

SC C5 – Electricity markets & regulation
PS 1 - The changing nature of markets and ancillary requirements**Market tools for managing thermal generation fleet.**

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The existing structure of generating capacity in Russia is historically characterized by a significant share of thermal power plants in the structure of installed capacity - 68%. The share of hydro and pumped storage power plants is 21%, nuclear power plants 11%. Renewable sources of electrical energy in the structure of installed capacity is less than 1%. This feature is primarily due to the presence of fuel sources closely located to the generation facilities, widely distributed network of pipelines for transporting natural gas, the principles of construction the transmission grid (the presence of significant power flows over long distances), a significant geographical distance from the main load centers to generation facilities, extensive use of centralized heat supply systems (combined production in thermal and electrical energy).

Historically, the main part of commissioning generation equipment of thermal power plants, using steam cycle technology, occurred in the 1960-1990 years of the last century, starting with power units of relatively small unit capacity, up to 300 MW and ending with units of large unit capacity of 800 MW. As of 2019, most of the turbines has an actual mileage exceeding the standard service life, while stay the current conditions by 2030, the share of such equipment will be more than 75%. The first wave of the investment process in the power industry of Russia (2008-2018), the main purpose of which was to attract private investment in energy sector, made it possible to upgrade only a small part of the significantly older and inefficient capacities decommissioned by the owners.

The complex of market mechanisms in the electric power industry existing in Russian at current time frame as a whole meets the tasks assigned to it. The capacity market model used since 2016 creates incentives for the decommissioning of old (commissioned more than 55 years ago) inefficient capacities, the capacity volumes operating in the “forced” mode (receiving “off-market”, increased payment) are reduced, created mechanisms for maintain balance reliability in the medium term (up to 4 years ahead). Price signals created in day-ahead market is not highly volatile and are characterized mainly by seasonal fluctuations. At the same time, the existing complete payment from capacity market and day-ahead market is

not enough to carry out a set of events to replace the main elements of power equipment: a boiler and / or a turbine.

In order to attract investments for modernization at the facilities of thermal power plants, a comprehensive modernization program was developed, consisting of 2 main parts:

- To support of non-capital-intensive modernization projects (replacement of non-main parts of boiler and / or turbine equipment) - adjustment of parameters of the capacity market: transition to a more long-term capacity selection period and updating the price parameters of demand slope curve.
- To support of capital-intensive modernization projects (complete replacement of boiler and / or turbine equipment, replacement of the main parts that determine the life cycle of the entire generating facility) - a mechanism for competitive selection of modernization projects: selected by increasing by LCOE for equipment with higher capacity utilization factor. A market participant whose project has passed the selection receives an obligation to perform the declared events, maintain the generating equipment in working condition for 16 years and receives payment of the costs incurred (minus the income from the day-ahead market), taking into account inflation and the rate of return.