



## Unit Commitment in the Russian electricity market

Prior to the beginning of the day-ahead market auctions, the Administrator of Trade System (ATS) and System Operator (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.

The SO organizes the unit commitment procedure as follows. No later than 16.30 (MSK) on Tuesday, producers send notifications to the SO about each generation unit's state, its technical parameters and declared production schedule at each hour of the concerned one-week period. On the other hand, the commercial operator (ATS) receives the price offers from producers submitted for the purpose of participation in the unit commitment procedure. Producers should submit their price offers no later than 12.00 (MSK) on Thursday. The offers must contain production plans and maximal prices of electricity production for every generation unit or group of generation units of a producer at each hour of the prescribed one-week period. In addition, producers inform the commercial operator of start-up costs of their generation units. At 13.00 (MSK) on Thursday at the latest, the ATS transfers the collected data to the SO which, in turn, based on own forecast of hourly demand within the territories of Russia and forecasts of electricity export and import solves the unit commitment problem taking into account transmission constraints and the required amount of reserves in the power system. The solution defines a set of power units committed to cover the expected system load and power losses over the period from next Saturday to Tuesday. In addition to that, also a preliminary set of generators to produce over the period from next Wednesday to Friday is determined. On next Monday, the SO updates results of unit commitment solution for the last three days of the prescribed one-week period. The SO also has right to re-examine a set of committed units more precisely two days before the day of actual delivery.

It is important to note that some groups of power stations in Russia should be committed irrespective of the result of the unit commitment procedure. For instance, turn on/off state of nuclear and hydro power stations is fixed prior to the procedure of unit commitment. In addition, the SO establishes a list of heat

generators which are given a must-run status for reasons of steam supply of customers or for reasons of power plant's secure operation (Fig.1.). In compliance with market regulations, the prices which these heat generators submit for the purpose of participation in the unit commitment procedure must be equal to their regulated tariffs. Finally, the SO assigns heat generators that must stay on-line for reasons of the power system's safety operation. In such case, a heat generator is committed regardless of production price in his offer.

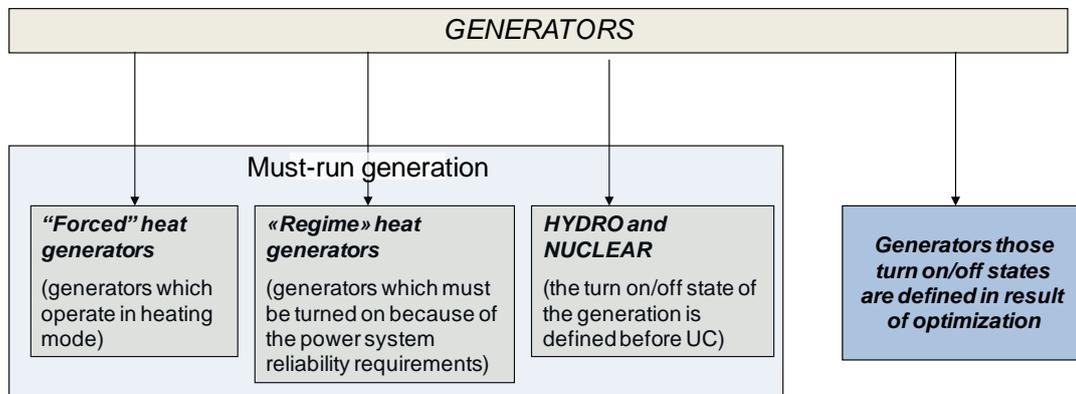


Fig. 1. Must-run generation in the unit commitment.

In accordance with the market rules, only those producers whose generation units were selected to produce in unit commitment are allowed to participate in the day-ahead market. It is important to mention that committed generators cannot be switched off in result of the day-ahead market auctions. Therefore, in order to prevent possible abuse of market power, the prices submitted by generators to the unit commitment procedure are later utilized by the commercial operator as "price caps" for the bids sent by these generators to the day-ahead market.