

HERA (Croatian Energy Regulatory Agency) has started public hearings on Croatian TSO (HOPS) ten-year development plan of the transmission network from 2017 to 2026, with detailed elaboration for the initial three-year and one-year period and it will be held from October, 17 to October, 31 2016.

In conclusion of the document it has been noted that significant integration of wind power plants into the Croatian power system implies a significant increase of costs for ancillary services of secondary control and tertiary control for balancing energy, which now HOPS pays to provider of ancillary services (HEP Production) on the basis of bilateral agreements. Greater integration of WPP will substantially increase costs of tertiary reserves for balancing, and these costs will increase their share in the total balancing costs.

The total cost of balancing services in 2015 amounted to EUR 36 million out of which fixed part of the balancing cost (power reserve) amounted to EUR 25.8 mil (78%) and variable part of the cost (activation) amounted to EUR 10.2 mil (28%). Expected deviations in the future indicate that after the integration of 744 MW in WPP, the mean absolute error of consumption and wind forecast would increase from the current 43 MWh/h to 78 MWh/h (with the same average forecast error of WPP), or in the range from 65 to 93 MWh/h (with the average forecast error of WPP from 8% to 12%). For the integration of WPP having total capacity of 744 MW, that currently have signed agreements on connection to grid, it is estimated that the total cost of secondary and tertiary control will increase to about EUR 50 million from the current level of EUR 36 million if the same average forecast error of WPP is maintained after it is undertaken by HROTE (compared to the existing HOPS forecast).

Given that as of January 1, 2017, the real obligation related to planning of WPP production is to be undertaken by HROTE, the accuracy of the HROTE forecast for the amount of balancing cost (which is expenditure in HOPS operation) will be of great importance. "The current forecast of renewable energy production which HROTE delivers to HOPS is insufficient in terms of quality, and it does not allow keeping the existing levels of balancing costs even if no new WPP is connected to the system", it is seriously pointed out. In case HROTE production plan for WPP is used for the operation of the system in 2015, the total balancing cost would increase from the actual EUR 36 million to EUR 45 million.

In case the quality of forecast would deteriorate, costs of ancillary services of secondary and tertiary control could be increased to EUR 59 million or more. By integrating WPP with a total output of 1000 MW, the request for tertiary power reserve would rise to  $\pm 316$  MWh/h and total balancing costs would increase from the current level of EUR 36 million to about EUR 64 million with the same average forecast error of WPP (9.81%) after production forecast obligation is undertaken by HROTE. In case the quality of forecast would deteriorate, balancing costs could be increased to EUR 75 million (12% error) or more. For the sake of WPP integration having total output of 1000, 1200 or 1500 MW it is estimated that the total cost of secondary and tertiary P/f control for balancing energy would increase

to EUR 64, EUR 74 or EUR 89 million if the same average forecast error of WPP would be maintained after it has been undertaken by HROTE (in relation to the existing HOPS forecast). On the basis of all conducted analysis, it is clear that for the possibility of a future greater integration of wind power plants it is necessary to implement such process gradually, with appropriate preparation and analyses of impacts of the constructed WPP on the system operation. The implementation of appropriate balancing mechanism should be provided, in which all entities responsible for the deviation should participate and ensure adequate compensation for the transmission in order to cover the costs of balancing of WPP that will not jeopardize the HOPS operation. It is necessary to harmonize dynamics of WPP integration with the process of increasing the quality of WPP production forecast. For a certain level of WPP integration it is necessary to arrange adequate secondary and tertiary P/f reserve for the balancing, if the amounts of it are technically and economically available by the providers of these services in Croatia, or if any provider of such services could and would like to contract these services with HOPS. In addition, HOPS should use other mechanisms for balancing the system, such as participating on the intra-day (liquid) power market in the Republic of Croatia and on the balancing market, once when it is organized. Greater WPP integration (more than 1000 MW capacity), except in case of balancing the system, has a significant impact on necessary reinforcement of the transmission grid, and therefore HOPS should organize and administratively prepare on time the construction of the necessary reinforcements, related to including necessary new lines and transformer stations in spatial plans, defining routes, solving property and legal issues on routes or on the sites of transmission facilities, preparing project documentation etc. Peak loads up to 3200 MW are achieved within Croatian power system. Total regulatory reserve of hydropower plants participating in the secondary control in the Croatian power system amounts  $\pm 191$  MW (total 382 MW). "Such power of secondary control would theoretically be available only under the assumption if all three hydropower plants were in operation with working points in the middle of its operating range, and with sufficient quantities of water, which is in practice impossible," it is said in the document which is on the public hearing.