

The Energy Law (“Official Gazette of RS”, no. 145/2014) defines ancillary and system services in the electric power system. Ancillary services are “services provided by users of the electric power transmission and distribution system to the transmission and distribution system operator in order to provide system services” and system services are “services provided by the system operator which are necessary for providing a safe, reliable and stable operation of the energy system.”

The Law specifies that types and the scope of ancillary and system services are to be defined by the Electricity Transmission Grid Code, and the method of providing system services by the Electricity Market Code. In the applicable Electricity Transmission Grid Code, primary, secondary and tertiary control, voltage regulation, purchase and sale of electricity as a compensation for unintentional deviations of control area and black start and island operation of generators are defined as system services. The amount of power which must be reserved for the needs of primary, secondary and tertiary control has been defined and it has been specified which part of that power must be supplied from the production units connected to the transmission system. However, this Code must comply with new legal regulations, which indirectly specify that ancillary services are primary control, voltage regulation, black start and island operation and that their prices are regulated, and that system services are power reserve of secondary and tertiary control and prices of power reserve lease can be regulated, and that the Agency will analyze until when these prices shall be regulated.

Determination of prices of system services

In determining the prices of system services, which are defined by the applicable Electricity Transmission Grid Code, different methodological approaches for determining the prices depending on the type of service can be applied. Although these services can also be provided by end buyers of electricity, practically in the electric power system of Serbia, services are provided only by the electricity producers. In order for power plants to participate in the provision of service of voltage and reactive power regulation, i.e. to have the capability of black start and island operation, the adequate equipment must be installed. On the basis of the purchased value and the expected lifetime of the equipment, the amount of costs to be taken into account in determining the price for these services is set. For the provision of the primary and the secondary control, it is also necessary to install the appropriate equipment, but in addition to these costs, the price should also include the lost revenue in the electricity market, if the loss of revenue really exists, because for these services, the production capacity is reserved which must be available to the system operator at any time. When it comes to the provision of the tertiary control, there is no special equipment, the production capacity is reserved and the price should include only the lost revenue in the electricity market. Finally, the price of purchase and sale of electricity as a compensation for adverse deviations of control area may be obtained on the basis of the

balance energy price, as the energy for these purposes is obtained from the same capacities. Considering the above mentioned methodological solutions, the most interesting is the question of determining the price of capacity reserve lease for the provision of primary, secondary and tertiary controls. The primary control is automatic and normally it can be provided by all producers connected to the electric power system. The provision of the primary regulation is typically the obligation of power plants to the system to which the power plants are connected and in some systems, this service is free of charge (France, Spain, Greece, Hungary...). Having the above mentioned in mind, the Energy Agency has estimated that electricity producers in Serbia are also obliged to provide this service without financial compensation, so the methodology, on the basis of which prices for reserving the capacity for system services of secondary and tertiary controls, is left to be determined.

Methodology for the determination of the price for secondary and tertiary reserves
Prices of system services of secondary and tertiary controls shall be determined by the mechanism of compensation for undelivered electricity value in the electricity market due to the reservation of capacities for these purposes. Namely, electricity producers, whose power plants are technically equipped and operationally ready to provide these services, are required to provide them upon the request of the transmission system operator. This means that they are obliged to keep the part of the operationally ready capacity in reserve and that they are unable to engage it according to their own will, at the time and in the scope which suits them, in order to sell electricity in the electricity market. Because of this, producers suffer some damage, i.e. are unable to generate revenue from electricity sales (lost revenue), so the prices of these services are determined in such way that the revenue is compensated for. The height of the lost revenue is specified by determining the lost energy and the price at which the lost revenue will be calculated.

In determining the prices of system services, the way in which they are provided in practice is also considered. When it comes to the secondary control, the power range is provided, as a rule, the controller in the power plant which provides this service is set in such way that the power plant operates with a mid-range power, so that, if necessary, this service can also be activated both in the direction of power reduction and in the direction of power increase. In the case of tertiary control, there is a separate reservation of the capacity in the direction of power increase and the capacity in the direction of power reduction. It is indisputable that the electricity which will be freely offered in the market cannot be produced from the capacity reserved in the direction of the power increase. However, the question is, whether the obligation of providing the capacity in the direction of power reduction causes the loss of revenue of producers, taking into account the conditions in the electricity market and the established rules for determining the electricity price in the balancing mechanism? Having all this in mind, at this point it is estimated that the capacity reservation in the direction of

power reduction is free of charge.

In determining the prices of system services of secondary and tertiary controls, the data available should be borne in mind, since these prices must be determined before the end of the current year for the following year, so that energy entities, the transmission system operator and electricity producers, could enter into relevant contracts on the provision of these services on time.

In determining the prices of secondary and tertiary controls for 2015, powers of production capacities have been taken from the power balance which must be kept in reserve for the purpose of providing these services. It is assumed that the hourly use of power plants capacity planned for providing the reserve, is equal to the hourly use of total installed capacity of these plants engaged for the purposes of the annual production of electricity from the power balance. In determining the hourly usage, power plants are analyzed separately depending on the type - run-of-the-river hydroelectric power plants, pumped-storage hydroelectric power plants and thermal power plants.

By multiplying the capacities which are in reserve and their assumed hourly usage, the amount of potentially undelivered electricity has been obtained. The amounts of potentially undelivered electricity calculated in this way are reduced by applying the appropriate coefficients - because of the reservation of the capacity for secondary control, it is assumed that 50% of the potential revenue will be realized from the sale of electricity in the market, and due to the reservation of the capacity for tertiary control, it is assumed that 75% of the potential revenue will be realized. Additionally, due to problems with coal in the Kolubara mine (floods), it is assumed that in the first half of 2015 there will be no electricity surplus which is not placed on the market due to keeping the secondary reserve in thermal power plants which use that coal for production - TPP "Nikola Tesla". According to the energy balance, in the first half of the year, for the secondary reserve in capacities of TPP "Nikola Tesla", 46% of the annual amount of energy is "reserved" which would be obtained from the reserved capacity for the secondary reserve. Since it is assumed that due to the lack of coal there would be no production from TPP "Nikola Tesla" to be offered on the market, the amount of potentially undelivered electricity from TPP "Nikola Tesla" is additionally reduced by 23% ($0,46 \cdot 50\%$).

The price on the basis of which the lost revenue due to the reservation of capacity for the needs of secondary and tertiary controls has been defined amounts to 41,53 € / MWh in 2015. This price is obtained as a weighted average of achieved average monthly prices of annual futures for continuous production in 2014, for 2015 on the stock exchange HUPX for Hungary, with a weighting factor of 80% and on the stock exchange EEX for Germany and Austria with a weighting factor of 20%. High weighting factor set for HUPX, as the largest regional stock exchange, is the consequence of the market merge of Czech Republic, Slovakia, Hungary and Romania in November 2014, which resulted in the increase in the

stock *liquidity* i.e. increased volume of trading. On the other hand, the biggest European stock exchange EEX is more stable, less sensitive to major changes in supply and demand of energy, and is therefore taken into account in determining the prices. The average monthly price of annual futures on the stock exchange HUPX has amounted to 43,14 €/MWh, and 35,12 €/MWh on the stock exchange EEX. Finally, the annual value of lost revenue due to the reservation of capacity for the needs of secondary and tertiary controls, has been calculated as the product of reduced amounts of potentially undelivered electricity, weighted stock price and the average euro exchange rate achieved in 2014. Prices are determined by dividing the calculated values of the services of secondary and tertiary controls by the powers which are in reserve for these services.

The transmission system operator is obliged to provide system services defined by the rules of operation, so that the operation of electric power system managed by it would be secure and stable. According to the existing, but also according to the new European labor rules which have been prepared and are to be applied, it has been envisaged that a part of the reserve must be provided from the capacities which are connected to the system. Therefore, in conditions of the existence of a dominant producer in the system, there are no conditions for establishing the market competition of different capacity bidders for the provision of the reserve, so it is necessary for the regulator to determine fair prices for the provision of the reserve. The paper describes the methodology by which these prices are determined based on the estimated lost revenue in the electricity market.

The Energy Agency of the Republic of Serbia will, through monitoring of the system operation and the electricity market, as well as in accordance with the changes in the Electricity Market Code, improve and change the methodology described. The possibility of defining more objective criteria for the determination of coefficients used in the methodology and the need to define a price for the provision of tertiary control in the direction of power reduction will be particularly analyzed.

According to the Energy Law, the Energy Agency of the Republic of Serbia has the obligation to estimate until when these prices should be regulated. In this procedure it must be estimated whether there are conditions for market competition which is primarily reflected in the presence of excess production capacities in the system and the existence of different producers which can offer capacities for providing system services.