Hungarian Energy Market

REPORT

1st Issue 2011
The aim of the Regional Centre for Energy Policy Research (REKK) is to provide professional analysis and advice on networked energy markets that are both commercially and environmentally sustainable. We have performed comprehensive research, consulting and teaching activities on the fields of electricity, gas and carbon-dioxide markets since 2004. Our analyses range from the impact assessments of regulatory measures to the preparation of individual companies’ investment decisions.

**Research**
Geographically, our key research area is the Central Eastern European and South East European region:
- regional electricity and gas price modelling
- CO₂ allowance allocation and trade
- supports for and markets of renewable energy sources
- security of supply
- market entry and trade barriers
- supplier switching

**Consultancy services**
- price forecasts and country studies for the preparation of investment decisions
- consultancy service for large customers on shaping their energy strategy on the liberalised market
- consultancy service for regulatory authorities and energy supply companies on price regulation
- consultancy service for system operators on how to manage the new challenges

**Trainings**
- Our training programmes:
  - summer schools
  - courses for regulators
  - trainings and e-learning courses in the following topics:
    - price regulation
    - electricity markets
    - market monitoring
    - gas markets
  - occasional trainings for companies based on individual claims

Nowadays, due to market opening, energy markets cannot be analysed without taking into account regional environment. We monitor the market situation and developments of the countries of the Central Eastern and South East European region. We have built a regional electricity market model including 15 countries to forecast regional electricity prices.

The experts of REKK with their energy regulatory experience and academic background can supply scientific solutions taking also into account the specialities of the given markets.

**Our reference partners:**

**Regulatory authorities and ministries**
MEH (Hungarian Energy Office), GVH (Hungarian Competition Authority), KVVM (Ministry of Environment and Water), GKM (Ministry of Economy and Transport), FVM (Ministry of Agriculture and Rural Development)

**Energy companies and large customers**
Mavir, E.ON, MOL, MVM, ELMŰ, Főgáz, Alcoa, DRV

**International organisations**
DG TREN, USAID, ERRA, CEER, NARUC
Dear Reader,

We proudly present the first issue in the third volume of our publication Hungarian Energy Market Report. We sincerely hope that our readers have been satisfied with the issues so far.

Due to the modification of the Natural Gas Act, strategic natural gas reserves are set annually by a ministerial decree from 2011 on. Our first study examines the required value of strategic gas reserves, based on past daily peak capacities of the natural gas system and consumption data of the previous years.

Contrary to the general electricity market developments, prices of ancillary services have constantly grown in the past years. Our second article deals with the reasons of this phenomenon. The first part of the article quickly summarizes development of the volume, structure and total cost of the capacity reserves called by MAVIR. In the second part we assess whether the rise in costs can be related to the pricing strategy of the major power plants providing balancing services.

On 2 December 2010, Regulation 994/2010/EU came into force, aiming at the enhancement of the community’s natural gas security of supply. Our last analysis sums up the requirements for gas infrastructures set by the new regulation, and by using simple indicators, we examine how do the countries in the region – among others Hungary – comply with the security of supply minimum criteria set by the Regulation.

We are hopeful that we can provide lots of useful information to our valued readers in the current issue.

Péter Kaderják, Director
ELECTRICITY MARKET DEVELOPMENTS

During the fourth quarter of 2010, immobility of factor markets was interrupted by a slow growth. The price of crude oil increased by 10 USD/barrel, the price of coal surged by 20 USD/ton. The effect of commodities price increase on the German futures market could be observed only in December. A slight decrease could be detected in the price of EUA, on the last trading day, the product was sold at EUR 14.

In the Hungarian domestic market adjusted quarterly electricity consumption exceeded the last year’s consumption by 2.9%. Within regional futures electricity markets, price advantage of Czech and Slovakian markets over the German shrank to 60 Eurocents, while the Hungarian rose to EUR 1. MVM held its annual tenders for 2011, altogether selling 7.3 TWh electricity for an average price of 50 EUR/MWh.

**International price trends**

In the fourth quarter of 2010, a slow but for untroubled growth was observed in factor markets, as opposed to the stagnating previous months. Crude oil prices rose by more than 10% from October to the end of December, one barrel was traded on USD 90 at the end of the year. The growth was restrained by a medium 8% price fall, in mid November. Apart from negligible price drops, ARA coal prices displayed an undisturbed growth in the analysed quarter: compared to the 100 USD/ton price in the previous period, a ton of coal was sold for USD 118 at the end of the year.

Till the end of November 2010 the previous period’s trend of slow price decrease on the 2011 futures market of electricity remained, then prices of both base and peakload products started to grow. On the last trading day of futures, 28th December, baseload price climbed from its November EUR 46 bottom to EUR 50, peak product closed over EUR 60. Peak and base products moved closely together, and the two prices approached each other even more: in the period analysed, peak power cost EUR 11 more on average, while one year ago the spread was as high as EUR 22. The price of the European Union Emission Allowance (EUA) was decreasing at a slow pace.
compared to the preceding quarter, and closed at a price of 14 EUR/ton. During the last trading days, the highest amount of daily volumes was traded, nearly 44 million tons. Volumes traded were 2% higher and the turnover was exceeded by 8% compared to the previous year.

**Overview of the electricity market in Hungary**

In the fourth quarter of 2010 the monthly temperature adjusted consumption, excluding seasonal impacts, was 2.9% higher than the consumption of Q4 2009. The consumption was not only higher than last year’s values, but exceeded the highest value from two years ago by 1.4%. Nevertheless, monthly consumption during the analysed period displayed considerably high deviation: in November, the consumption was identical with the previous year, while in December electricity utilisation was 5% higher, than a year before.

As opposite to the high ratio of import consumption during the summer in the fourth quarter only 7.9% of the demand was satisfied from foreign sources, the same ratio, as a year before.

At the monthly capacity auctions settlement prices were low in general, negligibly different from zero. Cross-border transportation of 1 kWh electricity cost merely 0.15 HUF, prices over 1 HUF/kWh were set only at the Romanian border for the capacities of October-November. Moreover, Austrian export and Serbian import capacities were sold at prices higher than the quarterly average.
ELECTRICITY MARKET DEVELOPMENTS

Compared to the previous period, 8% less electricity was traded on the daily auctions, approximately for HUF 0.14. The 1 HUF/kWh price level was exceeded only on the Romanian border.

Spot baseload electricity price traded on regional exchanges rose by 13% in the quarter. An intriguing development occurred, namely, the baseload prices of the HUPX exchange, which had been moving closely together with the baseload spot prices of the EEX, demonstrated 10% price advantage compared to the German prices. During the fourth quarter, 288 GWh baseload electricity was sold.

The wholesale price of electricity is influenced by balancing energy prices, the costs of settlement of deviations from the schedule. The financial costs of balancing for the balance circles are determined by the spreads between the balancing energy prices and the spot price of electricity in the settlement period. The higher the price of positive balancing energy is compared with the spot price the more costly it is to purchase the shortage from the balancing energy market, and the lower the price of negative balancing energy compared with the spot price, the higher the loss incurred from selling the surplus to the system operator (instead of selling it to the market) is.

Hourly positive balancing energy price during the period was 29.9 HUF/kWh, procurement of negative balancing power cost 0 HUF/kWh on the average. This price level was quite stable, it has not changed in the past year.

Figure 6 Results of monthly capacity auctions in Hungary, Q4 2010
In the figure capacities mean the capacities offered for auction. Capacities were not sold fully in the period under review only if they were oversubscribed at a specific price since then the system operator regarded the next highest price as the auction price.

In the Hungarian section of the Prague Power Exchange 0.77 TWh electricity was auctioned, at a value of EUR 37.5 million during the fourth quarter. Compared to the

Next year’s electricity prices in Hungary and in the Central-European region

In the Hungarian section of the Prague Power Exchange 0.77 TWh electricity was auctioned, at a value of EUR 37.5 million during the fourth quarter. Compared to the
record lows of the previous period, PXE turnover in the period was only 6% lower, than in the previous year.

To determine the 2011 baseload price, we compared the 2011 PXE baseload futures prices of Czech, Slovakian and Hungarian sections with the corresponding EEX product. The price drop of the previous period continued until the beginning of November, followed by a small scale price growth. The price advantage for the Hungarian baseload remained in the interval of 40-45 Eurocents in October and November, however in December the spread rose to EUR 1. Czech and Slovakian discount stood at the same level as in the previous period, offering a EUR 1.5 premium over each MWh electricity in October, the difference shrank to 60 Eurocents in December.

MVM trade held its last capacity auction in the quarter. In the capacity auction organised on 17th November, another 1.3 TWh electricity was auctioned, at a price of 13.5 HUF/kWh. The amount of baseload electricity sold for the year 2011 made up about 14% of the consumption, together with the peak and off-peak products, the 7.3 TWh of electricity auctioned accounted for 20% of the consumption. The average price of marketed baseload electricity was 14.08 HUF/kWh, which – exchanged on 280 HUF/EUR – equals to 50 EUR/MWh, slightly higher than the price of electricity traded on EEX the last six months.

Results of 2011 yearly auctions provide valuable information regarding the possible future development of wholesale prices. Capacities available were expanded on every border. It should be noted that the Slovakian import direction was increased by 200 MW, the Austrian import direction by 180 MW. From January 2011, Central Allocation Office organises the daily, monthly and annual trade on the Slovakian and Austrian borders, the company was formed via the cooperation of the regional TSOs at the end of 2010. The rights of organising auctions was licensed to the CAO, however, national TSOs still do have the right to decide over ATC values, and to hold auctions based on auction rules in force. In spite of past months, MAVIR held common auctions on all borders. Prices observed in the previous year stabilised, and on several borders decreased further. Capacity usage fees did not exceed 1 HUF/kWh on any of the borders, only the Romanian import approached 0.9 HUF/kWh.
COMING SOON!

Security of Energy Supply in Central and South-East Europe

REKK is about to publish the research findings of its Security of Supply project, launched in 2009, enclosed in the volume titled Security of Energy Supply in Central and South-East Europe.

The English-language publication analyzes the question of supply security thoroughly, focusing on the following subjects:

- Regional electricity- and natural gas demand forecast to 2020
- Regulatory preconditions to encourage multi-country new gas infrastructures
- Lessons from the 2009 January gas crisis
- Modelling a regional gas market
- Measures and indicators of regional electricity and gas supply security
- Generation investments under liberalized conditions
- Mid-term gas supply security scenarios for the CSEE region
- The economic value of increased supply security

The book can be downloaded from the homepage http://rekk.eu/sos in March.

Figure 10 Results of annual cross-border capacity auctions in Hungary for 2011

In the figure capacities mean the total amount sold by both TSOs. Common auction was held on all borders.
ENERGY MARKET ANALYSES

On the justified size of strategic natural gas reserves

The end of 2010 brought along a number of substantial regulatory changes within the gas sector, generating serious turmoil within the industry due to their foreseen impact. Of these the reduction of strategic gas reserves received possibly the least attention, even though this regulatory amendment may considerably impact several gas market segments. According to the new regulation, the strategic reserve of natural gas is reduced from the former “at least 1,200 million m³ working gas reserve” to “at least 600 million m³ and at most 1,200 million m³ working gas reserve”, with the actual annual value being set by a ministerial decree by 15 January each year. And while Decree 2/2011. (I. 14.) of the Ministry of National Development (MND) published this year did not make use of the opportunity offered by the amendment of the act, leaving the former capacity of 1,200 million m³ untouched, the regulatory door is now open, and policy makers can – among others – reduce the costs of strategic storage and, consequently, the related fees contained by the retail gas price.

This new development therefore prompted us to take a closer look at the volume of strategic gas reserve, i.e. what is the value that based on the peak daily capacity of the gas system and the consumption data of recent years would be considered justifiable.

Analysis of past data

Through the strategic gas storage facility Hungary ensures that its consumers would not have to face painful consumption restrictions in case one of the gas supplies is temporarily cut and the rest of the sources cannot fully meet demand. One is curious about the proper volume of reserves necessary to tackle such unforeseen events. For the purpose of our analysis, in line with N-1 formula of the October 2010 EU Regulation on the security of gas supply, we define a potential supply disruption as the event of disruption of the single largest piece of gas infrastructure, but in case of import, we apply a definition that is more stringent than that of the Regulation, namely the failure of the largest import direction. Table 1 includes the peak capacities of the Hungarian gas infrastructure in 2006 – the year in which the act ordering the construction of the strategic gas storage facility was adopted – and in 2010.

<table>
<thead>
<tr>
<th>E.ON Földgáz Storage</th>
<th>2006</th>
<th>2010 – Scenario 1</th>
<th>2010 – Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic gas storage facility</td>
<td>-</td>
<td>(20 + 5)</td>
<td>(20 + 5)</td>
</tr>
<tr>
<td>Zsana</td>
<td>21</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>Pusztkaerics</td>
<td>2.9</td>
<td>3.1</td>
<td>3.1</td>
</tr>
<tr>
<td>Hajduszoboszló</td>
<td>19.2</td>
<td>20.8</td>
<td>20.8</td>
</tr>
<tr>
<td>Kardoskút</td>
<td>2.6</td>
<td>3.2</td>
<td>3.2</td>
</tr>
<tr>
<td>Maros-1</td>
<td>1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic production</td>
<td>10.2</td>
<td>10.7</td>
<td>10.7</td>
</tr>
<tr>
<td>Import direction Austria</td>
<td>12.1</td>
<td>12.1</td>
<td>4</td>
</tr>
<tr>
<td>Import direction Ukraine</td>
<td>30</td>
<td>57.4</td>
<td>57.4</td>
</tr>
<tr>
<td>Complete infrastructure (without the strategic gas storage facility)</td>
<td>99.8</td>
<td>135.3</td>
<td>127.2</td>
</tr>
<tr>
<td>Remaining infrastructure</td>
<td>69.8</td>
<td>77.9</td>
<td>69.8</td>
</tr>
</tbody>
</table>

Source: FGSZ annual reports, E.ON Földgáz Storage website

Table 1 Daily peak capacity of the Hungarian natural gas system, million m³/day

As the Table 1 shows (2006 and 2010 – scenario 1 columns), the largest disruption in the domestic system could be caused by the loss of the Ukrainian import direction, the impact of which was experienced in January 2009, when the strategic gas storage facility had not yet been completed. Within the table we indicated the size of the remaining infrastructure – which under these circumstances has to serve all of the domestic consumption - if the import direction is disrupted. As a result of the investments by

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1 Paragraph 4(1) of Act XXVI of 2006 on strategic natural gas storage
2 Paragraph 1(1) of Act CXXXIV of 2010
3 Interestingly, according to the MSZKSZ website (www.mszksz.hu) the current (January 21) size of the strategic reserve is 1 347 640 thousand m³, which is above the 1,200 million m³ limit.
4 In order to cover its costs, MSZKSZ, the designated entity to create and maintain the strategic reserve collects a specific membership fee – approved by the Minister - from the gas market participants legally obliged to be members. The fee is obviously included in the consumer price. Its present value (as of 1 January 2011) is 60.5 HUF/GJ, which, based on an assumed 11 billion m³ of annual consumption, results in HUF 22 billion of contribution to the financing of strategic storage by the consumers.
E.ON Földgáz Storage, and the slight increase of domestic production, its size grew from 2006 to 2010 by 8.1 million m³, thereby reducing the need for the strategic reserve. The need for consumption curtailment in case the import direction is disrupted, i.e. the minimum proper size of the strategic gas storage facility has been estimated as the difference between the actual daily gas consumption data from recent years and the size of the remaining operating infrastructure after the import direction is disrupted. In other words, we compared the daily consumption data between the gas year of the market liberalisation (2003/2004) and the most recent completed gas year (2009/2010) – with the exception of 2008/2009, when the gas crisis took place –, with the remaining peak capacity of 69.8 million m³ in 2006 and 77.9 million m³ in 2010.

For the gas years in question Table 2 summarizes the number of days when daily gas consumption exceeded the year 2006 remaining capacity of the infrastructure, and altogether how much the demand for strategic storage would have been if on each day, when the peak capacity of the remaining infrastructure would not have been enough to satisfy demand, Ukrainian import would have actually been disrupted.

Table 2 Demand for the strategic gas storage facility based on past domestic daily consumption data and the peak capacity of the natural gas system

<table>
<thead>
<tr>
<th>Gas year</th>
<th>number of critical days (2006)</th>
<th>need for consumption curtailment 2006, Mm³</th>
<th>need for consumption curtailment 2010-S1, Mm³</th>
<th>need for consumption curtailment 2010-S2, Mm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003/2004</td>
<td>21</td>
<td>201</td>
<td>49</td>
<td>201</td>
</tr>
<tr>
<td>2004/2005</td>
<td>48</td>
<td>464</td>
<td>145</td>
<td>464</td>
</tr>
<tr>
<td>2005/2006</td>
<td>33</td>
<td>306</td>
<td>79</td>
<td>306</td>
</tr>
<tr>
<td>2006/2007</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2007/2008</td>
<td>20</td>
<td>144</td>
<td>7</td>
<td>144</td>
</tr>
<tr>
<td>2009/2010</td>
<td>7</td>
<td>49</td>
<td>0</td>
<td>49</td>
</tr>
<tr>
<td>Total</td>
<td>129</td>
<td>1164</td>
<td>280</td>
<td>1164</td>
</tr>
<tr>
<td>Average</td>
<td>21.5</td>
<td>194</td>
<td>46.7</td>
<td>194</td>
</tr>
</tbody>
</table>

Source: daily consumption data: FGSZ, calculations: REKK own calculations

As Table 2 shows, during the last few years the estimated need for strategic storage - even with the 2006 infrastructure - would not have reached the 600 million m³ level. In fact, the maximum demand through the 6-year-period has been less than 80% of this value. Given the current infrastructure (2010-S1 column) the need for strategic reserve is even lower, the maximum demand of 2004/2005 is less than one-fourth of the 600 million m³ indicated as a possibility in the amendment of the act.

It could be questioned whether it is justifiable to use the daily peak capacity of the remaining infrastructure for the calculation, since that presumes that there are sufficient reserves in the commercial storage facilities, commercial contracts ensure peak import on the other border, and domestic production can deliver at its maximum potential. We believe that these assumptions are partly valid, since it does not make sense to build a strategic gas storage facility simply because existing infrastructure is not utilised efficiently. It is cheaper to require a minimum obligatory gas reserve at the commercial storage facilities or making strategic contracts at the Austrian border than to construct a new storage facility. Then again, during the 2009 gas crisis we saw that while domestic production and withdrawal from the commercial storage facilities performed at peak capacity, the shortage of Russian gas was also felt at the Austrian border section as well, limiting imports to 4 million m³/day instead of the daily peak capacity of 12.1 million m³/day.6

Therefore we examined this case with regard to the current infrastructure as well, since data on the 2006 infrastructure is not applicable for the future. Therefore under the second 2010 scenario (2010-S2), beyond the disruption of the main import direction, the gas crisis also cuts Austrian imports to one-third of the baseline figure. This will lower the peak capacity of the remaining operating infrastructure to 69.8 million m³, which is 8.1 million m³ less than in scenario 2010 S1, and by coincidence is exactly the same as the examined value from 2006. As we have already concluded, the 1,200 million m³ value of the strategic gas reserve still seems excessive, and the planned 600 million m³ capacity still more than covers the likely demand for strategic stock based on data from recent years.

The experience from the year of the gas crisis

We have not carried out the above calculation for the 2008/2009 winter, since then the

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Ukrainian import was indeed disrupted, and due to the absence of the strategic storage facility an involuntary consumption curtailment was imposed, therefore we do not know how much the consumption would have been without the curtailment.

The consumption curtailment imposed due to the crisis lasted for about eight and a half days. The need for curtailment, that is, the size of the demand for strategic storage, however, is not clear. Even though estimates on actually curtailed consumption – altogether approximately 61.5 million m$^3$ – are available,\(^7\) since the curtailment system limits larger consumer units and categories,\(^8\) we do not know how much gas would have actually been needed to avert the curtailment.

Incidentally, this casts light on one of the benefits of the strategic gas storage facility and a critical flaw of the present curtailment system. Excessively large units of curtailment categories amplify, or may even multiply, the costs of a gas crisis as they limit a much larger volume of consumption than what would be necessary for the smooth operation of the system. This has been one of the lessons of the 2009 gas crisis, when in parallel with domestic consumption curtailment – companies in the first curtailment category had to scale back on their gas use, thereby suffering losses equal to at least the net revenue of their daily production - Hungary was in a position to provide gas to Serbia and Bosnia from its own sources and from Austrian transit as well. In other words, some resources were still available, just not enough to completely avoid curtailment. If we have strategic reserves, then there is no need to introduce curtailment, therefore undue restrictions and related additional costs can be prevented.\(^9\)

Based on all of the above, the 61.5 million m$^3$ curtailment applied during the 2009 gas crisis definitely overestimates the real need for strategic reserves. Nevertheless, even this figure is well below the current size of 1,200 million m$^3$ and the planned size of 600 million m$^3$. Therefore the experience gained during the gas crisis also highlights the rationale to reduce the size of the strategic reserves.

All in all, our analysis indicates that reduction of the size of strategic gas reserves is justified and we hope that Hungary will make use of this opportunity. In addition to its favourable impact on the strategic storage fee, the lower strategic reserve – as some of the storage capacity is released – may also contribute to the expansion of the commercial storage market and the intensification of competition in this field. We will revisit this exciting new opportunity once the size of the reserve indeed gets reduced by the ministry.

### Cost developments of operating reserves and pricing strategy of regulating power plants in recent years

In spite of general electricity market trends, prices for ancillary services have continuously increased in the Hungarian electricity sector. End consumers today are charged nearly 2 HUF for ancillary services by each unit of kWh consumed, totalling 67.5 billion HUF in 2010. In the first part of our article, we briefly summarize the volume, structure and total cost changes of operating reserves procured by MAVIR. The second part analyzes whether the increasing cost of reserves can be attributed to the pricing behaviour of some major generation companies.

### Changes in the volume, structure and cost of operating reserves

Physical coordination of demand and supply – ie. ensuring the safe operation of the electricity system – can only be realised, if the TSO possesses capacity reserves allowing immediate intervention. If real time surplus or shortage occurred in the national energy balance, the TSO would create the balance of production and consumption by activating previously purchased capacity

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\(^7\) Presentation of Dr. János Zsuga: Hungarian aspects of the Russian-Ukrainian gas crisis, from the perspective of the TSO. Demos Hungary conference. 25 February 2009, Budapest.

\(^8\) A shortage of 1 million m$^3$ already elicits full restriction of category I consumption, which, if all users consumed according to their peak capacity reservation, could equal a restriction of up to 11.8 million m$^3$/day.

\(^9\) Obviously, a re-designed, more flexible restriction regime could also substantially limit these undue damages.
reserves. Operating reserves are mainly created in power stations, though there are examples for demand side capacity reserves. Capacity reserves are purchased via annual tenders, where the TSO selects the most favourable bids with regards to price of availability and energy and other parameters of capacity offers. The winners of the tender are offered a “market maker” contract, in which the supplier is obliged to give offer on the daily market during the year – for a price not higher than the price offered at this tender – and TSO is also obliged to accept these offers. The TSO activates the reserves in the order of the energy prices of the accepted day-ahead market bids. So in the actual system of procurement, suppliers compete for providing reserves on the annual tenders, while for providing regulation they compete on a daily basis. Accordingly, the price of availability is set on the annual, while the price of regulation energy on the daily tenders.1

Based on the activation time, primary, secondary and tertiary reserves can be distinguished. The activation times for primary, secondary and tertiary reserves are 30 seconds, 5 minutes, and 15 minutes, respectively. Based on UCTE methodology, the Hungarian electricity system requires 350 MW primary, 3150 MW secondary and +450 MW, -150 tertiary reserves. Figure 11 presents the volumes of reserve capacity in the 2008-2011 period, by the type of reserves. We have also indicated the total yearly amount of upward and downward regulation.

As we can see, the amount and structure of reserves in the past four years has considerably changed. In accord with the European practice, and the requirement that TSOs are only responsible for short term security of the electricity system, MAVIR ceased to procure hourly reserves. From 2010 to 2012, the acquisition of the so-called ‘emergency reserve’ will be gradually put an end to. Emergency reserves have been procured form Litér, Sajószöged and Lőrinci power plants, owned by MVM GTER Ltd, under long term contracts between MAVIR and MVM. These power stations are able to produce minute reserves. Of the three power plant, from 2010 one, from 2011 two, and from 2012 all have to participate in the tender for minute reserve. In the previous years, MAVIR procured only regulation capacity for upward regulation, downward regulation was carried out by altering the schedule of power plants. Acquisition of capacity for downward regulation occurred first in 2010, when MAVIR made market maker contract for 172 MW of secondary and 77 MW of minute reserves for downward regulation. We can conclude that the volume and structure of system capacity reserves in Hungary has approached the UCTE recommendations, still, the total amount of reserve procured exceeds the level deemed sufficient by the UCTE, and the procurement is dominated by capacities for upward regulation. It must be noted however, that the predominance of upward regulation (see Figure 11) and thereby the need for more upward reserves is related to the anomalies of the framework of feed-in obligation. The settlement with power plants producing within the feed-in obligation scheme drives producers to over-schedule their estimated output, as well as the physical constraint for traders to receive the unfavourably profiled feed-in generation adds up so that the annual distribution of imbalances is dominated by deficits.

Year 2009 introduced significant changes to the market and regulatory framework of ancillary services. Terminating the long-term contracts with Dunamenti and AES Tisza, the monopoly power of MVM diminished in the secondary reserve market, furthermore, HEO cancelled the obligation of cost-based pricing from the operation license of MVM. Drastic increase in the cost of secondary reserve and regulation caused a rise in the cost of ancillary services in 2009 (see Figure 12.). Average availability price for secondary reserves increased from 3200 HUF/MW/year to 4400 HUF/MW/year, while the average price of secondary reserve, making up the bulk of all regulation, grew from 22.9 HUF/kWh to 33.7 HUF/kWh. Rise in prices and a slight increase in the volume of upward regulation resulted approximately a 15 billion HUF cost increase in 2009. Total cost of system operation in 2009 were somewhat mitigated by a decrease in the prices of hourly and emergency reserves; the former occurred due to the strengthening competition, the latter because of the introduction of price ceiling for emergency reserves. In 2010.

1 Apart from market maker contracts, so-called optional contracts also exist, which can be contracted to enterprises offering a valid bid on the annual tender, but gained no market maker contract. Companies possessing an optional contract – being called pre-qualified companies – may make offers on daily tenders, which can be exercised by MAVIR. Due to the offer and accept obligation-based market maker contracts, optional contracts do not influence reserve costs.
two major developments influenced system operation costs: i) the procurement for hourly reserves ceased to exist, and ii) the procurement for operating reserves for downward regulation were introduced. The former measure meant 7 billion HUF savings, the latter 20.5 billion increase in costs. One should note that the gradual dissolution of emergency reserves has not caused savings yet, because the TSO increases its minute reserve procurement to the same amount as it reduces its emergency reserve procurement. The total costs of ancillary services are likely to be on the rise in 2011 again, since MAVIR is going to spend about 6 billion HUF more for operating reserve primarily because of the rise in the price of availability of secondary reserve.

### Pricing behaviour of power plants in the secondary reserve and regulation markets

The following part analyzes the question whether the bids offered by the main participants on the reserve market reflect the actual costs of services delivered. Our analysis focuses on the most important segment of the ancillary service market: the provision of secondary reserve and regulation services. Regarding the limits of the analysis, it must be noted, that MAVIR publishes the winner companies’ bids only at a certain aggregation level. Therefore we do not always have accurate information about from which unit does the reserve and regulation service come from, likewise it is not always known for which part of the year or time of the day does the offers stand. (From 2011 on, suppliers may offer separate bids for each hour of the year.) Consequently our calculations are partly based on assumptions and estimates, allowing only conservative conclusions.

Let us first examine the market for upward regulation. Figure 13 shows the development of generation costs of the three most important power plants, Dunamenti, Csepeli (MVM) and AES-Tisza, and the average price for upward regulation from 2008 to 2010. As we can see, following the termination of the MVM long-term contract with Dunamenti and AES-Tisza, and the ending of price control, the market for upward regulation displayed a significant rise in prices. At the same time, production costs for power plants had barely changed. They showed a slight fall in 2009 due to the fall in CO2-quotas costs and a weak increase in 2010 because of the increase in gas price. Based on the costs of the least efficient Dunamenti-F and AES-Tiszai power plants, the spread between the price and cost of upward regulation rose up to around 9 HUF/kWh in 2009, followed by a drop to 6.4 HUF/kWh.

Figures 14, 15 and 16 show the results of the yearly tenders for secondary reserves between 2008 and 2011.
the winning bids (quantity-availability price pairs by participant) for the down- and upward reserve tenders, while the third one shows the weighted average price of accepted bids from 2008 to 2011. Without any thorough analysis, which is beyond the scope of the article, the following remarks can be made. A gradual growth can be observed in the number of participants on both the up- and downward reserve market. Apart from Mátrai Erőmű, all major fossil power plants have entered the operating reserve market by now. It is a welcome news, that the major cogeneration plans (Budapesti Erőmű) as well as power stations entering commercial operation in 2011 (Bakonyi Erőmű, Gönyüi Erőmű) offered bids in the last capacity reserve tender. In spite of the rise in numbers of market participants, the market remains fairly concentrated: market share of the two greatest players add up to 84% on the upward reserve market, and 81% on the downward reserve market. Despite the similar structure of the two markets, average prices moved in the opposite direction for this year: while the average availability fee on downward reserve market slightly shrunk, the availability fee of upward reserves significantly increased (See Figure 16). The phenomenon may be explained by the fact that due to lower demand – MAVIR procures half as much downward reserve capacity than upward –, downward reserve market is characterised by relatively abundant supply and more intense competition.

When comparing and evaluating the bids one has to bear in mind that the prices of reserve services are set somewhat differently than the prices of wholesale electricity. For a power plant the cost of offering operating reserve is basically determined by the relation of the market price of electricity and the short term marginal cost of the plant. For a power plant that produces electricity at a cost below the market clearing price, the unit cost of providing upward reserve equals the difference of market price and unit cost of generation. In other words: the revenue from keeping upward reserve should compensate for the loss of income resulting from the reduced sale of electricity on the wholesale market. For the same power plant, keeping downward reserve does not incur any costs, because it is economical for the power plant to operate higher than its minimum generation level anyway. It is more complicated to determine the cost of keeping reserve in a plant with production cost higher than the market price. This “high cost” plant, in order to be able to provide upward regulation, should operate at least on the minimum generation level. The power plant is enforced to sell this minimal quantity on the electricity market cheaper than the costs of generation, so the cost of keeping reserve equals the before mentioned loss. The cost of providing reserve is constant in this case, ie. the same amount no matter the power plant keeps 10 or 50 MW capacity as reserves. If the high cost power plant offers downward reserve, then the level of production should be raised from the amount of minimum load at least with the magnitude of reserves provided. In this case, total cost of downward reserve consists of a fixed element – covering losses caused by minimum production – and a variable part depending on the size of reserve offered. Similar to the upward reserve service, the slope of the company’s supply curve for downward reserve service will be diminishing. If the power plant bids for providing both down- and upward reserves, then it will depend on the pricing strategy of the power plant, how it allocates the fixed costs between the two services.

Based on the assumptions described before, the following remarks can be made on the pricing strategy of the two greatest regulating power plants. At the time of the tender for capacity reserves for 2010, power stations Dunamenti F
and AES Tisza could expect to generate electricity at a cost of 26.5 HUF/kWh and sell it at a price of 26.5 HUF/kWh in 2010, assuming baseload operation. This meant an expected loss of 13 000 HUF per each MWh generated. Looking at the bids offered for upward and downward reserves, one can conclude that the two players set their prices for downward reserves to compensate for this loss, while the fixed cost of keeping reserve – approximately 650 000 HUF for a minimum load of 50 MW – was included in their bids for upward reserve. Based on this the calculated costs for upward reserve in case of AES Tisza bidding 200 MW implies 3250 HUF/MW/h (=650 000 HUF/200 MW), whereas Dunamenti F’s 75 MW offer means 8666 HUF/MW/h (=650 000 HUF/75 MW). It can be seen that our calculated costs are quite close to the bids actually offered by the two power plants. Performing the same calculations for Dunamenti G2 unit, we get that the power plant could supply downward reserve for a price of 6500 HUF/MW/h, and upward reserve for 7800 HUF/MW/h. Compared to the F unit downward reserve can be supplied cheaper from the G2 unit, while the costs of upward reserve does not appear to be different, since the mitigating effect of higher efficiency on cost is offset by the cost increase related to higher minimal load. It is not known, to what extent Dunamenti uses one or the other of its generating units for providing reserve, but it is for sure that, in 2010 prices, using G2 for providing downward reserve could yielded remarkable profit for the power plant.
Before evaluating the 2011 bids, it should be noted, that the procurement of reserve occurred somewhat differently than in the previous years. At the end of the tender, the MAVIR - instead of the originally requested 280 MW upward reserve - contracted only for 158 MW capacity. Bids of Dunamenti power plants – possibly for the high availability fees – were not accepted. In December, MAVIR announced a new tender for securing the missing reserves, where the bids of Dunamenti power plants proved the most favourable.

As we can see, the offer of AES-Tisza contained a significantly higher price for upward reserve, compared to the last year. The magnitude of price increase is hardly justified even if we take into account the fact that (i) a lower capacity offer was accepted, (ii) that off-peak capacities – when the generation of the power plant causes a greater loss – represent a greater share among all offers, and that the power plant faced a minor rise in fuel costs. Our own calculations indicate that cost-based pricing would have justified only a price 2000 HUF/MW/h lower than the submitted bid. However, the second round offer by Dunamenti power plant containing a baseload availability broadly reflects our price estimations for the service. The bids of AES-Tisza for downward reserve are higher than the last year due mainly to the fact that 2011 offers were set in off-peak hours.

In our essay, we attempted to provide an explanation for why the cost of ancillary services have increased significantly over the last years. Evaluating the demand side of ancillary services market we concluded that in spite of the fact that the total volume of reserved contracted by MAVIR decreased, the relative share of more expensive reserves increased within the procured reserve portfolio. This shift in the reserve mix was one reason for the price surge in ancillary services. Our analysis on the supply side of the market showed that weak competition has also played a role in the increasing prices. Prices are especially high in the regulating market, where according to our estimations even the producer with the highest marginal cost enjoys a margin over 25%.

Abbreviations in the report

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>APX</td>
<td>Amsterdam Power Exchange</td>
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<tr>
<td>ARA</td>
<td>Amsterdam-Rotterdam-Antwerpen</td>
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<td>ANRE</td>
<td>Autoritatea Națională de Reglementare în domeniul Energiei</td>
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<td>CEGH</td>
<td>Central European Gas Hub</td>
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<td>CER</td>
<td>Certified Emission Reduction</td>
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<td>ECX</td>
<td>European Carbon Exchange</td>
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<td>EEX</td>
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<td>ENDEX</td>
<td>European Energy Derivatives Exchange</td>
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<td>EUA</td>
<td>European Union Allowance</td>
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<td>HAG</td>
<td>Hungary–Austria Gasline</td>
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<td>HEO</td>
<td>Hungarian Energy Office</td>
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<tr>
<td>OPCOM</td>
<td>Operatorul Pietei de Energie Electrica</td>
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<tr>
<td>OTE</td>
<td>Operátor trhu s elektrínou</td>
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<tr>
<td>PXE</td>
<td>Power Exchange Central Europe</td>
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<tr>
<td>SEPS</td>
<td>Slovenská elektrizačná prenosová sústava</td>
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<tr>
<td>UCTE</td>
<td>Union for the Coordination of Transmission of Electricity</td>
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<td>WTI</td>
<td>West Texas Intermediate</td>
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HOT TOPICS

An EU regulation on gas supply security has come into force

On 2nd December 2010 a new EU Directive aiming to improve the security of gas supply within the community came into force [Regulation (EU) No 994/2010 of the European Parliament and of the Council of 20 October 2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC; henceforth Regulation]. The new regulation can be viewed as a significant part of the EU’s answer to the January 2009 gas crisis,1 and its implementation may considerably alter Hungary’s security of supply as well as its gas market position. The regulation is legally binding, transposition by Member States is not needed. It strives to attain its goal firstly through prescribing minimum requirements for the gas infrastructure and specific priority services, and secondly through the gradual introduction of a member state specific, but centrally coordinated planning system for crisis prevention and management. After a short summary of the infrastructure related requirements of the regulation we are going to use simple indicators to examine the status of selected countries from the region – including Hungary – concerning the degree to which they currently meet the minimum regulatory requirements on security of supply. We will also consider which regional partners may be best suited for Hungary when it comes to joint development of crisis prevention and management plans.

Minimum requirements on the infrastructure

The first rule regarding infrastructure is the so-called N-1 requirement, according to which by 3 December 2014 at the latest all member states2 must ensure that in the event of a disrup-

1 It is easy to recall that during the early 2009 crisis the infrastructural conditions of a number of Eastern member states of the EU did not allow for efficient crisis management despite the fact that within the European Union there were sufficient natural gas resources to substitute for the missing Eastern shipments. Lack of transmission facilities prevented the delivery of the desired volumes to the region hit by the crisis, while the countries with bad infrastructural conditions were not prepared to manage the state of emergency (REKK Hungarian Energy Market Report, 2nd issue 2009).

2 Luxemburg, Slovenia and Sweden are exempted and are subject to other, special rules.
- Supply for 7 consecutive days of gas in extreme temperatures peak period occurring with a statistical probability of once in 20 years;³
- Gas reserves sufficient to satisfy 30 days of exceptionally high gas demand;
- Supply for a period of at least 30 days in case of the disruption of the single largest gas infrastructure under average winter conditions.
These conditions need to be fulfilled by the natural gas enterprises appointed by the authority.

**Analysis: where do we stand now?**

The cost of meeting the regulatory requirements may substantially vary among member states, and will greatly depend on the initial conditions concerning security of supply in each country. We inspected this initial state for several countries in our region, including current and prospective EU member states as well. REKK first estimated an indicator measuring the daily peak consumption exposure covering all consumption in the whole region. The indicator is

\[
EXP = \frac{C_{peak} - P_{dom} - S_{ext} - L_{ext}}{C_{peak}}
\]

where \(C_{peak}\) is the daily peak consumption, \(P_{dom}\) is the maximum capacity of daily domestic production, \(S_{ext}\) is the daily peak capacity of withdrawal from storage facilities, while \(L_{ext}\) is the daily capacity for LNG regasification. The maximum value of the indicator is 1, revealing 100% import dependency in meeting peak demand. Lower values represent an improving situation. Lacking consistent data, instead of daily peak consumption the results described in Figure 17 were calculated using 2008 average winter daily consumption published by Eurostat. This, obviously, considerably underestimates actual peak consumption. We looked at two periods: the January 2009 gas crisis and the end of 2010 (for the latter we assumed that the Hungarian-Croatian cross-border capacity already operates).

As the figure illustrates, in Austria, Croatia and Hungary the enlargement of storage capacity and other infrastructural developments substantially improved the security of supply between the two inspected periods. The deterioration of Bulgarian and Romanian data is explained by decreasing domestic production.

Next we estimated the impact that the disruption of the piece of infrastructure with the largest capacity would make on satisfying peak winter demand (in accord with rule N-1), with the stipulation that in all cases the largest import capacity was considered as the largest piece of infrastructure. We were curious how security of supply evolved in the countries of the region since the 2009 gas crisis. The applied indicator is

\[
RSI = \frac{P_{dom} + S_{ext} + L_{ext} + I_{total} - I_{largest}}{C_{peak}}
\]

where \(C_{peak}\) is the daily peak consumption, \(P_{dom}\) is the maximum capacity of daily domestic production, \(S_{ext}\) is the daily peak capacity of withdrawal from storage facilities, \(L_{ext}\) is the daily capacity for LNG regasification, \(I_{total}\) is the total pipeline import capacity, while \(I_{largest}\) is the largest single pipeline import capacity. An indicator value above 1 confirms that even if the largest import pipeline is disrupted, the rest of the infrastructure is still capable of supplying peak consumption. Results are included in Figure 18.

The Hungarian-Croatian cross-border pipeline has again been considered as operational. As shown by the figure – besides Croatia and Hun-

³ In case of Hungary, peak consumption of 2005 was the greatest: according to FGSZ data, it accounted for 89 million m³, while HEO reported 91.6 million m³
Figure 18 Residual supply index*

*One or more pipelines originating from the same import direction were considered as one.

Gary – Austria and Slovenia carried out significant capacity enhancements. Despite its low size, the Hungarian-Romanian cross-border pipeline improves the security of supplying Romanian consumers. If the two pipelines linking Ukraine and Romania were handled separately then the value of the Romanian indicator would be around 1, where the new West-bound cross-border pipeline would lift the value above 1.

Regional cooperation

Member states typically aim to satisfy the minimum requirements of the regulation and enhance their security of supply through costly supply side investments (new, perhaps strategic gas storage facilities, cross-border capacities). Compliance costs may be curtailed if several member states cooperate to fulfill the regulatory requirements and execute the risk assessment, preventive action and emergency plans together. We wonder if it may be advantageous for Hungary to initiate such a cooperation with one of the neighbouring member states. Since there is no gas pipeline connection with Slovakia, such a cooperation is not realistic in the short run. This may change, of course, if the bi-directional, Hungarian-Slovakian cross-border pipeline with 6 billion m³/year capacity is finished by 2014, as planned. Until then opportunities for cooperation should be investigated on the Austrian-Slovenian-Croatian, and Romanian border sections. From our perspective the most attractive may be an Italian-Austrian-Slovenian-Croatian collaboration, since LNG and North-African gas delivered to Italy will become accessible for our region once the Italian-Austrian pipeline is upgrade to be bi-directional. This gas can arrive from Croatia through the Italy-Austria-Slovenia-Croatia path, or directly through the Austrian-Hungarian HAG pipeline. Expanding the capacity on these routes (e.g. on the HAG) is a cost-efficient way of improving our compliance level with the N-1 requirement. From the perspective of regulatory compliance the Romanian-Hungarian cooperation is likely to be more valuable for the Romanian partner, mainly because of improved Romanian access to the Hungarian storage facilities. Such a cooperation, nevertheless, would also serve domestic business interests.