

Ensuring the system Adequacy in the Romanian electricity market

The electricity only market forces should normally lead the electricity system to a medium term security/adequacy. There are concerns however, especially after several relevant events happened, that in real life the electricity only market cannot assure the adequate capacity at all moments. The signal given by a high electricity price could have different roots as a lack of producing capacity, energy resources, congestion.

The Romanian Energy Regulatory Authority developed in July 2007 a regulatory framework for a capacity mechanism as a first step in order to ensure a more specific signal, to ensure on medium term the adequacy of the system and reward all generators which contribute to effective competition or to system reliability.

The paper will contain a short description of the present situation of the electricity&heat system and of the regulatory framework in Romania, followed by an analyses on different capacity mechanisms. The paper will focus on the step achieved in this field in Romania followed by different further developments which are considered to be implemented in future.

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I. Introduction

The electricity market started in Romania in year 2000, when the Romanian Energy Regulatory Authority (ANRE) regulated the trading relations between the electricity producers and suppliers and when the first electricity sale/purchase contracts between them were signed. Since its establishment, the electricity market has recorded a continuous progress both in increasing its opening degree and in the increasing of the participant numbers, but also by the diversification of the contract types.

The electricity system is organized today in production companies (the biggest is SC Hidroelectrica SA, followed by SC Nuclearelectrica SA), one transport and system operator (TSO) CN Transelectrica SA, eight major electricity distribution companies (five of them privatized with foreign investors) and more than 150 suppliers. Even the opening degree is 100%, not all is used. The electricity market has two parts: the regulated one with regulated quantities and prices on portfolio contracts for households and assimilated consumers, and the competitive side.

At present, according to the Electricity Law, the Ministry of Economy and Commerce is responsible to issue the long-term development strategy of the electricity system, the TSO to issue the medium term development plan of the transmission network which has to be endorsed by ANRE and there is not a medium term capacity mechanism.

The paper starts from the question on the capacity adequacy of the electricity system. Can this task be as-

sured by electricity market only? Normally, the electricity market forces should lead the electricity system to a medium term security/adequacy. There are concerns however, especially after several relevant recent events happened in the recent past, that in real life, the electricity only market cannot assure the adequate capacity for both reliability and effective competition at all moments. Just on average it is not enough to assure them.

II. Present Romanian situation

The Romanian net installed capacity is 17 GW and the peak load is smaller than 10 GW. This means a huge overload to cover overhauls, outages, non-usable capacity, system services reserves and a remaining capacity. The system service reserve is comparable with the other UCTE countries and the non-usable capacity is comparable with similar systems. The remaining capacity is greater than 15% over the load. The present UCTE's policy is to consider a requested remaining capacity of at least about 5% from the total net installed capacity, so, the "number of megawatts" which don't have to deliver electricity and which don't have to provide even system services reserves is high.

It is in the benefit of the society to implement a mechanism to allow to the most inefficient units (limited value provided by UCTE) to supply the security/adequacy for the electricity system without any operating hour and, in the same time, to give the security on the capacity adequacy not on short term where there are in charge other mechanisms, but in future, on medium term. This medium term has to be set on at about 4 years, in order to allow, if there is the case, the necessary time to actually build a new power plant.

The results obtained from the simulations realized for the portfolio contracts establishment for year 2004, highlighted that the operation of 150 MW in units running on lignite with efficiency smaller than 25 % for a production of about 700 GWh, leads to a reduction of electricity delivered by efficient units running on lignite with a higher efficiency (higher than 30%) in order to respect the maximum annual quantity of lignite available for electricity sector and to an increasing of the electricity production in units running on hydrocarbons. The supplementary cost at production system level was about 12 mil \$. The supplementary cost for loss procurement of the TSO represents about 0,7 mil \$. We have to mention that the unit considered

in analysis doesn't have to operate in the base simulation and there is not congestion in that area.

The base simulation performed for the portfolio contracts establishment models the entire electricity and heat system, unit by unit, including the co-generation units and the thermal capacity installed in each plant (co-generation plants, heat boilers). The portfolio contracts (hourly quantities and prices) are determined for each electricity production company based on the annual tariff and annual quantity specified by ANRE and on the total hourly electricity production of each company and the system marginal cost obtained from simulation. The simulation is performed with economic loading order of the units after considering the restrictions (national annual quantity of lignite and hard coal, water restrictions, system restrictions, congestions etc.). The producer doesn't have to produce the entire contracted quantity in its capacities, being allowed to buy electricity from the market.

By setting on the regulated side of the electricity market, for medium term (5 years), the portfolio contracts for big power producers and the electricity contracts for the independent power producers/self producers and for long term, the power purchase agreement for the nuclear unit, a part of the medium term electricity system capacity adequacy is achieved. Another part is achieved by setting on the competitive side of the electricity market, the electricity contracts with the eligible consumers.

The portfolio contracts established on regulated methods together with the appropriate bidding mechanism allow together the scheduling of system operation on economic bases.

At present, with a market totally opened, the share of portfolio contracts will decrease. In the same time, the total former vertical integrated electricity company is split now in many companies and the present mechanism to establish the portfolio contracts can make a company to have portfolio contract for a half of unit which complicate without reason the operation of the plant. This mechanism is now under revision process (initial contracts, initial option contracts instead of portfolio contracts).

Having in view that the construction time for power plants is at least 2 - 4 years, the danger we can notice at the present Romanian market is that in order to keep for future system needs this already installed big "remaining capacity", high tariffs for portfolio contracts are set even for some very inefficient companies/units

and quantity of electricity are settled according to the tariffs even for these very inefficient units. By their operation, millions of dollars are lost. The fuel resources are not properly used and the environment is polluted. More, there is not a correct signal for new power investors.

In this respect, the capacity reserve, an ancillary service which has the goal to assure of adequacy in the National Power System, has been implemented starting from 1st of August 2007 as a result of approval and published of a certain methodology by ANRE. This document - Methodology for establishes, implementation and use of ancillary services capacity reserve – was approved by Order no.19/2007 and published in Official Gazette of Romania no.507/30th of July 2007. The capacity reserve is an additional power reserve requested by TSO, assured by power units which can start and upload in a shorter time than 72 hours to assure power consumption in special conditions.

The methodology is applied by TSO for: determination of requested quantity for capacity reserve, selection of dispatchable power units for this service, nominalization of suppliers for this service, use in service of capacity reserve, ending of service. It is implemented also by the suppliers running power units qualified for capacity reserve and by ANRE approve tariffs and regulated quantities for capacity reserve.

Based on a procedure endorsed by ANRE, TSO estimates, using computation methods for every next year, gross electricity consumption (for each month), maximum number of hours for not supplied electricity, capacity reserve (for each month).

There are defined two stages in implementing the capacity reserve. The 1st stage started from August 2007 and ends on December 31, 2008.

The power units are selected by TSO based on a certain criteria as: the unit is off running and has no contract for ancillary services or for power, the unit has no environmental restrictions, the unit is not restricted to power flow, the unit is not in rehabilitation or retrofitting program, the unit has proved its availability, the supplier proved fuel availability, the period for which the unit can supply this ancillary service, geographical area of the unit, the period of time necessary from the appointment of the unit till to available status of the unit for this ancillary service.

Based on TSO's information and calculation and suppliers offers, ANRE approves the maxim price and the requested quantities of capacity reserve. The appoint-

ment of the units is settled based on the bidding price, no higher than the maxim price approved by regulator, if the offer of the supplier for capacity reserve is greater than the requested quantity. The appointment of the units is settled based on a regulator ordinance, if the offer of the supplier for capacity reserve is smaller than the requested quantity. The suppliers are paid by the bidding price, no higher than the maxim price.

TSO and the capacity reserve suppliers settle dispatchable power units based on a contract. The use of capacity reserve is possible only through dispatch order for a period no less than three days. Capacity reserve is rebuilt in no more than two weeks from the starting point of running this ancillary service.

On the balancing market, the units will be paid with maxim price in the first three days and in the following days will be pay as a result of the bids on the balancing market. The power bidding on the day ahead market of these units is forbidden

Ending of service for reserve capacity before the contract period is allowed in specified conditions: force majeure, TSO requirement and regulatory approval if the power unit has not achieved contractual tasks at least one time after penalty payment, when the power units is above the maximum level allowed, when the license of the supplier was suspended or retracted, in other cases including contract suspended but only with regulator approval.

The characteristics of the 2nd stage (starting 1st of January 2009) has to be defined.

III. Existing and new capacity mechanisms

According to the Directive 2003/54/EC of the European Parliament, "security" means both security of supply and provision of electricity, and technical safety. Article 4, Monitoring of security of supply, highlight the monitoring activity including "covering the supply/demand balance on the national market, the level of expected future demand and envisaged additional capacity being planned or under construction,..., measures to cover peak demand and to deal with shortfalls of one or more suppliers". Article 28, Reporting highlights that "special attention will be given to measures taken in Member States to cover peak demand...". Article 7, Tendering for new capacity, specifies in accordance with Article 9 (Tasks of Transmission System Operator TSO – "responsible for: ensuring the long –

term ability of the system to meet reasonable demands for the transmission of electricity, contributing to security of supply through adequate transmission capacity and system reliability, etc.”), that the TSO may be designated as the body responsible for organizing, monitoring and controlling the tendering procedure for new capacity”.

System reliability can be described by two basic and functional attributes: adequacy and security (source UCTE). The adequacy measures the capability of the power system to supply the load in all the steady states in which the power system may exist considering standard conditions. The TSO should have or promote the mechanisms which allow in the most efficient way to fulfil these requirements in the market environment.

A new Directive on Electricity Supply Security was proposed by EU Energy Commission in order to “complete the process” and maintain adequate margins in both power transmission and generation.

The present commitment to assure the security is very strong, especially after all events happened in recent past. These lessons showed that even liberalization requires adequate reserve margins and as it was expected, they decrease after liberalization process. There are voices which expect that competitive markets will provide adequate levels of security (eg many in UK), but also others considers that markets are unlikely to provide enough adequacy in “real life”.

An energy only model exists in England and Wales under the New Electricity Trading Arrangements - NETA framework. There is not in place a capacity adequacy mechanism. The introduction of NETA led to significant drop in wholesale price, which was followed normally by a mothball process of the un-efficient plants. At present, the wholesale prices increases and there is a need for a un – mothball process or demand side management.

In order to reduce the response time of the investors to the electricity price signals, in Ireland, as part of the wholesale market transition, a scheme to facilitate the rapid construction of new capacity is considered for adoption. Even with this reduction, the time difference between the electricity market signal and the commission of the plant remains.

In 1998 when the National Electricity Market Management Company - NEMMCO was created, there was enough capacity in the Australian system. NEMMCO had the role of “reserve trader” and to evaluate the system adequacy. There isn't capacity remuneration.

The system is relying only on market prices. Recently, there was a need to double the price cap (value of the load lost) and there are discussions about establishing an operating reserve market.

The capacity payment mechanisms reward companies for making capacity available. An analyse performed in year 2004 showed that the mechanism was abandoned in England and Wales, but still used in Argentina, Colombia (under revision process), Spain and Northern Ireland (proposed). The price was/is/will be set by the loss of load probability and the lost load value (England and Wales), a value of 10\$/MW/hr in order to have enough capacity even for extra dry years (Argentina), Pt0.8/kWh*monthly domestic demand (Spain) or loss of load expectation and a capacity margin of 20% (Northern Ireland). In the Colombian existing mechanism, monthly equivalent capacity in a long term model for each capacity and the fixed cost of an open cycle gas turbine are considered. The fixed costs are considered theoretically as variable costs and capacities have to demonstrate the fuel supply agreements.

The payment is not provided by a market mechanism and there are difficulties in determining the volume and allocation of the payments to generators. By paying only the present generators, this mechanism doesn't provide a guarantee that the adequacy will be met in medium term if it is met at present. Some generators decommission in medium term because of the completion of their life time.

It looks to be more appropriate that instead of considering only the capacities with fuel contracts, to implement a capacity market with medium term capacities offers and a penalty system who discourage an over estimated capacity.

The “reliability contract mechanism” proposed by Prof. Perez-Arriaga for Colombia considers that the system operator buys an auction on behalf of consumers a quantity of reliability contracts determined by regulator, a penalty for non-delivery and a time horizon of the auction longer than a year.

The capacity markets implemented by PJM and NY-ISO are even more complex. Each supply company has to show in advance that it has sufficient capacity to meet its forecast plus its share of the reserve margin according to the instruction from PJM or NYISO. The capacity tickets are used on daily and monthly market organized by ISO to allow retailers to adjust their holdings and to bring them in line with their obligations.

For a fail to meet the assigned capacity requirements, the charge is calculated on the cost of a new combustion turbine, installed and connected to a transmission grid. Even so, a half of a year penalty works to be cheaper than building a peaking generator.

Three regional Independent System Operators (PJM, NY and NEE) formed in 2001 the Resource Adequacy Model Group in order to develop better rules for the capital adequacy markets. The proposal is on procuring capacity three years in advance in an annual auction by each ISO to meet its aggregate requirements. Many experts consider that a capacity market can solve the security of supply issue along the electricity market and in this direction are both, Mr. Tom Welch's proposal and Federal Energy Regulatory Commission - FERC's proposal. They both look a few years into the future to ensure adequacy, but they differ by the considered link between any particular load and any particular capacity etc.

IV. Conclusions

The electricity market can solve the security/adequacy problem, but in real life it is questionable to wait for it alone to do it. The price signals given by the electricity market is correct and it will encourage the capacity build, but the problem is what happens with the electricity prices, the continuity of electricity supply and associated political problems until such capacity is built.

The problem is more acute in Romania considering the long time requested by now for rehabilitation of different plants on coal or hydrocarbon (for some units more than 10 years), the long time requested to finalizing the first nuclear units and then of the second one with a remaining levelized cost less than 30 \$/MWh.

That's why we consider that a mechanism to ensure today enough capacity for medium term (about 4 years) and to put on market basis this managing activity of the surplus capacity could be appropriate.

It is sustainable for the society to ensure a market mechanism, which provides the financial resources for units offering medium term adequacy of the electricity system in order to let the in-efficient units which can provide adequacy, not to operate.

A medium term capacity market could give the correct signal for new efficient units in order to assure the medium term adequacy of the system and also it could give the surety on an adequacy of the system from capacity point of view. It recognizes in time the potential capacity shortfalls (or surpluses) before they actually occur, thereby facilitating the capacity investments that would avoid the price volatility that results when electricity supply becomes limited. The implemented mechanism have to allow that the cost of security to be met by the whole system, not just the companies or consumers where the spare capacity is held.

TSO should determine the needed capacity for each year of the near future period of time based on the estimated demand received from suppliers and long term system and generation planning studies. This period of time should be about 4 years in order to allow the building of new capacity. A longer period would bring the estimation errors and stranded cost in unneeded capacity. TSO could awards certificates for each capacity available in the target year according to the net available long term capacity (or differentiated by various categories of reserves/plants) in order to be used on the market by each production company.

The market mechanism should require to each supplier to medium term secure or contract for sufficient reserve capacity to match his customer profile according to the system operator specification, bilaterally/ offers to the capacity market operator/ via auction. Those consumers who need higher power reserve should buy more reserves. The money would be paid in the year in which capacity is promised. A penalty system has to be considered for both demand side and supply side of capacity.

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