



**REKK**

REGIONAL CENTRE  
FOR ENERGY  
POLICY RESEARCH

# RENEWABLE ENERGY AND ENERGY EFFICIENCY QUARTERLY

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## FOCUS

### MEKH-REKK WORKSHOPS ON RENEWABLES REGULATION

The Hungarian Energy and Public Utility Regulatory Authority (MEKH) has initiated public consultations regarding three major RES regulatory issues in Hungary:

- ◆ Tendering options for RES-E
- ◆ Assessment of current PV regulation and proposal for a new regime
- ◆ Incentive schemes for RES District Heating

MEKH has assigned REKK to carry out background policy studies and organized public consultation workshop in these topics.

#### Tendering options for RES-E

**New RES-E support regime has to be adopted by the beginning of 2017. REKK has proposed technology neutral RES-E tenders.**

Within the next year and a half EU Member States (MS) need to adjust their RES-E support schemes to align with the prescriptions of the EU guideline on state aid published in 2014.<sup>1</sup> As the main rule, the guideline requires the allocation of support to be carried out through a competitive bidding process and the direct sale of the produced electricity on a market basis.

Accordingly, national support schemes still prevalent across a number of MSs based on feed-in tariffs and the obligatory purchase of produced electricity will need to be amended, with the introduction of either a green certificate system or an auction based premium system. The deadline for the introduction of direct market sales is 1 January 2016, while the deadline for the introduction of a competitive bidding process is 1 January 2017.

REKK has prepared a new RES-E support concept taking into account worldwide RES-E tender experiences and findings from the public consultation organized by MEKH. The main tenets of the new RES-E support concept are:

- ◆ Premium based RES-E support scheme where premium is distributed in auctions (above 0.5 MWe)
- ◆ Technology neutral tender with a single evaluation criteria based on the required premium level
- ◆ Only a financial guarantee is needed for participation in the auction, its level at some 1-5 % of the total investment cost
- ◆ Publication of a medium term tender calendar is important to reduce the uncertainty and the required support level.

European Commission C(2014) 2322 guidelines on state aid, covered in detail in the 2/2014 issue of our Report („The nightfall of the obligatory purchase regime“)

### Assessment of current PV regulation

*Even with greater PV penetration, maintaining the present support policy would only have a relatively moderate effect on the financial situation of the stakeholders.*

The consultation workshop on the support policy of small scale household power plants focused on photovoltaic installations, given that this technology accounts for 99% of generation capacity in this category. The study which was presented and discussed in the workshop takes into account three different PV capacity deployment scenarios, and estimates the impact of staying the course (yearly net metering) next to alternative support systems (e.g. different feed-in tariff designs) on the financial well-being of affected parties: distribution and transmission system operators, electricity traders and universal service providers, consumers, and the state budget. The findings of the paper suggest that sustaining the present support policy, even in case of a higher penetration (assuming 1 GW installed PV capacity in 2020), would have relatively moderate effect on the balance sheet of the stakeholders.

Although the relationship between specific investment and operational costs and retail electricity prices suggest that net metering has probably been introduced prematurely in Hungary, to provide sufficient support for most PV installations - and mainly investment grants from EU sources have determined the development trend so far - representatives of the PV sector prefer the current system for its simplicity. However, net metering in its current form has different shortcomings. The underlying issues that require policy revision are the following: a) the hidden nature of subsidizing PV generation through cross-financing by electricity customers not owning PV systems, b) the inability of the current mechanism to deduct the support received through initial investment grants, possibly leading to excessive support, c) the absence of PV operators' contribution to electricity system costs, and d) the endless provision of the benefits in its current form, making it unsuitable to follow changes in investment costs. The proposed modifications to the current support system attempt to suggest solutions to these problems.

### Incentive schemes for RES District Heating

*RES DH can be competitive with gas-based DH if financial risk is addressed. The main obstacle of new RES based investments is the annual and uncertain price setting.*

The REKK study identified biomass and geothermal heating as the two main technologies which may significantly contribute to reach the National Renewable Action Plan (NREAP) goals set for district heating. The study analyses the cost structures of these plants (biomass heat only, biomass CHP, geothermal at favourable location, geothermal at average location and geothermal at unfavourable location) and compared the average costs to gas district heating. It finds that while the RES DH technologies are competitive with new gas heating plants, commissioned gas plants that have recovered some investment costs have an advantage. Policy should therefore focus on potential district heating areas where the replacement of existing gas plants is due in the near future.

The study also considered the existing European incentive schemes for the promotion of RES district heating in its proposal for a diversified support system in Hungary. In the opinion of participants, the most prominent regulatory burden these projects face is neither the availability of biomass supply nor the drilling and water pressure risk of geothermal projects, but the financial risk coming from the unpredictable annual district heating price setting. Without predictable long-term revenue financing of RES DH investments remains extremely challenging.



# DEVELOPMENT OF TECHNOLOGY PRICES

## RECENT RES-E TENDERS IN EUROPE

*PV average price is 90-100 €/MWh according to the UK and German RES-E tenders.*

The 2014 State Aid Guidelines sets new parameters for renewable energy support in Europe, namely requiring a tendering process from 2017 for all new capacities. Even though tendering is not a new concept in European public policy, an increasing number of countries launch their RES-E tenders for testing purposes. Next, we briefly assess the results of two such recent MS tenders.

### RES-E auction in the UK

The UK returned to the tendering process for new electricity generation capacities in 2014. RES-E technologies are divided between three groups: established technologies, less established technologies and biomass conversion, each with a separate budget. Projects in the same group compete within limits of technology specific prices. Winners are awarded a 15-year contract with the Low Carbon Contracts Company (LCCC) for the difference between the clearing price and the average market price. The first auction was closed in February 2015 and yielded the following results for established technologies (See Table 1).<sup>2</sup>

The limit price announced for each year (start of commercial operation) reflects the LCOE forecast of the regulatory agency. OFGEM expects moderate cost decrease for wind and PV and stable cost for waste incineration. The results show that the tendering process generally pushed down prices. The PV clearing price for short term delivery (2015/2016) – on the other hand – is remarkably low. The two PV projects with a 50 GBP/MWh (67 EUR/MWh) clearing price, barely above the market price, have already been shelved as nonviable investments.<sup>3</sup>

### German PV tender

Germany plans to implement tendering for all renewable electricity generation from 2017, and started to test the different tender designs on ground mounted PV applications between 100 kW and 10 MW. Three tenders are planned for each year with a pre-set amount of capacity (100-200 MW in each round). The initial tender rules were:

- ◆ pay-as-bid type auction
- ◆ remaining capacity is auctioned in the consecutive round
- ◆ no limit on the number of project per investor
- ◆ applicants bid for the EUR/MW amount needed for the investment (basis of market premium calculation)
- ◆ eligibility for the premium is 15 years
- ◆ 4 EUR/kW financial bond required for the application and 50 EUR/kW at contracting (for winning projects) that is lost if the commercial operation is not achieved within 2 years.

In the first 150 MW tender in April 2015, 25 bids with a total capacity of 156.97 MW were accepted at an average rate of EUR 91.7/MWh with successful bidders in that round receiving support in the amount of their bids (pay-as-bid). Altogether 170 bids have been submitted and 37 bids have been disqualified for failure to comply with administrative conditions. The lowest bid was EUR 84.8/MWh, whereas the highest successful bid was EUR 94.3/MWh. The average price was lower than the price limit of the tender (EUR 112.9/MWh) but higher than the current ground mounted support provided under the EEG scheme (EUR 90.2/MWh).

Table 1 Results of the UK RES-E tender

	2015/2016			2016/2017			2017/2018			2018/2019			Total capacity (MW)
	Clearing price	Limit price	Capacity	Clearing price	Limit price	Capacity awarded	Clearing price	Limit price	Capacity awarded	Clearing price	Limit price	Capacity awarded	
	EUR/MWh	EUR/MWh	MW	EUR/MWh	EUR/MWh	MW	EUR/MWh	EUR/MWh	MW	EUR/MWh	EUR/MWh	MW	MW
Onshore wind	-	128	-	107	128	45	108	121	78	111	121	-	749
PV	67	161	33	107	155	39	-	148	-	-	135	-	72
Waste incineration	-	108	-	-	108	-	-	108	-	108	108	95	95
CHP													

<sup>2</sup> For detailed results see: Contracts for Difference (CFD) Allocation Round One Outcome

<sup>3</sup> The Carbon Brief: UK renewables auction pushes down costs

The implementing agency (BNetzA) has published the details of the second auction for a capacity of 150 MW in total. Bids have to be submitted by 3 August 2015.<sup>4</sup> The main features of the new tender round are:

- ◆ the limit value has been lowered from EUR 112.9/MWh to EUR 111.8 MWh (still higher than the current EUR 90.2 MWh that is the basis for market premium calculation)
- ◆ uniform pricing method will be used (instead of pay-as-bid) meaning that all successful bidders will receive support in the amount of the highest accepted bid

- ◆ bidders who were not successful in the first tender can take part in the August tender

PV tendering experience will be assessed by mid-2016 and contribute to the final RES-E tender scheme due to operate from 2017. The draft proposal for the tendering rules of onshore and off-shore wind plus rooftop PV installation is currently under public consultation and the first test rounds are likely to be announced in late 2016.

4 German energy blog: BNetzA Launches Second Tender for Freestanding PV Capacity

## HUNGARIAN RES-E REGULATORY AND MARKET PANORAMA

### ANNUAL DEVELOPMENT OF SUPPORTED RES-E GENERATION IN HUNGARY

*From 2013 to 2014 feed-in tariff (FIT) supported RES-E increased by 29%, reaching 2400 GWh/year. This can be mostly attributed to a policy change regarding biomass co-firing.*

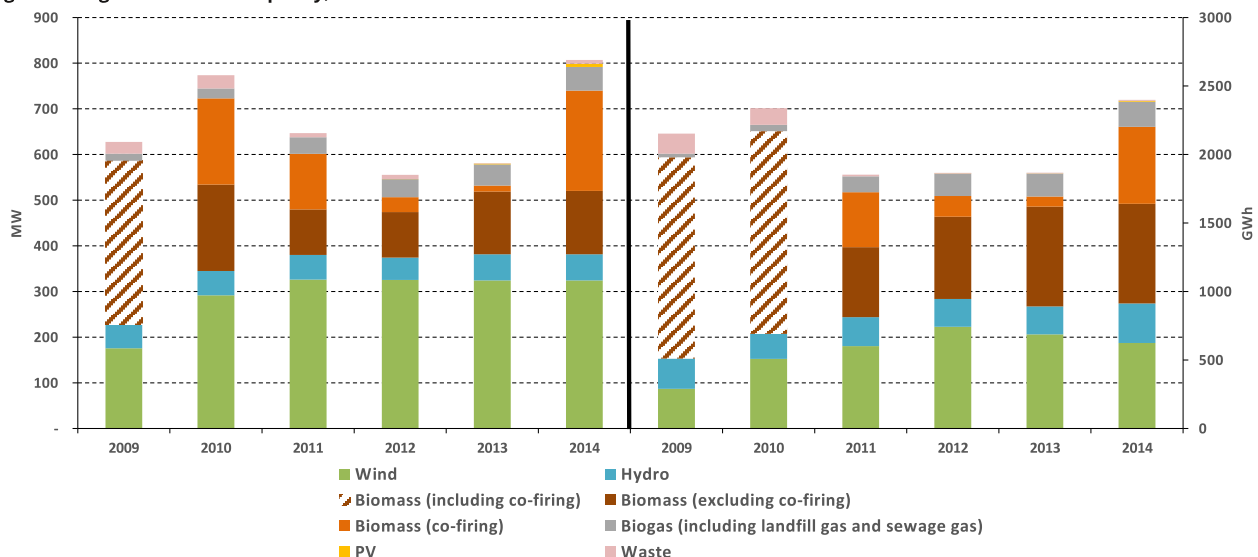
The regulatory change reallocated quotas for coal-biomass co-firing plants, reconstituting more than 200 MW capacity into the FIT system. While the supported hydro capacity remained the same, generation increased significantly (by 42%) due to favourable weather conditions.

The total amount paid to FIT generators in 2014 was HUF 78.82 billion, which is around 30% higher than in 2013. The main driver of the growth

was the increased production, while annual inflation based indexation only raised tariffs by ~1.5%. The "total support" (calculated the following way: (FIT - average day-ahead HUPX prices)\*total FIT supported generation) was HUF 49.12 billion, 35% more than the previous year, mostly as a result of higher production but also partly due to lower average HUPX prices.

Although the overall FIT budget increased in 2014 mostly in the form of tariffs paid to producers, the costs of balancing caused by deviation from schedules decreased. According to the new rules, about 40% of total received electricity is sold on the day-ahead HUPX market. This way planning can be more precise (daily instead of monthly planning), so less balancing energy is needed to secure safely. According to MAVIR, around HUF 5 billion saving could be achieved.

Figure 1 FIT generation and capacity, 2009-2014



## MONTHLY DEVELOPMENT OF RES-E GENERATION IN HUNGARY

*The total FIT generation increased by 31% from the first observed period (2013 Q2-2014 Q2) to the second (2014 Q2-2015 Q2), mainly due to higher bio-mass production.*

The main reason FIT generation increased by 31% from 2013 to 2014 was due to the increase of biomass based production that peaked in June and August at around 155-175 GWh/month. Wind production was noteworthy as well, mainly in the first quarter of 2015. As biomass based generation is not influenced by weather conditions, the level of production mainly depends on the plant operator's decisions. However high biomass based generation – as we mentioned in our previous Quarterly – cannot be explained with higher monthly average prices in June and August. The likely explanation is the timing of quota (re)allocation: in 2014 more than 200 MW additional biomass co-firing capacity became eligible for FIT again. In addition, Pannonpower's co-generation power plant in Pécs started operation at the beginning of 2014.

The monthly average unit cost of FIT support (see figure above) more or less followed the trajectory of monthly production, as the level of obliged consumption was less volatile. From 2014 universal service consumers are exempted from paying the contribution to the FIT support budget which increases the burdens of the rest of the electricity consumers. This increases the unit cost some 50% higher, adding an additional 1 HUF/kWh for the contributing consumers, most of which are industrial enterprises.

## CHANGES IN RES LEGISLATION

The past quarter brought about changes to the legal framework of the renewable sector. (123/2015 NFM rendelet) A major change included in the ministerial order is that FIT support can be granted for the test period of a power plant even before the start of commercial operation.

Another modification concerns regulatory energy: wind power producers and biogas plants up to the capacity of 5 MW are not required to pay for regulatory energy in the first 6 months after entering a balancing group.

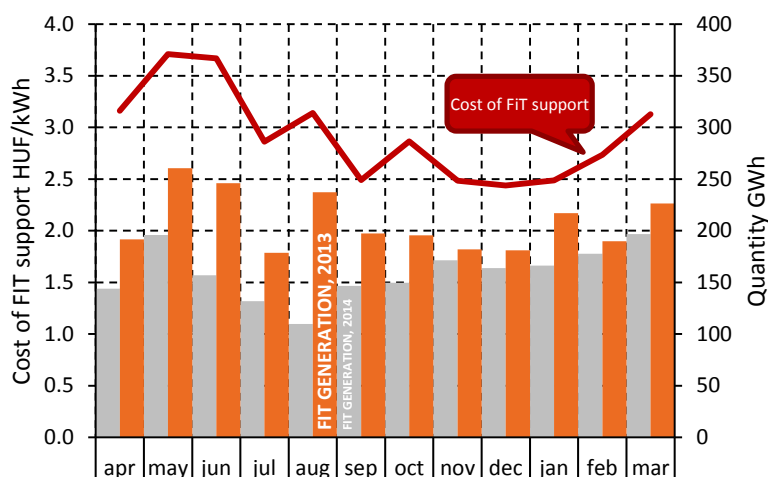
## CHANGES IN RENEWABLE CAPACITIES BASED ON MEKH RESOLUTIONS

### PV drives the capacity expansion

Some withdrawals occurred in the previous quarter but this did not result in a change in generating capacity; power plants which opted to withdraw their license have been mothballed or were not commissioned at all and no new power plant licenses were issued.

Based on the FIT resolutions issued by MEKH, 4.5 MW PV is expected to be connected to the grid in the first half of 2015 while none of the capacities surpass 500 kW. Below this threshold, licensing procedure is easier (no license issued by the Energy Office is required) but producers may receive FIT support for their generation. Therefore it is not uncommon that a company planning to install 1 MW capacity splits it into two separate power generating units. The Energy Office granted nearly 25 years of FIT support for each generating unit under 500 kW.

Figure 2 Monthly FIT generation and cost of FIT support (2014 Q2- 2015 Q2)



Household-scale renewable generation capacity (up to 50 kW) has been booming as well: by the end of 2014, renewables – mainly PV generating capacities – totalled nearly 70 MW. In 2012 a fourfold capacity increase was observed, while in 2013 and 2014 PV installations doubled. The main driver is believed to be the investment support and the relatively stable regulation of net metering. Industry interviews indicate another 10-20 MW of household-scale installations will be added in the first half of 2015.

## EU REGULATION

### EU ON TRACK TO MEET RENEWABLE TARGETS

*The projected share of renewable energy in the gross final energy consumption for 2014 is 15.3%.*

The EU is on track to meet its 2020 renewable energy targets according to a new report by the European Commission<sup>5</sup>, with 25 Member States, including Hungary, expected to meet their 2013/2014 interim national targets. The projected share of renewable energy in the gross final energy consumption for 2014 is 15.3% en route to the 20% target for 2020. With a projected share of 5.7% of renewable energy in transport in 2014, achieving the 10% target will be challenging but remains feasible according to the Commission. In Hungary, RES share increased from 9.3 to 9.8% between 2011 and 2013, surpassing the interim trajectory of 6.0 and 6.9%, respectively. Hungary's binding target for 2020 is 13% but the country indicated its unilateral intention is to reach 14.65%.

The Commission's progress report shows that the deployment of renewable energy resulted in 326 Mt of gross avoided CO<sub>2</sub> emissions in 2012 and 388 Mt in 2013. EU demand for fossil fuels decreased by 116 Mtoe in 2013. Renewable energy

substitution of natural gas made up 30% of all avoided fossil fuel use in 2013, while almost half of Member States reduced their gross inland consumption of natural gas by at least 7%. Avoided imported fuel costs due to increasing use of renewable energy amount to at least 30bn euros a year. The EU now has 3 times more renewable power per capita than any other part of the world, with more than 1 million people working in the renewable energy sector that is worth over 130bn euros a year. The block exports 35bn euros worth of renewables every year.

Although Europe is still ahead of most other regions in terms of its share of renewable electricity, the world is gradually catching up and massively investing in new capacities. In 2013, renewables accounted for more than 56% of net additions to global power capacity. This is also good news for Europe and can provide new market and research opportunities for EU companies and technology. For example the EU is leading in wind turbine manufacturing with almost 40% of the global market shares in 2013.

5 EU on track to meeting 20% renewable energy target



# MONITORING OF INVESTMENT SUPPORT OPTIONS

## KEHOP BUDGET 2015

*The amount allocated to KEHOP 2015 calls equals 125 bn HUF.*

The Hungarian Government has decided on the budget allocation of Environment and Energy Operational Programme for 2015 adding up to 124.9 bn HUF (404.5 mn EUR). The three main focus areas are Energy Efficiency, RES-Electricity and RES-Heat.

Energy Efficiency support in 2015 focuses on the energy efficient renovation of public institutions, especially Government Offices, schools and hos-

pitals. These renovations might be complemented by renewable energy utilization. Altogether 45.5 bn HUF is allocated to these energy efficiency refurbishments.

The amount allocated to Renewable Electricity targets the enhancement of renewable-based electricity production through a standard call in December and accounts for only a minor part of the total budget (10 bn HUF).

The KEHOP support assigned from this year's budget to Renewable Heat are related to three main areas: i) 5 bn HUF is allocated to RES District Heating and modernization of DH networks, ii) 5

### KEHOP Budget 2015

Environment and Energy Operational Programme				
Call ID	Name of Call	Amount allocated (bn HUF)	Type of Call	Planned timing
<b>Energy efficiency</b>				
KEHOP-5.2.0.	Energy efficient renovations of Government Offices with the potential of renewable energy utilization	20.0	Priority	December
KEHOP-5.3.0.	Energy efficient renovations of Law Enforcement Agencies with the potential of renewable energy utilization	3.5	Priority	September
KEHOP-5.4.0.	Energy efficient renovations of judicial and prosecutorial buildings	2.0	Priority	September
KEHOP-5.5.0.	Energy efficiency renovations of Education Units of Central Budgetary Institutions with the potential of renewable energy utilization	6.0	Priority	December
KEHOP-5.6.0.	Energy efficient renovations of Health Institutions with the potential of renewable energy utilization	6.0	Priority	September
KEHOP-5.7.0.	Energy efficient renovations of Churches with the potential of renewable energy utilization	5.0	Priority	September
KEHOP-5.8.0.	Energy efficient renovation of church-run hospitals and the Medical Centre, Hungarian Defence Forces	2.0	Priority	May
KEHOP-5.12.0.	Energy efficient renovation of public buildings owned by local governments with the potential of renewable energy utilization, Central Hungary Region	1.0	Priority	December
<b>RES Electricity</b>				
KEHOP-5.1.0.	Enhancement of renewable-based electricity production	10.0	Standard	December
<b>RES Heat</b>				
KEHOP-5.9.0.	Modernization of district heating networks with the potential of renewable energy utilization	5.0	Priority	September
KEHOP-5.10.0.	Serving local heating and cooling demand by renewable energy	5.0	Standard	December
KEHOP-2.3.0.	HUHA II. New Waste Recycling and Sludge Incinerator Plant	50.0	Priority	December
KEHOP-3.2.3	HUHA I. complex: Increasing district heat quantity, turbine replacement and boiler reconstructions	7.4	Priority	September
<b>Other</b>				
KEHOP-5.11.0.	Campaign to raise energy efficiency awareness	2.0	Simplified	September
<b>Total</b>		<b>124.9</b>		



bn to local heating and cooling by renewables and iii) 57.4 bn HUF to two large waste incineration projects that partly feed into the Budapest district heating network. A small amount is also allocated to raising awareness, which will be announced in September and adds up to 2 bn HUF.

The amount allocated to KEHOP 2015 calls equals 12.6% of the total 2014-20 KEHOP budget of 3,217 million EUR.

For more information please consult 69/2015 issue of the Hungarian Official Journal.

## REKK OPINION

**The former 2-year Actions Plans have been replaced by yearly budgets for each operative programme priority which increases the transparency of grant timing. The Hungarian Government is placing a huge emphasis on the reduction of state institutions' energy consumption through energy efficiency investments.**

## EU SUPPORT FOR ENERGY EFFICIENCY INVESTMENTS

**Project Development Assistance (PDA) supports the development and launch of ambitious and replicable energy efficient projects.**

The European Commission has set up different PDA facilities to support the development and launch of ambitious and replicable energy efficient projects. ELENA ("European Local ENergy Assistance") is run by the European Investment Bank (EIB), and is funded through the European Commission's Intelligent Energy-Europe programme. It targets towns and regions that lack the necessary technical expertise and organisational capacity to implement large energy efficiency and renewable projects. ELENA covers up to 90% of the technical support cost needed to prepare, implement and finance the investment programme. This could include feasibility and market studies, programme structuring, energy audits and tendering procedure preparation. With solid business and technical plans in place, this will also help attract funding from private banks and other sources, including the EIB. Eligible programmes may include, but are not limited to retrofitting of public and private buildings, sustainable building, energy-efficient district heating and cooling networks, or environmentally-friendly transport.

It is expected that the European Commission will again issue a call for proposals for project development assistance for innovative bankable and aggregated sustainable energy investment schemes later this year in the framework of Horizon 2020. In the calls of 2013 and 2014, existing public and private buildings, retail energy market infrastructure, commercial and logistic properties and sites were targeted. The major objective of supported projects was to demonstrate the financial viability and sustainability of large-scale sustainable energy investments. The support was thus conditional on mobilized investments. Proposals were expected to have an exemplary/showcase dimension, to be replicable and to deliver organisational innovation in the mobilisation of the investments and/or the financial approach. Under both calls, projects of EUR 6 million – EUR 50 million were invited with the expectation that every million EUR of Horizon 2020 support will trigger investments worth at least EUR 15 million.

## SUPPORT FOR MORE EFFICIENT WASHING MACHINES

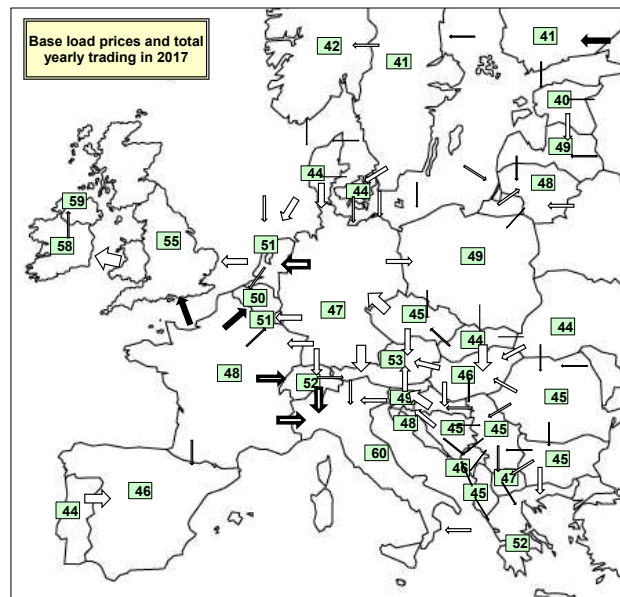
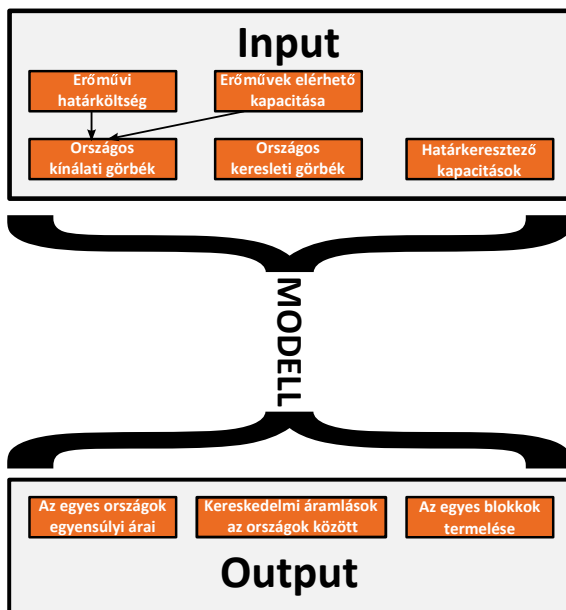
**500 million HUF will be spent on supporting 12,000 households to purchase new washing machines.**

The Ministry of National Development announced the fifth subprogram within the „Warmth of Home Program”: 500 million HUF will be spent on supporting 12,000 households to purchase energy efficient washing machines. Applications were to be submitted between the 1st of July and the 30th of September. Due to the exhaustion of funds, however, applications from the regions of Central Hungary, Southern Dunántúl, Western Dunántúl, Northern Alföld and Southern Alföld were suspended in less than two weeks.

The non-refundable support amounts to 50% of the purchase price, not exceeding 25 000 HUF for appliances in the A+, 40 000 HUF in the A++, and 45 000 HUF in the A+++ energy efficiency category. With the purchase of the new appliances, households are expected to reach at least 10% savings in energy consumption or 20 kg/year in CO<sub>2</sub> emissions.

# EUROPEAN ELECTRICITY MARKET MODEL (EEMM)

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



## ASSUMPTIONS

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

## USAGE

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

## RESULTS

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

## REFERENCES

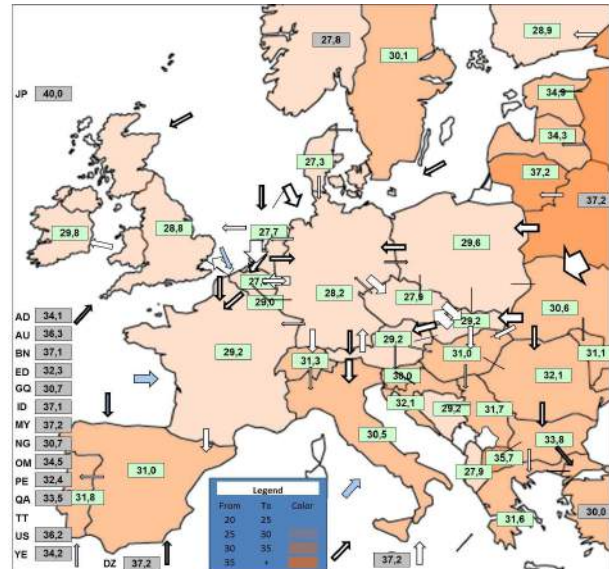
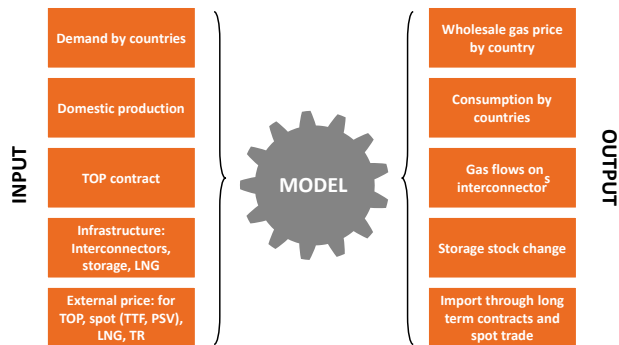
- ◆ Ranking of Project of Common Interest (PCI) projects
- ◆ Evaluating the TYNDP of ENTSO-E
- ◆ Assessing the effects of the German nuclear decommissioning
- ◆ Analysing the connection between Bal-cans and Hungarian power price
- ◆ Forecasting prices for Easterns and Southeast-European countries
- ◆ National Energy Strategy 2030
- ◆ Assessment of CHP investment
- ◆ Forecasting power plant gas demand
- ◆ Forecasting power sector CO2 emissions

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# EUROPEAN GAS MARKET MODEL (EGMM)

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



## ASSUMPTIONS

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

## USAGE

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

## RESULTS

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

## REFERENCES

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

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