices in order to sell the stored quantity at higher prices later.

Of the three listed services seasonal storage has the largest impact on the stock level. Within a given range the daily flexibility is independent of the stock level of the facility, but because of decreasing pressure the daily withdrawal capacity is somewhat lower as winter comes to end. Intertemporal arbitrage presumably takes a lower share of commercial gas contracts than seasonality related precaution. Therefore, to be able to solve the problem, we need to know why the demand for seasonal storage declined. Why would we require less seasonal storage? We identified three recent developments that may provide an explanation for shrinking demand.

- declining domestic natural gas demand, oversized domestic storage capacities
- amendment of the regulation on commercial storage activity
- overly concentrated storage market

Even if these three explanations add up, causing commercial storage facilities to echo from emptiness, we may still wonder why the surplus storage capacities of the Hungarian market have not been sold to neighbouring countries with less sufficient capacity?

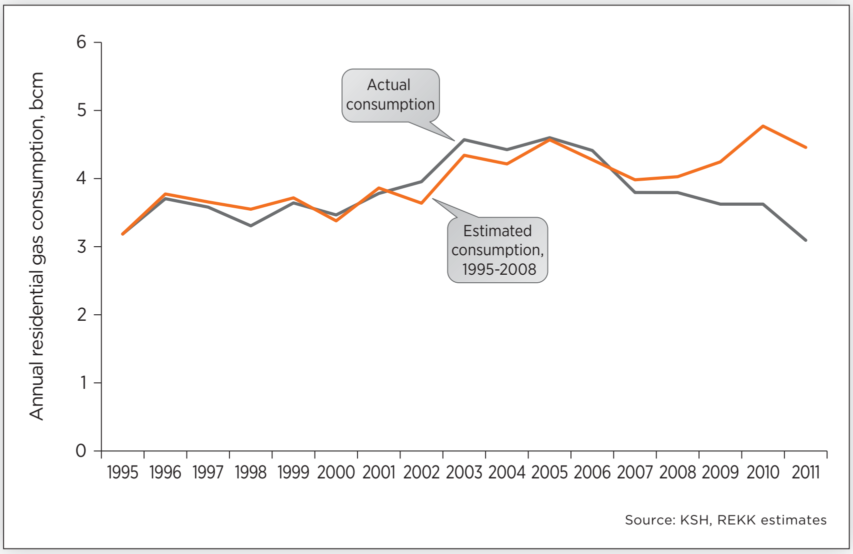


Figure 16. Household natural gas consumption: actual figures and estimates based on the 1995-2008 period

Declining domestic natural gas demand, oversized domestic storage capacities

In absolute terms natural gas consumption has been declining since 2008, as a result less stored gas was needed for the winter months. The economic crisis brought Hungarian industrial manufacturing to a halt and the real income of households fell, these developments were also mirrored by lower gas use.

Of the 2010 gas consumption of Hungary 34% was used by households, 32% by power plants, 17% by the service sector and 14% by industry. The remaining 3% comprised the use of other sectors, including agriculture, as well as network loss. Next we review the gas consumption of each of the sectors.

The per capita natural gas consumption of households considerably fell since 2008, even though winters since then have been 2-2.5 degree Celsius colder on average. Household gas use is very well predicted by temperature and the annual heating degree days. In Figure 16 we estimated the extent to which temperature and the ensuing heating degree days explain household consumption for the 1995-2008 period, then we made estimates for 2009-2011 and compared them with actual observations. As displayed, in 2010-2011 gas use per household consumer was already 300-400 m^3 below temperature adjusted projections. For all households together this adds up to 1.1-1.4 bcm/year for 2010 and 2011.

The decline of household consumption may be caused by several factors. As a result of decreasing real income, household consumers may have heated their apartments to a lower temperature. Perhaps less gas is needed by households due to the energy efficiency improvements of residential properties. Switching to alternative heating methods may also reduce the gas consumption of households, and this idea may, among others, be underpinned by the fact that in 2010-2012 the ambient concentration of particulate matter, originating primarily from the combustion of solid fuels, exceeded the health safety standards in several Eastern Hungarian towns.

Power generation during 2009-2011 also notably declined as a result of the crisis. Compared to 2008 Hungarian power plants produced 4 TWh less electricity, equal to 10% of annual electricity consumption. The gas use of power plants shrank from 5 bcm per year to 3-3.5 bcm.

In contrast, compared to 2008 the consumption of the service sector slightly increased, by 150 mcm in 2009 and 350 mcm in 2010, due to colder winters.

Industrial consumption consists of two components, use for energy purposes and non-energy purposes (chemical industry). Use for non-energy purposes in the chemical industry has been quite stable for the last five years, as consumption stayed within the 400-500 mcm/year range for all these years. The natural gas consumption of industry for energy purposes, on the other hand, dropped more markedly than in the neighbouring EU member states (except for Romania) and in Croatia. Compared to 2008 industrial natural gas consumption declined by 28% in 2009 and 17% in 2010, a difference of 300-400 mcm in absolute terms, as shown by Figure 17.

In total, compared to 2008 domestic natural gas consumption was 1.8 bcm less in 2009 and 1 bcm less in 2010. Taking the rule of thumb that the gas storage capacity utilisation for a given year is about one-quarter of annual consumption, lower consumption drives the Hungarian demand for storage down by approximately 250-450 mcm.

While demand shrank, storage facilities were constructed without any pause: since 2008 E.ON expanded the mobile gas capacity of its storage sites with 700 mcm, in addition, the Szőreg strategic gas storage facility with commercial mobile gas capacity of 700 mcm was completed. The additional capacity provided by the new sites has been calibrated for larger annual gas consumption, it is not surprising that they were not fully filled, and therefore we witness lower capacity utilisation rates even though the structure of consumption has not drastically changed in absolute terms.

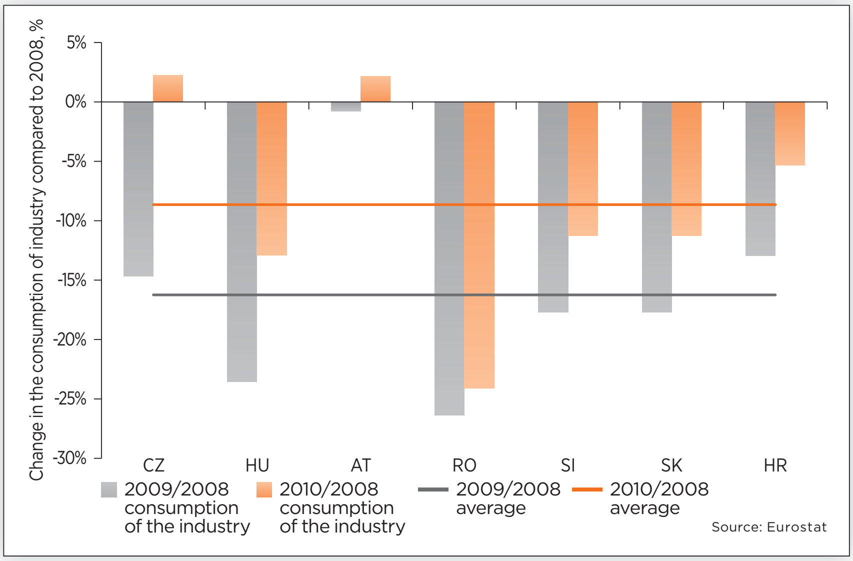


Figure 17. The dynamics of industrial natural gas use compared to 2008

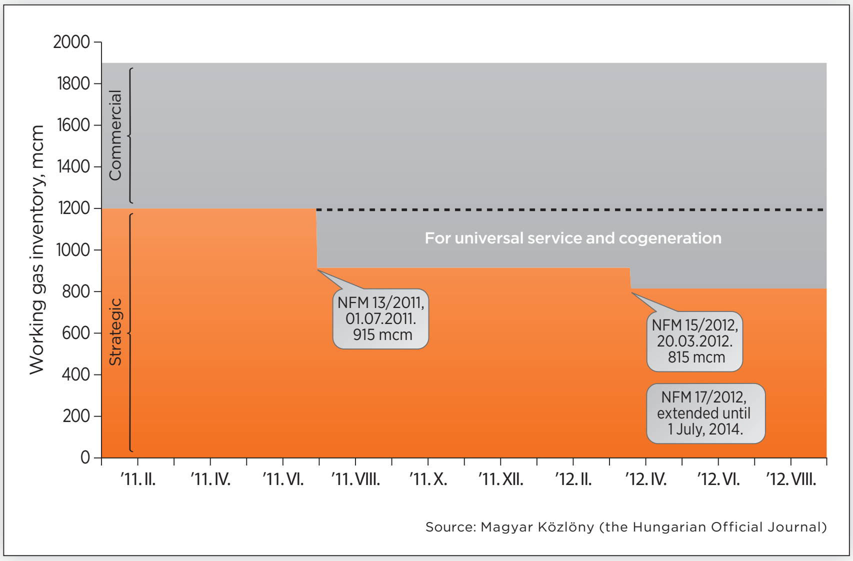


Figure 18. The mobile gas stocks of the strategic storage facility in view of the NFM decrees

Amendment of the regulation on commercial storage activity

Since 2011 the demand side of the domestic commercial gas storage market has been heavily influenced by the regulation on the strategic gas storage facility. In 2011 and 2012 altogether 400 mcm of natural gas was transferred to universal service providers, public institutions and cogenerators. First, with Decree 13/2011 of the Ministry of National Development (NFM), the Minister released 300 mcm of natural gas from the strategic reserve, a third of which was made available to universal service providers, while two-third was allocated to cogenerators. Decree 15/2012 of the NFM allocated another 100 mcm of the strategic reserves to supply the energy needs of public institutions. According to Decree 13/2011 of the NFM the reassigned gas would have been requalified as strategic reserve at the beginning of the 2012-2013 gas year, but Decree 17/2012 of the NFM postponed this provision until the 1 July 2014 start of the 2014-2015 gas year. The Decree also assigned import capacity to the reserves, allowing the recharge of the storage facilities. The reassigned stock, therefore, competes with commercial capacities, reducing the market demand for storage by 400 mcm all the way until 2014.

	Number of market players	Mobile gas HHI	Withdrawal capacity HHI
AT	4	2 825	2 808
CZ	3	6 257	5 705
HR	1	10 000	10 000
HU	2	6 893	7 674
RO	3	7 966	7 904
SK	2	6 564	7 048
RS	2	5 002	5 002

Source: REKK calculation, ENTSO-G, Blue Fuel, MEO, corporate websites

Table 2. Storage market concentration based on mobile gas capacity and withdrawal

	Owners	Daily withdrawal capacity (mcm/day)	Daily withdrawal capacity, by company (mcm/day)	Note
Storage facility	E.ON facilities	55.10	55.10	
	MOL-MMBF	4.85	4.85	Commercial section of the strategic reserve
	the part of the strategic reserve awarded to E.ON		3.87	15/2012. NFM
	the part of the strategic reserve awarded to MVM		3.87	15/2012. NFM
Domestic production	MOL	4.69	1.56	
	E.ON		1.56	
	Főgáz		0.78	
	Tigáz		0.78	
Bereg-daróc import	E.ON	7.01	2.55	
	Competitive		4.45	
HAG import	E.ON	3.49	1.88	15/2012. NFM
	MVM		1.50	15/2012. NFM
	Competitive		0.10	

Source: REKK working paper: The possibility of gas storage competition in Hungary (2009), FGSZ, Magyar Közlöny (the Hungarian Official Journal)

Table 3. The Hungarian flexibility natural gas market in 2012

Concentrated storage market

Theoretically the low utilisation of the storage facility may be explained by the fact that most of the capacities are, in essence, possessed by one dominant player, thus the partially utilised storage sites are simply excessive capacities to deter new entrants. While in 2010 a new participant, namely the MMBF natural gas storage facility, entered the storage market, it is important to mention that without the construction of the strategic reserve this participant would not have appeared.

In Hungary storage facilities are currently shared by two participants, E.ON Storage owns 4430 mcm, while MOL owns 700 mcm of mobile gas capacity. In accord with the decrees described above, MVM has another 300 mcm and E.ON has an additional 85 mcm of capacity. Since 2008 E.ON expanded its mobile gas capacity with 700 mcm and its withdrawal capacity with 5 mcm/day. The newly built capacities remain untapped. Below we show that within a regional context the Hungarian market is viewed as heavily concentrated, and even when other instruments of flexibility are considered there is very little room for new entrants.

When we determine the concentration of the storage market, we assume that the relevant market for domestic storage facilities is Hungary. We can define two types of storage concentrations: first we calculate market concentration in a narrow sense, accounting for the mobile gas capacity of the sites and the withdrawal capacity. Next we also determine the concentration of the domestic flexibility market. The computed Hirschmann-Herfindahl index is the indicator for market concentration. It can have a maximum value of 10,000, HHI values above 1800 already indicate a concentrated market.

Apparently, Hungary is the third most concentrated market within the region, based on both mobile gas capacities and withdrawal.

Since the flexibility market considers the flexibility of not only the storage facilities, but also that of the infrastructure that potentially substitutes these facilities, it more precisely represents the market power of storage sites. If we consider the flexibility market in a broader sense then the daily withdrawal capacity of the facilities will have competition from the flexibility of the other sources of natural gas – import and production. The flexibility of the other sources can be computed by taking the average of the difference between the ten highest actual daily gas flows and the ten lowest actual daily gas flows. The table below illustrates the domestic flexibility market and the corporate concentration calculated from withdrawal capacities.

The value of HHI for the flexibility market is 6281, a little below the concentration computed based on mobile gas capacity. We cannot make indisputable conclusions from the degree to which the storage market is concentrated. The indicated market power makes it possible to obstruct new entrants, but this does not necessarily mean that the dominant company will indeed exploit this option. Potential new entrants may stay away from the market for other reasons, such as low demand or the high barriers to entry or exit the sector.

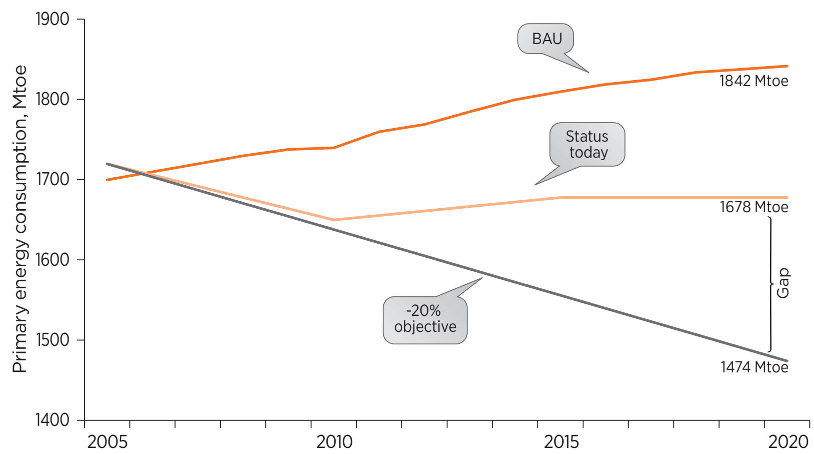
The relative costliness of domestic storage facilities

But why do the market participants of the neighbouring countries not take advantage of such a large unused capacity? While in 2009 the gas consumption of all the neighbouring countries decreased, by 2010 gas use already increased in Austria and the Czech Republic. Since 2009 Serbia has engaged the E.ON commercial storage sites to store gas for its own consumption, but we are not aware of similar measures by other regional countries or companies. The low utilisation of the facilities may be explained by the incompetitiveness of the sum of the storage fee and the transmission tariff in comparison with other storage sites in the region. In other words, Slovenia, for instance can satisfy its seasonal storage demand through an Austrian storage facility at a lower cost, than if it contracted the same service from Hungary. The analysis of storage and transmission tariffs is beyond the scope of our current article, but we will revisit this topic in a future issue of our Energy market report.

A few questions related to the new Energy Efficiency Directive and the energy efficiency obligation schemes

At the end of the year the Official Journal of the European Union will publish the new Energy Efficiency Directive, which will oblige Member States, on the one hand, to set mandatory national energy efficiency targets, and on the other hand to establish regulations affecting multiple economic sectors and actors. The reason behind the regulatory initiative of the Commission is that of the 20-20-20 targets of the EU, the 20% primary energy savings goal, as forecasted in 2007, is unlikely to be met based on the present trajectory of energy use (that is, considering already adopted measures), and actual savings are likely to be less than 10% by 2020. The new Directive, therefore, should in principle generate primary energy savings of about 200 Mtoe. The national targets of primary or final energy consumption, expressed in absolute values, to be submitted by the Member States by 30 April 2013, will be summed by the European Commission, and if the total does not meet the 2020 energy use target of the Community (1474 Mtoe), then the Commission may adjust the proposed national figures.

The original Commission draft of the Directive – in addition to the EU and national measures already in force – introduces new general



Source: A new A new Directive on Energy Efficiency, Challenges addressed & solutions proposed, DG Energy, 22 June 2012. (presentation)

Figure 19. **The 2020 primary energy use scenarios of the EU**

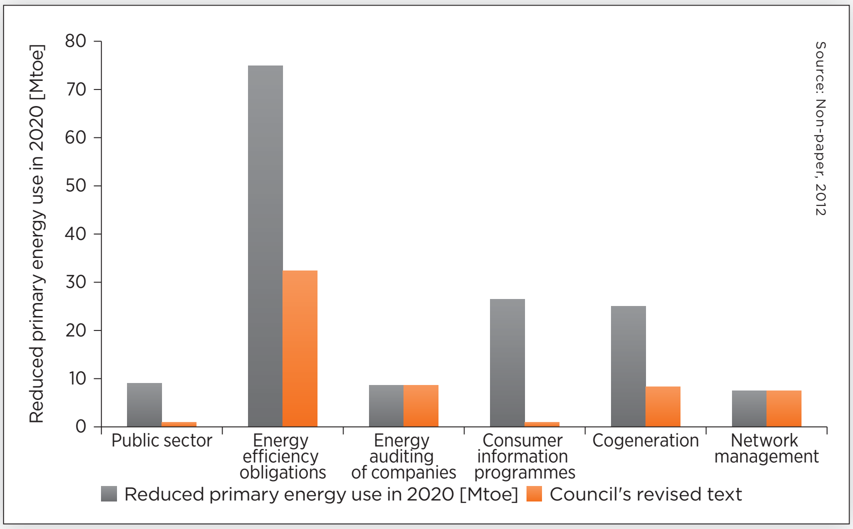


Figure 20. **Primary energy savings in the original and the April 2012 versions of the Directive, by measures (Mtoe)**

(horizontal) and sector specific regulatory tasks, which, according to the estimate of the Commission, would have ensured total primary energy savings of 151.5 Mtoe.[1] Due to the opposition of the Member States, however, in April 2012 the Council of Ministers decided to lax a number of important measures, making it possible for the Directive to come into force this December.[2] This amended version contains only 39% of the originally proposed primary energy saving (58.1 Mtoe instead of 151.5 Mtoe).[3]

The community level savings induced by the proposed measures clearly show that the biggest burden falls on the energy service providers under the mandate of the energy efficiency obligation schemes under both scenarios. The Commission would have expected substantial savings delivered by metering and invoicing reforms, that is, the more cost conscious behaviour of better informed consumers, and also by the support of cogeneration. Related measures, nevertheless, have been considerably scaled back by the Council.

Likewise, the Council curbed the measures that aim for improved energy efficiency within the public sector, even though the original draft Directive of the Commission would have placed great emphasis on the public sector to demonstrate good practices. As opposed to the total stock of state owned buildings the final version of the Directive requires Member States to renovate 3% of the total floor area of only the central government owned buildings each year to a level that meets the requirements of Directive 2010/31/EU on the Energy Performance of Buildings. Moreover, during public procurement procedures Member States are obliged to give preference to products, services and buildings that are highly energy efficient. The large difference between the energy savings of the two proposals is explained by two factors: the renovation requirement applies only to the buildings of the central government (and excludes those of local governments), and the preference for higher efficiency during public procurement is also conditional upon cost efficiency. The requirements concerning obligatory energy audits (which needs to be conducted by non-SME enterprises every four years) and the operation of networks (network access fees enabling demand side adaptation) have not changed.

Energy efficiency obligation schemes

Under the energy efficiency obligation schemes energy saving targets are set for companies involved in energy supply (distributors or retail energy sales companies), which are then obliged to reach these targets with savings reached in pre-specified consumer groups. Obligated companies annually have to implement energy saving measures that accounts for 1.5% of their retail sales volumes(as new saving). During the negotiations this target inflated, as the final text provides a number of reliefs. First of all, it allows Member States to exclude energy used in the transport sector from the reference quantity – the option that is likely to be used by a number of countries. The target thus derived can be further lowered with up to another 25% as detailed below:

- gradual introduction of the 1.5% target (2014 and 2015: 1%; 2016 and 2017: 1.25%; 2018-2020: 1.5%; on average: 1.28%),
- industrial energy use of facilities falling under the EU ETS scheme,

[1] IMPACT ASSESSMENT Accompanying the document: DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on energy efficiency and amending and subsequently repealing Directives 2004/8/EC and 2006/32/EC, SEC(2011) 779

[2] Proposal for a Directive of the European Parliament and of the Council on energy efficiency and repealing Directives 2004/8/EC and 2006/32/EC. 2011/0172 (COD)

[3] NON-PAPER OF THE SERVICES OF THE EUROPEAN COMMISSION ON ENERGY EFFICIENCY DIRECTIVE, INFORMAL ENERGY COUNCIL, 19-20 APRIL 2012

- savings from the transport of energy (district heating, smart networks), and
- early energy efficiency savings (measures prior to 2008 with impacts lasting until at least 2020).

Based on the average final energy use of the 2008-2011 period, Hungary is obliged to achieve new savings of 6.3 to 10.5 PJ/year, depending on the extent to which the above mentioned reduction options are used (Table 4). To illustrate the scale of these efforts: 6.3 PJ/year of new savings in 2020 equals 18% of the total 2010 energy consumption of households, and it is more than twice the 2010 energy use of the agriculture.

The decisions taken on all these reduction options still do not define the the actual target to be reached within the obligation scheme, since its savings can be (partially or wholly) replaced by "alternative measures". Of these carbon or energy taxes, investment grants, voluntary agreements, national standards that are more stringent than EU norms, and specific information services (e.g. energy consulting) are explicitly spelled out by the Directive, but any state intervention resulting in energy savings is also acceptable.

During the implementation of the energy efficiency obligation scheme a number of decisions need to be made, and these decisions have to be submitted by the Hungarian government (and all other member states) to the Commission for approval by December 2013 at the latest.

	Annual commitments (%)	Annual obligation (PJ)
Based on total final energy use	1.5%	10.5
	1.125%	7.9
Based on total final energy use without transport	1.5%	7.6
	1.125%	6.3

Source: Eurostat data and own calculations

Table 4. Annual new energy saving obligation of the energy suppliers of Hungary as prescribed by the Energy Efficiency Directive (2014-2020)

Defining the obligated parties

First the coverage of energy suppliers is to be determined. These may include only network industry products (electricity and gas) and their suppliers, or also other energy products (cooling/heating, heating oil, LPG, fuels) and the supplying companies as well. Secondly, in case of network products should the suppliers or the distributors (network owners and operators) be obligated? Besides the counter-incentive of participants that have an interest in maximising the volume of sold energy, the obligation may potentially also generate new business opportunities (energy efficiency services). Suppliers are in direct contact with their clients, which, on the one hand, makes it easier for them to inform clients about the energy efficiency actions that stem from the obligation (e.g. on the monthly bill), and on the other hand – knowing the consumption profile and payment discipline of their customers – they are in a favourable position when it comes to supplying clients with energy efficiency services. An argument for the distributors is that they are less numerous, they are a priori subject to price regulation, therefore expansion of the obligation scheme to also cover them would involve lower administrative costs. Of the European obligation schemes traders are the obligated parties in the British and French cases, while distributors in Italy, Denmark and Flanders.

The Directive mandates the Member States to determine the subset of energy distributor and retailer companies to be covered by the scheme. Member States have the option to exclude smaller companies (by setting a minimum size) and to include the traders/distributors of only specific energy products.

Defining the eligible end-user segments

It is essential to decide on the consumer segments (residential, service, industry and transportation) and energy carriers (electricity, gas, district heating, heating oil, fuels etc.) the savings of which are eligible to be accounted for. The precondition to most efficiently reaching the savings target is the lack of any restriction on the eligible consumer segments, fuels and measures (project types). In this case the obligated parties can select from a wide range of options with different marginal costs, which – supplemented with the ability to trade the certificates – provides an optimal regulatory framework to achieve the joint target at a low overall cost.

White certificate is a tradable security representing energy savings, which is traded either through bilateral transactions or on an organised market (exchange). At the end of the compliance period obligated parties need to submit an appropriate number of certificates to match their savings target. The white certificate system is not an indispensable element of an obligation scheme.

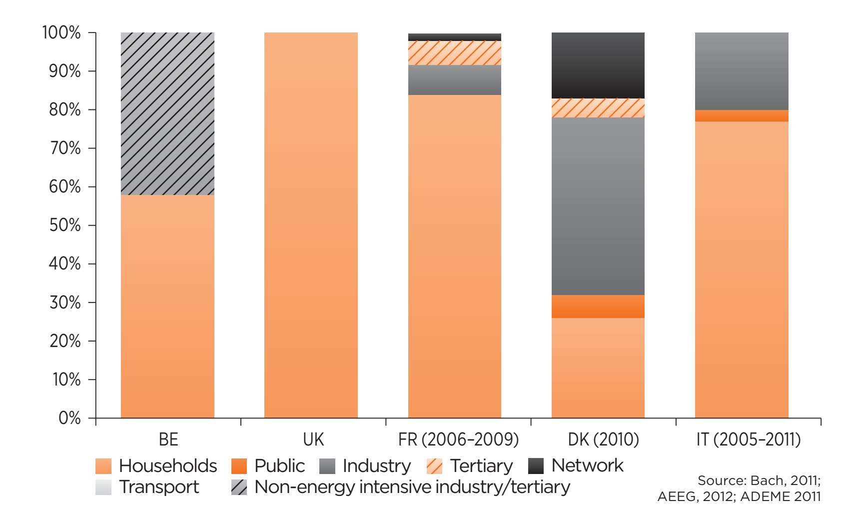


Figure 21. **Distribution of the achieved energy savings among final consumer sectors (%)**

Since there are regulatory costs to establishing the system, specifying (and regularly updating) the methods of accounting, the case by case evaluation of non-standard measures and verification, the set of measures to be part of the system needs to be optimised with attention to efficiency as well as costs. If the scheme does not cover all sectors, it makes sense to include the segment(s) with the largest potential that can be inexpensively utilised, offering projects that can be easily multiplied (savings due to economies of scale at the obligated parties), and whose savings potential can be reliably estimated in advance.

The household segment is of critical importance in all the inspected countries: in France 84% of all savings, while in Italy 77% of total savings take place in this segment (Figure 21). Denmark appears to be an exception, where the scheme is characterised mainly by large projects of industrial modernisation with non-standard accounting methods. In the United Kingdom and Flanders the division of savings targets is set by the regulation (only households, and a predetermined ratio of households and industry, respectively). These systems – similarly to the Directive – basically require that savings are realised at the final consumers, although in some countries reduction of network loss and selected renewable investments are eligible as well (e.g. Italy: household sized PV).

Determining the eligibility period and the method of savings calculation

The exact procedure and institutional background for accounting differs by the country, but the applied methods reveal a rather uniform practice. The accountable energy savings of standard measures - that are replicable and whose savings can be estimated accurately - are set ex ante by the regulatory authority, thus the obligated party can anticipate an exact savings value it can claim for that measure. The other option is project specific assessment which involves substantial verification costs as well as a risk borne by the obligated party, since the savings to be booked are not known in advance. Both methods are applied in all of the inspected national schemes. The obligated parties are usually in favour of ex ante calculation and the regulator indeed makes estimates for the savings delivered by the standard measures. The individual assessment reigns only in Denmark, driven by the prevalence of unique industrial investments.

The volume of savings that can be booked (together with the cost of the savings) steers the obligated parties toward measures with the lowest cost per unit of energy saved. To reach the same level of savings, vastly different level of effort is needed (number of measures, unit deployed etc.) depending on the number of years for which the savings can be accounted for. Obviously, the accounting method itself does not influence actual energy savings, but turns the obligated party towards projects that seem more favourable, which does not necessarily coincide with the socially desirable portfolio. In Italy, for instance, during the first compliance period (2005-2007) only 8 years of energy savings was allowed to be accounted for building thermal insulation (in contrast with 40 years in the United Kingdom and 35 years in France), and 5 years for all other investments. In Italy this drove the obligation market towards replacing traditional light bulbs with CFL, but restrained from lowering the heat demand of the building stock (Bertoldi et al., 2010).

Defining the rules of cost recovery

If the activity of the obligated parties (or one of its segments) is subject to price regulation, the regulators may opt to recognise and compensate for the incurred costs through the tariffs, to be paid by the customers. Energy service providers in liberalised markets, on the other hand, may try to recover these costs through their prices. In Denmark and Flanders the full cost is recognised, while in Italy the obligated party receives a fixed refund (at a value of 100 EUR/toe until 2008). The ex post reimbursement of all incurred costs does not provide an incentive to obligated parties to search for and exploit cheaper options, thus it is inefficient for society as a whole. The fixed rebate, on the other hand – depending on its level – provides an incentive to obligated parties to maximise net revenues or minimise losses, in other words, to move from cheaper options to more expensive ones during compliance. As Figure 22 shows, until 2008 in Italy the exchange based (annual average) price of all three types of certificates stayed below the level of cost reimbursement resulting in net income for the companies.[4] The previously separate goals for electricity and gas were merged in 2008, as a result the two prices converged, and the cost reimbursement was also extended to other energy carriers. From this year the previously fixed 100 EUR/toe value is annually adjusted with the end customer energy price. Since 2010 only a portion of the costs are recognised because of the increasing price of certificates, reflecting the rising unit costs of energy savings.

The other important question regarding the recognition of costs is the extent to which the socialisation of cost is justified, since in this case – in contrast, for example, with supporting renewables – the recipient of the benefits generated by the investment is identifiable: it is the household where energy use and its costs decline thanks to the investment. The contribution of the beneficiary to the investment is reasonable on the grounds of both fairness and efficiency, since the transfer of income (from all consumers to the beneficiary) declines, and the household will have a stake in "optimising" the investment, that is, it will carry some of the related risks (identification of efficient means to save energy).

In a way it is ironic that while the new Energy Efficiency Directive requires member states to introduce obligation schemes, in Great Britain the energy efficiency system that has been in operation for 10 years will come to an end this year, being replaced by an ESCO type financing system (Green Deal), in which the household pays for the investment monthly, ex post from the savings on the energy bill.

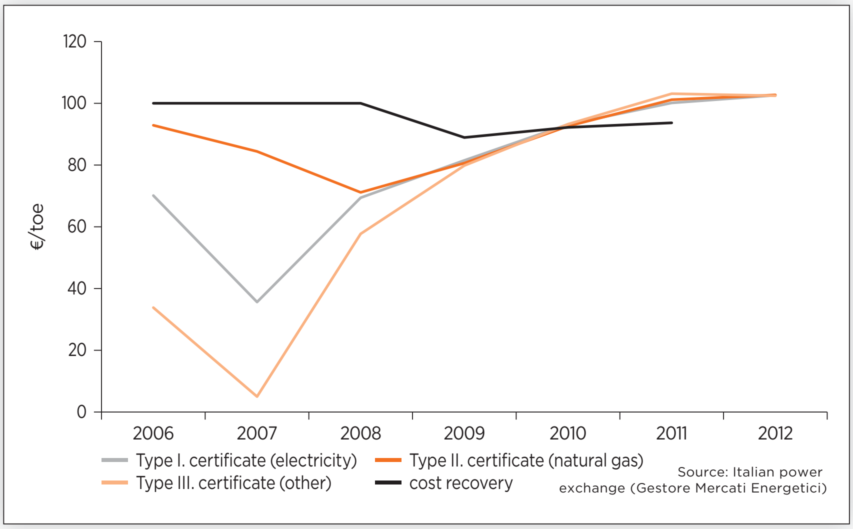


Figure 22. The annual average price of different types of certificates and the value of cost reimbursement in Italy

[4] In Italy a uniform white certificate for savings is not in use, instead, there are separate certificates to represent savings in the use of electricity, gas and other energy carriers.

References:

ADEME (2011): The French Energy Savings Certificates Scheme, Joint European Commission and eceee seminar on Energy Efficiency Obligations, 30 September, 2011, http://www.eceee.org/eceee_events/energy-efficiency-obligations/2_ademe

AEEG (2012): Sixth Annual Report on the mechanism of the Energy Efficiency Certificates, http://www.autorita.energia.it/it/docs/12/070-12.htm

Bach, Peter (2011): Energy Saving Obligations in Denmark (presentation, BMU-International workshop)

Bertoldi, et al. (2010): Energy supplier obligations and white certificate schemes: Comparative analysis of experiences in the European Union, Energy Policy, 38/2010, pp. 1455-1469.

CURRENT EVENTS

Evaluation of the Czech-Slovakian-Hungarian market coupling based on the results of the first two months

One of the objectives of the European Union is the development of a Integrated European electricity market by the end of 2014. As part of this endeavour, a lot of the member states participate in market coupling initiatives[1]. Hungary made its contribution to market integration when on 11 September 2012, as the first trading day, the coupling of the Czech, Slovakian and Hungarian day-ahead electricity markets started.

The key advantage of market coupling is that it provides an opportunity for the application of implicit auctions, during which the electricity and the capacity rights needed for its transmission are sold to market participants as a joint product. In the long run the target model for the coupling of day-ahead markets is flow-based price-coupling. In case the method for flow-based capacity calculation is applied, the capacity that can be distributed is set centrally, on a regional level, simultaneously considering the impact of commercial transactions on flows at all relevant border sections, their interactions, as well as the internal network components, allowing for an improved model of physical flows. All this plays a part in more efficient utilisation of available capacities, improves operational safety and prevents undesirable loop flows. For the time being, nevertheless, the method to be applied is under development, therefore the European market coupling initiatives have, thus far, been based on NTC. The relevant system operators calculate the capacity available for next day auction for all border sections[2], of which the optimisation algorithm considers the lower value for each border. In parallel with the start of market coupling, daily explicit capacity auctions stopped on the Slovakian-Hungarian border, all of the available transmission capacity is reserved for market coupling. The annual and monthly capacity auctions organised by the Central Allocation Office (CAO) as well as intraday capacity auctions are, however, retained. As a result, next day OTC trades will not any more be possible, that is, outside of the energy exchange, importing or exporting electricity will be restricted to those who are in possession of capacities reserved for the long run.

It is important to note that on the Slovakian-Hungarian border only about a quarter of all cross-border capacity available for a specific hour is allocated in the context of market coupling, that is, only a minor portion of the Hungarian electricity market is directly affected by market coupling. This notion is also confirmed by the observation that the year-to-date volume of HUPX in 2012 has on average been only 15% of domestic electricity consumption – something to keep in mind when the consequences of market coupling are assessed.

Generally two main types of market coupling are differentiated, price and volume based. In both cases the next day bid and ask offers of all participating exchanges (OTE – Czech, OKTE – Slovakian, HUPX – Hungarian) are matched at the same time, taking into consideration the transmission capacities between the various locations as constraints.

In case of price coupling, which is more frequently used in Europe, a central algorithm determines the prices and commercial deliveries for each area. As a result electricity flows from the direction of cheaper markets toward more expensive markets until the prices of different areas become equal, assuming that abundant cross-border capacity is available. If the distributable transmission capacity is below the optimal trading volume then prices will get closer to each other, but they cannot fully equalise. In this case the price difference between the two markets is equal to the rent from the capacity right, while the product of the price difference and the allocated capacity will make up the revenue of the system operators. If the available cross border capacity does not prove to be tight, then the rent from the capacity right, and consequently the revenue of system operators from the specific border section is zero.

In case of volume coupling, of the results of the central algorithm the exchanges regard only the transmission volume between given areas as

[1] For a summary of the roadmap for European electricity market integration please see issue 4/2011 of the Energy market reports.

[2] The next day available transmission capacity (ATC) can be derived from the maximum allocatable transmission capacity (NTC), also considering operational safety specifications, by subtracting the long term schedules reserved in the same direction from the value of the NTC, and increasing it with value scheduled in the opposite direction.

definitive, and prices are determined by each exchange independently, using volume as an input variable. The advantage of this model lies in its flexibility, since it can also be applied when the operating standards of different exchanges are not harmonised (due, for instance, to different currencies, or the application of different rules on rounding or optimisation). Nonetheless, it also has a disadvantage, as it can result in inefficient outcomes that would not happen in case of price coupling (for example a price difference may arise between two markets even when the cross border capacity is not scarce).

The market coupling method introduced in Hungary is compatible with the algorithm used in the Central-Western-European (CWE) region[3], thus this is a noteworthy step within the course of joining the Integrated European Market. In the near future additional countries are expected to join the currently trilateral market coupling (negotiations go on with both Romania and Poland).

The introduction of market coupling may generate a number of benefits. Most importantly, prices may decline in all electricity markets where competing import had been excluded not by technical or transmission barriers, but regulatory shortcomings. Another important benefit of market coupling is that it allows for a more efficient utilisation of cross border capacities, since it results in one net commercial flow on a given border section, while in case of an explicit auction parallel, opposite flows may take place. Furthermore, it prevents market participants from reserving capacities – for strategic reasons – that they will not use. The security of supply of the markets in question may improve due to increased volume and liquidity resulting from market coupling. Additionally, the degree of price volatility may decrease, since demand and supply shocks arrive to different markets irregularly and with differing intensity, and their impact may be dampened as a result of market coupling. All this improves predictability and therefore may reduce the risk premium. Another advantage of market coupling is that it may alleviate market concentration as foreign participants have easier access to the markets in question, reducing the market power of incumbents.

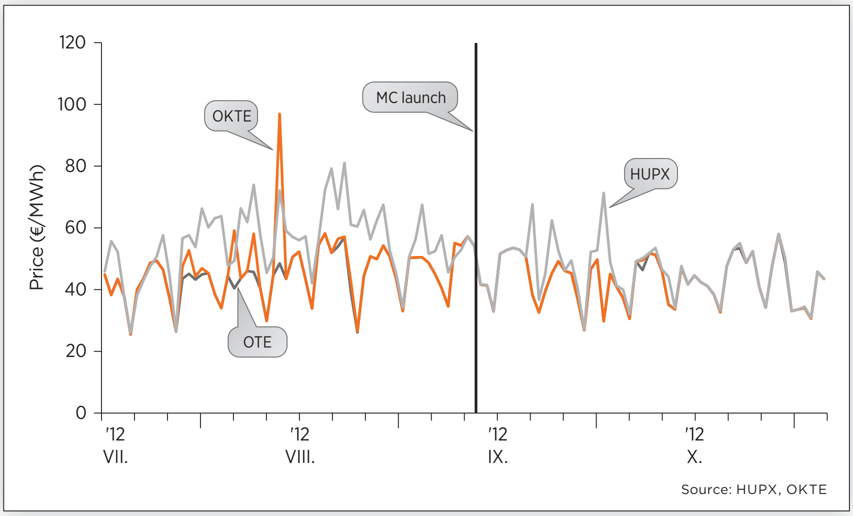


Figure 23. Next day baseload prices on the relevant exchanges before and after market coupling

Moreover, daily operation is also made more straightforward, since the two existing auction procedures – day-ahead capacity and product auctions – are combined. Finally, market coupling makes daily export and import easier, offering a chance for improved portfolio optimisation.

Next we evaluate the developments of market coupling in the first two months from the perspective of these advantages. The figure below depicts the day-ahead baseload prices of the relevant exchanges for the eight weeks before and after market coupling.

As shown, for the first nine days the prices on the three exchanges moved in almost perfect unison. The likely reason for this is that market participants were quite cautious for the first few days and brought lower demand to the day-ahead market, without generating a bottleneck on the Slovakian-Hungarian border. After this initial period for a few weeks Hungarian prices often climbed above the rest, before prices started to approach each other again. Like before, Czech and Slovakian prices continue to move almost seamlessly together, a price difference of more than 5 EUR has been observed only for 5 hours, when Slovakian prices departed from the Czech prices and rose to the Hungarian price level as a result of narrow capacities on the Czech-Slovakian border.

The table below quantifies the convergence of day-ahead baseload prices. For the rest of our analysis, the results of the period after market coupling will be compared to the numbers of the previous eight weeks and the same period of last year. The first two rows show the absolute average difference between the prices of the relevant

[3] For price based market coupling within the CWE region the COSMOS algorithm is used, developed by the EPEX SPOT.

	The analysed period		
	12.09.2011-06.11.2011	18.07.2012-11.09.2012	12.09.2012-06.11.2012
HUPX-OKTE	10.19	10.66	2.53
OKTE-OTE	0.00	1.80	0.12
HUPX-EEX	9.71	10.68	3.90
EEX-OTE	3.27	1.90	1.92

Source: HUPX, OKTE, EEX

Table 5. The average absolute difference between regional exchange prices, and also compared to EEX prices, €/MWh

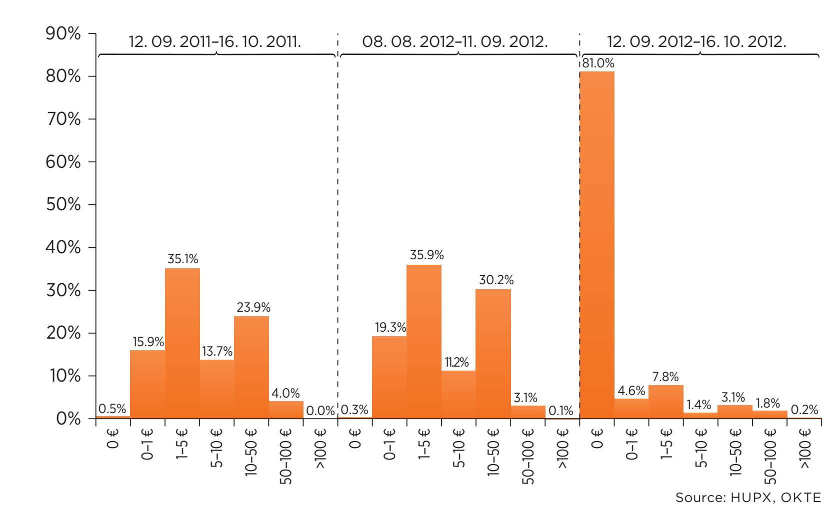


Figure 24. The frequency of various levels of price difference between the Hungarian and the Slovakian exchanges during the analysed periods

	The analysed period		
	12.09.2011-06.11.2011	18.07.2012-11.09.2012	12.09.2012-06.11.2012
HU	12.6%	10.9%	11.4%
SK	9.8%	6.6%	8.6%
CZ	9.6%	5.0%	8.4%

Source: own calculation based on HUPX and OKTE data

Table 6. The volatility on given exchanges during the analysed periods

exchanges, while the last two rows describe the average difference of the Czech and Hungarian exchanges compared to the German exchange.

Apparently, while market coupling has not had any major impact on the relative position of the day-ahead baseload prices on the Czech and Slovakian exchanges, and the shift in these prices compared to the EEX, the average of HUPX prices started to converge to the average price level of both the Czech and Slovakian, as well as the German exchanges.

The impact of market coupling on the level and frequency of the hourly price difference between the Hungarian and the Slovakian exchanges is depicted by the figure below.

As displayed, the percentage of hours in which the prices on the Hungarian and the Slovakian exchanges are equal increased from below 1% to over 80%. Additionally, during the hours with price difference the gap between prices substantially declined. Particularly large price differences, nevertheless, still take place (for 27 hours the Hungarian exchange was over 50 EUR more expensive than the Slovakian one). Furthermore, the accession of the Hungarian exchange also lowered the average difference between the Czech and Slovakian hourly prices compared to the period before market coupling.

To analyse if price volatility decreased as expected we applied an indicator used in literature that expresses the average price change between the hours as a percentage of the daily average price.

The 11.4% value for HUPX, for example, shows that the hour-to-hour change of prices is on average 11.4% of the average prices for the same day. Consequently, while it has not decreased compared to the summer period before market coupling was launched, price volatility is lower for all three exchanges than it was during the same period of last year.

As mentioned before, a key advantage of market coupling is that it allows for an efficient use of cross-border capacities. Due to its operating principle it removes a number of efficiency eroding factors that may take place during explicit auctions. The past frequency and degree for the incidence of a number of such factors is summarised by the table below.

In case of the explicit auctions for the Slovakian-Hungarian border section, transmissions frequently took place in both directions (capacity was allocated to both directions), resulting in inefficient use of cross-border capacities. Loss of efficiency is also implied by the fact that on day-ahead auctions available capacity for a large number of hours proved to be insufficient for both directions (the price of capacities is positive in both directions). The market distorting impact of the explicit auction mechanism is also suggested by the observation that in case of separate auctions for capacity and electricity, the price of capacity often deviates from the price difference between the two countries. As indicated by the last row of the table, the hourly price for the Slovakian-Hungarian cross-border capacity is on average several euros different from the gap between the prices quoted on the two exchanges for the same hour. As revealed by the last column of the table, the efficiency reducing factors are not relevant in case of market coupling, the introduction of the implicit auction mechanism automatically eliminates them.

The few weeks that have passed since the Czech-Slovakian-Hungarian market coupling started is certainly not enough to draw unequivocal, distinct conclusions. In light of the above described results, nevertheless, the launch of market coupling on the whole seems like a positive development. In addition to the more efficient utilisation of cross-border capacities, it has been observed that prices of the markets in question started to converge, price volatility declines, and Hungarian prices are getting closer to Czech-Slovakian and Western-European prices. It is worth noting, however, that – as indicated by the data described within the –Energy Market Developments section market coupling has not, for the first few weeks, triggered the convergence of the futures prices on the exchanges in question. This suggests that market participants have not yet encompassed the impact of market coupling on prices as part of their expectations.

	The analysed period		
	12.09.2011-06.11.2011	18.07.2012-11.09.2012	12.09.2012-06.11.2012
The percentage of hours with bi-directional capacity allocation	80%	89%	0%
The percentage of hours with capacity bottlenecks in both directions	6%	5%	0%
The average difference between the actual capacity fee and the theoretically justified level	9.5 €	9.2 €	0 €

Source: HUPX, OKTE, CAO

Table 7. The degree and frequency of incidence for efficiency eroding factors

WORKING PAPERS

Market Coupling Revue

The regulation that is called market coupling in European jargon is a logical expansion of the EU regulatory reform that has been going on for over a decade now, an essential concept of which has been the so called "unbundling" policy. Unbundling has prescribed the complete separation of network operation and energy production and trade, expecting the intensification of market competition for potentially competing activities. Within the market model based on the unbundling concept network access can be purchased from the transmission system operators in the form of physical transmission capacity utilisation rights.

In practice, however, it became evident that on transmission networks capacities may be withheld for strategic purposes and congestion can occur, obstructing efficient competition and the integration of European markets. As the markets opened up, greatly different price zones evolved in Europe for regulatory, structural and economic reasons. The pattern of European network development and the differing price zones together place an increasing burden on cross-border capacities.

Market coupling is the European avenue for the integration of electricity markets. It assumes the detached operation of the energy markets and the market for transmission capacities: energy markets function on the power exchange, while the market for transmission capacities is managed by the system operator.

> From the perspective of fragmented networks and markets, market coupling is a major step toward an integrated internal market.

From the perspective of fragmented national networks and markets, market coupling is a huge step forward: the power exchanges in each price zone balance the bid and ask offers held by them by also considering the prices quoted on the exchanges of neighbouring price zones, and cross-border transactions do not have to be supplemented with separate transmission capacities. Instead of explicit cross-border capacity auctions the system operator makes unreserved next day capacities available for market coupling. This regulatory development is certainly viewed as a positive phase in the history of European market integration.

The experience from the last few years have, nonetheless, clearly indicated that some of the details of the current market coupling regulation are problematic. Of these, currently the method applied to determine available transmission capacities is the most controversial aspect that generates further problems: the deviation of the available transmission capacity values set by the system operator from the actual figures and the ensuing need for re-dispatching.

In our article we summarise some of the literature focusing on this set of problem. The articles by Oggioni and Smeers [Oggioni, Smeers (2012) Energy Economics and (2012) Energy Journal] inspect those market failures that originate from the decision on transmission capacities and the required network actions under the European market coupling model. Drawing on Hogan's articles, on the other hand, we recap the critique of transmission capacity based regulation [Hogan (1992) and Hogan (2005)].

The articles by Oggioni and Smeers provide a critical review of market coupling as a regulatory model. Since the core feature of the market coupling model is the co-existence of zonal markets with different prices, according to the authors the merit of the model, its efficiency in an economic sense depends on the way transmission capacities are determined and the extent to which this result differs from actual network values at the end of the day. This difference is inescapable, and in case of too cautious planning it results in foregone benefits, while overuse requires costly interventions on behalf of the operator.

Importantly, the so called interconnectors that link zonal markets are not the same as the actual cross-border technical facilities. The interconnector expresses the net value of all transmission capacity (NTC) between two zones (typically, but not exclusively, two countries) or the actually available transmission capacity (ATC) of a given period as one figure. Thus the interconnector is an artificial (administrative) concept, which, while based on the technical characteristics of the transmission network, does not necessarily reflect the current technical attributes of the transmission network and the complexity of the network. Therefore it should be viewed as a typical, average value.

Total transfer capacity (TTC): the largest possible transmission potential between two network locations, assuming perfect information on the future status of the network.
Transmission reliability margin (TRM): operational safety reserve considering the uncertainties compared to the TTC values computed with the assumption of perfect information.
Net transmission capacity (NTC): NTC = TTC – TRM, the largest possible transmission potential between two network locations, allowing for the applicable operational safety specifications and technical uncertainties for both locations.
Already allocated capacity (AAC): the sum of transmission capacities already reserved either for settlement between system operators in case of technical problems, or for commercial transactions between markets.
Available transmission capacity (ATC): ATC = NTC – AAC, the unreserved portion of the net transmission capacity.

This partly explains why there isn't an exact method to compute these transmission capacities, there are only estimation techniques that consider the probabilities for different system statuses. The estimation method is therefore critically important: the published ATC acts as an export-import cap between price zones and as such, it is decisive from the perspective of market coupling. The authors draw attention to the serious uncertainty inherent in this regime, namely that instead of publishing the calculation method for transmission capacities, system operators issue a statement declaring that they cannot guarantee the validity of the announced transmission capacities.

Since the published value of the interconnector capacity is an estimate, in most cases it does not equal the true capacity of the network connecting the two price zones. Oggioni and Smeers therefore set up a model with which the impacts of under- and overestimating the transmission capacity can be assessed.

First of all, they isolated cases of underestimation from overestimated instances, since if the value of transmission capacity supplied for market coupling is below the actual cross-border capacity value of the network due to underestimation, then congestion on the real network will certainly not take place. In the absence of overflow the trade generated by market coupling can be executed on the physical network.

If, however, the capacity of the interconnector used in market coupling has been overestimated compared to the real network, then market coupling may bring about an overflow, if this overestimated value is indeed utilised for transmission between the price zones. In such a case the system operator needs to intervene in order to keep the real network operational.

In order to prevent overflows, system operators have to purchase a shift in consumption or production compared to the schedules for specific nodes of the network, in order to influence network flows. This activity of the system operator is called re-dispatching or counter-trading. Re-dispatching is a more appropriate expression since this is a transaction in the transmission capacity market without real energy trading.

The authors emphasize that under- or overestimating transmission capacities also has social welfare costs. Underestimation may be an obvious preferred safety strategy for the system operator as it does not require any adjustment (re-dispatching). Such a risk reduction for the operator does not necessarily prompt external costs: if the cautiously underestimated transmission capacity is not fully utilised by market coupling, since prices level off with a lower volume of transmission, then additional costs do not take place either.

If market coupling at an underestimated transmission capacity does not equalise the price of the two zones, then the welfare potential of the capacity that is not distributed due to being underestimated is lost for all players: the non-attainable import reduces the profit of the producers that belongs to the low price zone, and causes the loss of consumer surplus at the consumers that belong to the high price zone.

If, nevertheless, market coupling at such an underestimated transmission capacity does not equalise the price of the two zones, then the economic position of the affected participants will change. Welfare loss takes place at the consumers belonging to the higher priced zone and welfare is augmented for producers (or electricity importers) that belong to the lower priced zone, and this is not necessarily a simple transfer between the two groups, as it may also partly register as a capacity rent at the owner or operator of the transmission network. The welfare potential of the capacity that is not distributed due to being underestimated is lost for all players, in other words, the non-attainable import reduces the profit of the producers that belong to the low price zone, and causes the loss of consumer surplus at the consumers that belong to the high price zone.

> The ATC based market coupling method has to be replaced by market coupling relying on flow based capacity calculations.

The cost related to overestimation is different from that of underestimation: the cost of re-dispatching carried out to prevent overflow is absorbed by the costs of system operation. Its level is determined by the total cost of production and consumption adjustment purchased in order to facilitate network stability, and it is ultimately financed by the system users. The cost of re-dispatching operations introduced to cut overflows is an important component of the economic efficiency loss of the market coupling regime. Oggioni and Smeers used detailed numerical model computations to analyse how the cost of re-dispatching is influenced by its regulatory and coordinating framework. From this perspective they distinguished two base cases and three variations of the second base case.

One base case involves flawlessly coordinated re-dispatching. This is feasible only when the system operators of the price zones participating in market coupling merge to become one system operator supervising the price zones. This institutional arrangement ensures that the necessary re-dispatching actions are carried out at the lowest possible overall cost. The authors' model computations prove that the complete merger is necessary with respect to both the information requirements and the authority needed for the intervention, if the total costs are to be minimised.

Within the other base case each price zone has its own system operator, which, in order to prevent overflows, carry out re-dispatching operations independently of each other and without coordination. For all variations of this other base case the authors observed that model computations resulted in substantially higher re-dispatching costs. In the first sub-case, while the system operators do not merge, they have unlimited access to the re-dispatching resources (loads, injections) that are available across the border. Neither do system operators merge in the second sub-case, and their access to the re-dispatching resources across the border is limited. In practise this would imply the evolution of a certain market for interconnector services, through which the demand for re-dispatching would become price elastic, ensuring for system users that costs are capped to some degree. This variant is more expensive than the case of unlimited access to cross-border resources, but still much cheaper than the sub-case of uncoordinated measures. In the third modell variant the unmerged system operators do not have any access to cross-border re-dispatching resources, and for each action targeted at overflows they need to purchase resources within their own transmission network territory. This is the most expensive and subsequently the least efficient model version of all the modelled regimes.

Regulators are also well aware of these problems, therefore, as it has been declared, the ATC based market coupling method has to be replaced by market coupling relying on flow based capacity calculations. Using the laws of physics on flows, this method considers the flows on different networks due to each commercial transaction, thereby getting much closer to actual network impacts. Flow based capacity calculation not only reduces the methodological uncertainty inherent in market coupling for markets, it could also assist in improving network stability and the utilisation of transmission capacities.

The transformation of US energy markets is in many ways different from the European practice. The most critical of which is possibly how access to transmission networks and network congestions are handled. By the time market coupling started in Europe, in most places in the USA the original reforms were already being revised. These second and third generation regulatory efforts pay a lot of attention to the detailed rules of transmission network use, tariff setting and accounting and their impact on network investments. This regulatory deliberation is supported by extensive scientific analysis, of the large number of journal articles next we summarise two publications by Hogan.

According to Hogan the regulation has to take into consideration that the capacity of the transmission networks depends on the load of the relevant nodes. That is, the available transmission capacity on a given network section cannot be determined in advance or guaranteed on any time frame. Therefore, as Hogan argues, it is not realistic to describe the connection between the networks of two countries with one ATC figure. Meanwhile, even in 2009 the European Commission required European system operators that "...the maximum capacity of the interconnectors and/or the transmission networks affecting cross-border flows shall be made available to market participants..." (EU Regulation 714/2009, paragraph 3 of article 16)

In his articles Hogan proclaims that there is extensive professional and empirical evidence in support of electricity markets to be based on a coordination mechanism that brings the transmission and the energy segments into balance simultaneously. In other words, the dual nature of electricity – the physical and network attributes of energy - should be reckoned. In case of an electricity market model that also respects network characteristics, market balance is applicable to the nodes of the network, since all nodes bear the physical and network characteristics of electricity concurrently. In a market model like this, market clearing prices are specific to the nodes, and the transmission price between the nodes equals the difference between the nodal prices. This market model is referred to as the nodal pricing market model.

According to Hogan the transformed energy markets of the USA provide ample evidence that the nodal pricing market model is economically efficient and eliminates the room for spatial arbitrage that is generated by the bottlenecks of transmission networks under other market models. Despite this, for the time being, European institutions continue to maintain the sovereignty of national networks and treat cross-border flows separately. Thus the European market coupling model developed to integrate sovereign national networks has, in this respect, inevitably lower efficiency than the nodal pricing model.

The uncertainty surrounding the calibration of transmission capacities, typical to Europe, is of course not unheard of in American energy markets either. The Federal Energy Regulatory Commission (FERC) published a research report on the topic in 2005. The analysis concluded that the operators and owners of transmission capacities most often have an interest in underestimating the ATC value, as they are not immune from production-side interests. (Let's add that in case of an explicit auction or another mechanism to allocate network bottlenecks, underestimation can serve to augment the rent received by the owner or operator of the transmission capacity) Consequently, the FERC summoned transmission operators to make the formula for ATC calculation public and initiated the development of a uniform method for ATC calculation.

In Hogan's view these measures do not solve the problem. In his opinion the lack of transparent, observable and uniform methods for ATC calculation is a sign of a deeper, conceptual problem: regulators would like system operators to calibrate transmission capacities first, which should then determine the transmission activity. The transmission activity, however, exerts a fundamental influence on the size of transmission capacities. This approach, therefore, creates a circular reference, a senseless definition of the concept of transmission capacity. According to Hogan, thus, an ATC definition that is independent of transmission network use is self-contradictory.

> Physical transmission property rights belong to the unbundling market model concept, in which transmission markets and energy markets are detached, and the network access necessary to complete energy trading transactions has to be secured as physical transmission capacity. Under a nodal pricing model market integration is delivered by financial transmission rights as opposed to physical rights.

The market integration policy of the USA, of course, also has its challenges: how to ensure that individual commercial transactions pay for the use of each transmission network on which they generate a flow. Earlier regulations prescribed the affirmation of a kind of "contract path", that is, the regulator obliged market participants to contractually guarantee the transmission path of the electricity – that they sold or purchased – between the producer and the consumer. Since the contracted transmission path is only one network path, market participants paid for network use on only one (the shortest) route and did not pay for those parallel network sections where – based on the laws of physics – they also generated substantial flows. Regulators made different attempts to end this economic externality, due on the one hand to problems of ownership rights (uncompensated network use), and on the other hand to transmission congestions generated by the regulation outside of the contracted path.

> An ATC definition that is independent of transmission network use is self-contradictory.

Mainly based on the works of Hogan, the recent evolution of the regulation entails the replacement of the contract path by the contract network. Even in case of a complex network this regulation is capable of consistently delivering the rights to access transmission capacities, and by introducing fees in association with network bottlenecks in the short run it ensures the optimal allocation of bottleneck capacities, while in the long run it conveys appropriate price signals for network investments.

Within Hogan's market model local prices differ in each instance when a bottleneck occurs in a transmission network. The use of the bottleneck is subject to the payment of a fee, and the associated risk is reduced by market participants through a financial insurance, that is, they purchase a so called financial transmission right (FTR) for a given capacity and duration between the network nodes that are critical for them. The value of these rights constantly changes as a function of the location and timing of congestions on the transmission network. For any given hour of the day the owner of the FTR may decide to use its right for actual transmission or simply sell it. Thus the FTR mechanism ensures that scarce transmission capacity is used by the transaction with the highest utility, and strategic retention of the capacities is not an option.

The regulatory concept for the network of transmission contracts thus substantially departs from the regulation of the access to capacities built on the physical ownership of the transmission network. Physical transmission property rights belong to the unbundling market model concept, in which transmission markets and energy markets are detached, and the network access necessary to complete energy trading transactions has to be secured as physical transmission capacity either through bilateral negotiations or at explicit auctions. In contrast, under a nodal pricing model market integration is delivered by financial transmission rights as opposed to physical rights.

In future issues of our Report we plan to further elaborate on this complex, but nevertheless, exciting topic, as it is of vital importance from the perspective of European market integration.

References:

Hogan, William W. (2005): Electricity Market Restructuring: Successful Market Design; Electricity Committee, NARUC Summer Meetings, Austin, Texas, July 26, 2005; download: http://www.hks.harvard.edu/fs/whogan/hogan_naruc_072605.pdf, November 2012

Hogan, William W. (1992): Contract networks for electric power transmission; Journal Of Regulatory Economics Volume: 4 Issue: 3. p. 211-242.

Oggioni, Giorgia, Smeers, Yves (2012): Market failures of Market Coupling and counter-trading in Europe: An illustrative model based discussion, Energy Econ. (2012), doi:10.1016/j.eneco.2011.11.018, Article-in-press

Oggioni, Giorgia, Smeers, Yves (2012): Degrees of Coordination in Market Coupling and Counter-Trading , The Energy Journal, Vol. 33, No. 3., pp 39-99.

Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003.

Abbreviations in the Report:

APX	Amsterdam Power Exchange
ARA	Amsterdam-Rotterdam-Antwerpen
CEGH	Central European Gas Hub
ECX	European Carbon Exchange
EEX	European Energy Exchange
EUA	European Union Allowance
HAG	Hungary-Austria Gasline
HDD	Heating Degree Day
HEO	Hungarian Energy Office
OPCOM	Operatorul Pietei de Energie Electrica
OTE	Operátor trhu s elektřinou
PXE	Power Exchange Central Europe
SEPS	Slovenská elektrizačná prenosová sústava
toe/Mtoe	Tonne/Million tonnes of oil equivalent

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