Regulatory Problems of New Types of Power Generation

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Abstract –

In Hungary the market has been incrementally liberalised since 2003. As the country enters the EU this liberalisation will be virtually 100%. The regulatory authority encourages the generation from renewable resources, but it has brought some unwanted phenomena:

- **There are too many small gas motor units in the network**
- **The biomass means old type coal fired power plants changed to wood firing**
- **The Obligatory Power Purchase (OPP) of the government for renewable energy makes the planning of the schedules difficult**
- **The OPP is valid only for the small units, so the efficient combined gas turbines (over 50 MW) fall out from this subsidy**
- **There is no investment in wind generation for the lack of subsidy**
- **It is hard to control and balance the "wind power"**

Some other "traditional" problems occur, too:

- **The work by schedule is mandatory for all participants, but some of them plan the gross production, others plan the net**
- **High ratio of flat schedule import energy**
- **Independency of the ISO**
- **Marketplace: Where and what?**

The regulator identified these problems and started to resolve the contradictions.

***Keywords* - Deregulation, renewable energy, legislative problems**

I. The state of the deregulation in Hungary

In Hungary deregulation has happened in three main steps:

- Middle of the 90's: *privatisation*
- As of 2003: *market opening* for the large customers (over 6,5 GWh/year; cca. 15% of the total consumption)
- Nowadays *towards the total opening* and integration into the EU marketplace, day ahead market

In order to encourage the distributed generation (DG) and to apply the Renewable Energy Application (REN) the energy authority introduced the Obligatory Power Purchase (OPP) by the distributors (subsidized by the government). This is a guaranteed price, roughly 1,5-2 times higher than the average market price. The difference between the market and the subsidized prices is paid by the government.

The deregulation, a world trend to follow, is the result of change from the former centralised system. In parallel emerged the DG and REN technologies. The distributed gas motors, biomass based electricity generation, OPP, combined cycles, wind generation, control on the net sales, etc. - all these phenomena are new, they did not really exist in large scale applications two decades ago.

II. The new phenomena

A. Situation of renewables and distributed energy generation in Hungary

Hungary is not rich in primary resources. 40 % of the electricity is generated in a nuclear power plant, 25 % in lignite and coal fired plants and the rest in oil and gas plants. The hydro plant potential is not high, the photovoltaic resource has no real chance nowadays.

Through the development of the technology, the investment climate and the EU directives, the share of the DG and REN will increase. The operation of the small DG and REN unit is not scheduled yet, but in some case is not schedulable.

The structure of the Hungarian electricity production system is shown in the next table:

Total load	5-6000 MW
Built in capacity	~7000 MW
Nuclear	1760 MW
Oil/gas	~2300 MW
Gas turbine	~1000 MW
Lignite	860 MW
Other coal	~ 700 MW
Biomass	~120 MW
Water	~40 MW
Wind	3 MW
Net import	2-500 MW
Transit	800-1000 MW

1) Gas units

At the end of the 90's the momentary price of the gas and the energy inducted the sharp increase of the number of small combined cycle gas engines. Now there exist approx. 200 units with 1-3 MW electric generation capacity, with a 275 MW total capacity. The produced heat is used for central heating systems in hospitals, housing estates, etc. The main season for this unit is winter, but due to the

subsidized OPP price the units work all the year round. This winter 10% of the total load was supplied by OPP flat schedule power plants, typically 460-480 MW, whole day. This is almost 10 % of the 5000-6000 MW daily load. Nowadays, the increasing price of debt, the low subsidy do not create a positive climate for this small units. This process was driven mainly by the gas motor vendors.

2) Biomass

Four coal-based power plants were built in the middle of the 50's, with 90-120 MW capacity, typically with 30 MW units (Ajka, Tiszapalkonya, Pécs and Borsod - see Fig. 1.). The price of coal has increased, the emission has been strongly limited. Thus the energy generation permission of these plants was not
renewed, these plants had to be closed. In order to survive the staff of the plants launched a new strategy. The fuel has been changed.

Fig. 1.: The Ajka power plant

In the EU the renewable biomass is a material with a future, so the boilers were rebuilt for burning biomass. Biomass means minced wood and saw dust. It is used purely in Ajka, Pécs and Borsod (see fig.3.), and used a special mix of 20% saw dust and 80% coal in Tiszapalkonya plant (see fig. 2. and 4.).

The results are two folded:

- The plants can run in the market environment
- The old facilities (depreciated closely to zero) works some years more
- The plant staff and knowledge exists more
- The approx. 4 times 30 MW is only 2% of the whole energy consumption of the country
- The environment is not so hardly polluted
- Some wood material is burned instead of using as row material for paper or furniture material
- The wood capacity of the forests do not allow increase the production

Fig.2.: Coal and saw dust on the conveyor belt, running to the mill of Tiszapalkonya

Some steps forwards can be the usage as fuel the "energy grass". Some experimental cultivation is in process.

Fig.3.: Logs arrive from the forest to Borsod plant

Fig. 4.: Heap of coal and saw powder at Tiszapalkonya

3) Wind power

Hungary has a medium wind potential. Only 4 demonstration wind turbines have recently been built with total 3 MW capacity (Kulcs, Inota, Mosonszolnok I-II - see fig. 5.), but many investors made optional land purchase with concession for building wind farms. The planned capacity reaches 250-300 MW. Any investment in the REN sector can be profitable only with strong subventions. Entering the European Union, this investment climate can be positive, the development can be sudden.
The detailed energetic wind map will be prepared for 2005.

Fig.5.: New wind turbines at Mosonszolnok

Some aspects of the wind power application:
- The wind power is a good business for the turbine vendors, but has a really low ROE for the investors
- The landscape strongly changes by the wind farms
- One must count with the secondary
- environmental pollution, too (metal poles, plastic parts, etc.)
- Makes the network control more difficult
- Noise generation
- Is danger for the birds

4) Combined cycle

In the 50's the heat centres and the power plants were built and operated separately. Some plants were built to supply the heavy industry with steam (see fig. 6.). Since than most of the power plants has had heat production duties/contracts, and most of the heat plants built in generator units, too. This process has a positive outcome for the environment, but the heat schedule driven electricity production makes the control of the power system complicated. Many heat consumers break off from the central heating system, to arrange autonomous heating systems for their houses, flats.

The Inota plant was built to supply the aluminium blast furnace with electricity (see fig. 7.). The 52 MW coal fired plant has been stopped. For demonstration purpose a 0,25 MW wind turbine was set up. At the right side of the picture a 2 x 85 MW gas turbine can be seen.

Fig. 6.: A 40 years old 30 MW heat-coupled unit at Pécs power plant

Fig. 7.: Wind, coal and gas turbine plant at Inota.

B. Controlling problems

Hungary had a centralised, hierarchical power system control with good performance. Due to the deregulation and trade liberalisation the power system control is also in transition. The paradigm has been changed from "*searching the best technical solution*" to "*searching the profitable solution*". The distribution of the DG and the possible development of the REN (wind) applications cause new anomalies:

- For the OPP it is hard to manage the control and schedules, the balance energy
- The OPP does not result in economic and technical optimum, the small DG units have lower efficiency than the large combined cycle gas turbines
- It is hard to estimate the wind generated power and energy, hard to plan the balancing capacity
- Because of the existing long term Power Purchase Agreements (PPA) there is not enough capacity for the free market, for the day ahead spot

The OPP distorts the clear spot market

In order to encourage the DG and to apply the Renewable Energy Application (REN) the energy authority introduced the Obligatory Power Purchase (OPP) by the distributors (subsidized by the government). This is a guaranteed price,

roughly 1,5-2 times higher than the average market price. The difference between the market and the subsidized price is paid by the government. The operation of the small DG and REN units is not scheduled or schedulable.

III. Other problems

A. Unit of the trade

The traditional control system (SCADA and Automation Generation Control) was developed on the "gross" energy, generated by the generator units, measured on the connection point of the machines. The energy traders deal with trading units, the net production of the power plant. It can be bought, sold, transmitted. The traders handle the power plant as one unit, the ISO as independent generator units. Sometimes deals are settled with the sold energy, but who pays the loss off the unit transformer? The gross production has momentary power measurement, but the net quantity has only 15 minutes energy measurement, etc. Nowadays the ISO started a project to synchronize these anomalies and find the common (net) platform of the future.

B. Identity of the ISO

There are many possible organisational structures of deregulated markets. In Hungary the "independent" ISO has many "non independent" duties:
- Some parts of the network (120 kV) belong to private companies. The network parts should be used as a parallel back up of the high voltage net. There are some conflicts of interest how to share the loss, how to schedule the maintenance. In the firs step the possible TSO forming is taken into account, where the state owned high voltage network should be melted with the ISO.
- The ISO works a market organiser. Some movements strive to make an independent Power Exchange

C. Backwards of the free market

After one year of the liberalisation 15% of the consumed energy is bough from the free market, in the frame of bilateral contracts. After some provisional limitation of the import ratio (to 50%) the import is limited only by the transmission capacity. Many traders imported flat energy from Ukraine, Slovakia and Poland. The Hungarian system has no pump-storage plant, so all the load anomalies are balanced by hydrocarbon plants. For the high flat import ratio (up to 6-700 MW) the flat production of the nuclear power plant must be reduced to 80-90% at night- time. Through this the "non liberalised" public customers must pay the cost of the "cheap" energy purchase of the large eligible customers.

D. Market place

Over 80 % of the market belongs to the former central Hungarian Electric Energy Company (MVM). Through this unbalanced position the interests cannot be articulated for a real free market, and also there are no free capacities that should make the market liquid. In spite of it the day ahead market has just started and there are negotiations about the set up of Power Exchange or Electric Power Exchange.

E. Cross border capacity

The Hungarian network is well sized for the internal generation and consumption. Some bottle necks will cease this year The network problem has two sources:
- We have a really strong North - South and East -West transit load, and this will be increased during the next years. Before opening of the Hungarian-Croatian 400 kV line one doubted the real use of this line. Today it is loaded with 400-600 MW.
- The cheap import overloads the cross border capacities and the N-1 criteria cannot be held anymore. Some transactions can be limited for security reasons.

IV. Actions for resolution

In the liberalised Hungarian electricity market the state owned public wholesaler, the MVM represents the state. It has more rights, as the other equal partners. MVM makes the state investments to maintain the security of the energy supply and to provide path for the international transits, too. For the internal transmission a new 80 km long 400 kV line will come in operation this year between Paks and Pécs. At the Slovakian border planned a new line is planned, as well. There are some investigations for reswitching the Ukrainian - Hungarian 750 kV line for the support of East-West trade.

The Hungarian Energy Authority (MEH) started a project to synchronise the UCTE recommendations with the Hungarian regulation. It takes years for the directives of the Operational Handbook to come in practice.

The ISO (MAVIR) runs a project for clearing the situation about the measurement and settlement points of the power plants. A recommendation will also be made on "how to enter the net" with new units.

In the European Frame Program FP5 run the project "European Network for Integration of RES+DG - ENIRDGnet". Hungary joined this project and participates in the dissemination of the results, related to the European prospect of the application of the DG and REN technologies.

V. Conclusion

The deregulation can be made in several steps, it is more a process then a simple decision. In parallel with the deregulation many new phenomena emerged (all over the world). The answer can be found country by country. The quantity of the renewable energy increases slowly and the amount is limited. Because of the price and lack of gas and the coming controlling problems the uncontrolled increase of the small gas motor applications undesirable. The emerging interregional trade brings many local problems.

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VII. BIOGRAPHIES

Peter KADAR, was born in 1963 in Budapest. He received his M.Sc. in 1987; PhD. in 1994 at the Technical University of Budapest. His preferred topics are the expert system applications to the power systems.

He worked for the Power Station and Network Engineering Company (EROTERV) till 1991 and for the KFKI - MSZKI IAFO, Budapest (Research Inst. for Measurement and Computing Techniques, Department of Industrial Application) till 1996. In the next five years period he was the managing director of DYNAdata Ltd. (medium size software development company). In the industry he dealt with the power system control including different applications of intelligent functions, like load-forecasting, simulators, alarm filters, etc.

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