



Day-ahead electricity market in Russia

The day-ahead market is the central place for electricity trade in Russia. In 2011, a total of 213 buyers and 51 producers of electricity were registered as participants of the day-ahead market. The total amount of electricity traded in the day-ahead market was 864,9 TWh which constitutes approximately 80,5 % of all electricity volumes traded in the wholesale market (incl. regulated contracts, day-ahead market, balancing market) in 2011. The total market turnover was around 18,4 billion Euros.

The day-ahead market model in Russia employs the concept of bid-based, security constrained economic dispatch with nodal prices. Usually, the nodal pricing model is used in the markets where high transmission losses and insufficiency of transmission capacities between regional power systems make application of uniform price auctions economically unacceptable. Electricity prices are defined for each location of the grid and they include the marginal cost of produced electricity, transmission costs and the cost of power losses.

The commercial operator "ATS" (or power exchange) supervises operation of the day-ahead market of Russia in close cooperation with the System Operator (SO). The computation model used by the SO and ATS to evaluate day-ahead market prices includes around 8100 nodes, 12600 power lines and 900 groups of generation units. The market operates without price caps and the "Federal Antimonopoly Service of Russia" (FAS) monitors the day-ahead market for the purpose of market power detection.

Prior to the beginning of the day-ahead market auctions, the ATS and SO carry out the procedure of unit commitment. The objective is to define the optimal set of generators to meet the expected demand over a future week horizon at minimal total cost of production and also reduce the number of the power units' start-ups and shutdowns over the given time period. The time horizon for which optimal turn-on and turn-off schedules of generation units are determined is one full week that begins on Saturday. At the latest four days before the period starts, producers must send notifications to the SO about each generation unit's state, its technical parameters and declared generation schedule at each hour of the concerned period. Approximately at the same time, the commercial operator receives price offers submitted by producers for the purpose of participation in unit commitment procedure. The offers should contain production plans and maximal prices of electricity production for every generation unit of a producer at each hour of the prescribed one-week period. In addition, the producers inform the commercial operator of start-up costs of their generation units. The ATS transfers the collected data to the SO which, in turn, based on own forecast of hourly demand within the territories of Russia solves the unit commitment problem taking into account

technical constraints of the power system. The nuclear, hydro power plants and must-run heat generators, however, should operate regardless of market prices and they are excluded from the procedure of unit commitment. Therefore, the solution defines a proper set of remaining heat generators to produce for the period from Saturday to Tuesday. On Monday the SO updates results of unit commitment solution for the last three days of the prescribed one-week period.

Trading in the day-ahead market is organized as a closed auction with one trading cycle per day. Five hours before the day-ahead market gate-closure at latest, buyers must declare to the SO their maximal planned consumption at each hour of the following day of actual delivery. Based on this information and the unit commitment solution, the SO defines the operational constraints of the available generators and transmission resources for each hour of the following day. The data is then transferred to the ATS which, in turn, collects from the market participants their supply and demand bids for the day-ahead market auction. The prices in the producers' bids, however, should not be higher than the maximum prices they have earlier posted in the offers utilized by the SO for solving the unit commitment problem.

After the gate-closure of the day-ahead market, the ATS holds a competitive auction in which the amounts and marginal prices of electricity are determined for each location of the system. The nodal prices are obtained for each hour of the following day in result of maximization of social welfare of the market subject to operational constraints of the power system derived from the SO. In the day-ahead market producers also get one-time payments for start-ups of their generation units in case these units were scheduled to turn on in result of unit commitment solution. In order to collect necessary amount of money to cover start-up costs of assigned generators, the commercial operator increases financial obligations of buyers in the day-ahead market proceeding from data on irregularity of their monthly consumption.

The balancing market is an aftermarket to the day-ahead market. The SO runs the balancing market independently 12 times per one trading day using the computational model of the day-ahead market. The objective is to adjust production plans of generators in order to meet the expected load over a next two hours horizon. In the balancing market, the SO utilizes the same offers of generators that they have posted earlier to the day-ahead market. Nevertheless, the producers have right to submit "quick" price accepting offers for increase or decrease of electricity production no later than 90 minutes before the next auction. The short-term electricity demand is forecasted by the SO and customers are not allowed to submit offers to the balancing market auctions. The trade schedules updated in the balancing market are utilized to estimate deviations between planned and actual production and consumption at nodes. The prices of deviations depend on reasons that caused these deviations.