

By signing the Energy Community Treaty and the adoption of the relevant directives in the European Union (EU), Public Utility Enterprise “Elektroprivreda Serbia” (PE EPS) has taken a series of obligations and tasks in the field of environmental protection, in order to comply the work of all parts (production and distribution) with the EU standards. Projects of PE EPS that have been realized so far and that are being implemented at the moment in this area and those that are planned make a significant part of the accession activities of the Republic of Serbia (RS) to the EU.

In the period from 2001 to 2014 in the power plants of PE EPS, a number of activities for the environmental improvement and protection were implemented.

Study overviews of the of thermal power plant impact on air, water and soil were published, and then a project documentation for selected optimal solutions was made in order to reduce pollutant emissions to the level of emission limit values defined by the regulation of the RS and the EU.

By signing the Energy Community Treaty and the adoption of the relevant directives in the European Union (EU), Public Enterprise “Electric Power Industry of Serbia” (PE EPS) has taken a series of obligations and tasks in the field of environmental protection, in order to comply the work of all parts (production and distribution) with the EU standards. The current Energy Law (Official Gazette no. 84/04) defines that the energy policy of the Republic of Serbia (RS) include measures and activities taken for achieving the long-term objectives in the energy field, which also include the improvement of environmental protection.

PE EPS has identified the measures for environmental protection and adopted the Action Plan by 2015 for their implementation.

The most comprehensive planned works in PE EPS are related to the continuation of initiated modernization of the existing environmental protection measures in thermal power plants, as well as introduction of the new safety measures in all facilities in order to meet the legislative requirements of the RS and the EU in the field of environmental protection. In order to ensure the funds from the IPA Fund (Instrument for Pre-Accession Assistance- IPA 2007 - 2013), PE EPS, in cooperation with the Ministry of Mining and Energy and the Ministry of Finance, proposed projects for modernization and introduction of new environmental protection measures.

Cooperation with the Ministry of Mining and Energy, Ministry of Environment and Spatial Planning, Agency for Environmental Protection and the Fund for Environmental Protection, as well as with representatives of the European Bank for Reconstruction and Development and KfW Bankengruppe (KfW), which have provided certain loans for the implementation of

environmental protection measures, has been also continued.

Implementation of projects on changing the technology of collection, transport and disposal of ash and slag has been completed in TPP Nikola Tesla B (TENT B) - B1 and B2, TPP Kolubara A (TEK A) -A5 and TPP Kostolac B (TEKO B) B1 and B2 . The reconstructions of the electro-filters have been done in: TPP Nikola Tesla A (TENT) in power units A1-A6, TPP Kostolac A (TEKO A) A1 and A2, and TEK A -A5. Above mentioned measures were implemented in the period from 2004 to 2014. Funds were provided from the Environmental Protection Fund of the RS, donations, loans and by PE EPS

Air protection

The most important projects and programs in the field of environmental protection that have been finished or are currently being made - prepared in PE EPS are primarily related to the emission of air pollutants from power plants, including powdery substances (PS), sulfur oxides (SO₂) and nitrogen oxides (NO_x).

Electrofilters EF reconstruction and bag filters installation

Application of electrofilters (EF) for separation of powdery substances from the flue gas, the existing technologies of collection, transport and disposal of ash and the protection system in landfills did not meet the basic environmental criteria. There were some problems related to air quality as a consequence of PS emissions in the air from:

Point sources - chimneys (the dominant impact had the emission of PS in the power units of TENT A1 and A2, before EF reconstruction and particularly during the temperature inversion).

Diffusion sources - ash and slag landfills, due to aeolian erosion of ash in dry weather and during stormy winds, when it came to episodic air pollution

Many years of practice and experience have confirmed that the problem of pollution caused by particles of ash represents the biggest problem that has required priority and urgent solution.

Capital overhaul of the power unit A5 in TENT A was carried out in 2004, with funds from the donation of the European Agency for Reconstruction and Development. The funds were intended only for increasing the reliability of power units. Environmental projects could not be financed from this fund. The first reconstruction of the EF on the power unit A5 was carried out in 2004. The reconstruction was done with company's own funds, it was also the first work of this kind in Serbia, and the gained experiences were certainly valuable for the reconstruction of the other power units in thermal power plants of EPS.

In the majority of thermal power facilities EF reconstruction was made where the supplier gave guarantees for the mass concentration of PS, which is $\leq 50 \text{ mg} / \text{Nm}^3$

During 2014, the reconstruction of EF in TENT on the power unit A3 was performed, within the capital overhaul, from company's financial resources. During 2014, the reconstruction of the EF on the power unit B1 in TEKOB was performed as well, within the implementation of the first phase of the project package. During 2015, implementation the project related to EF in TEM has been planned, which will be financed within the donation, IPA 2012.

The guarantees given by the supplier of the EF equipment for PS mass concentration and for the EF, which is $\leq 50 \text{ mg} / \text{Nm}^3$, were confirmed during the warranty tests. In the period after the warranty period EFs of the power units A1 and A2 in TENT A and the power unit A2 in TEKOB do not meet the guaranteed mass concentration output of PS due to problems of increased volumes and flue gas temperature compared to the design value. The same problem was present at EF in TEKOA on the power unit A1. Implementation of measures to optimize the performance of EF in TEKOA on the power unit A1 in 2014 improved the EF order so that the measurement implemented in 2015 established the mass concentration of PS also for EF $\leq 50 \text{ mg} / \text{Nm}^3$.

In 2012 the construction of a new boiler - TE. K-405 on the power unit A2 for biomass combustion (sunflower seeds) was completed in thermal power plant-heating plant Sremska Mitrovica (TE TO Sremska Mitrovica). Within these works a bag filter was purchased and built for extracting the PS from the flue gas. The supplier of equipment gave guarantees for the mass concentration of PS and for a bag filter, which amounts to $\leq 10 \text{ mg} / \text{Nm}^3$. Only for the purchase of the bag filter 392,700 euros were invested, other costs were not included.

Construction of facilities for flue gas desulphurization (FGD)

The primary goal of the FGD construction is to reduce the mass concentration of SO₂ at the exit of the facility, to $\leq 200 \text{ mg} / \text{Nm}^3$, using limestone wet scrubbing process. In the Table 2.1 is shown an overview of the plan of building the FGD facility in thermal power plants in the companies within EPS, where the information on the implementation terms, financial investments and financing source is listed.

Project of FGD in TENT A is ongoing and is financed from the funds provided by JICA (Japan International Cooperation Agency) in a total amount of 28,252 billion yen. In May 2012 PE EPS chose a consulting organization TEPSCO (Tokyo Electro Power System Co.) (local consultant, Energoprojekt - ENTEL will assist TEPSCO) engaged in the preparation of tender documents necessary for the selection of the supplier of technology and equipment for FGD for the power units A3 - A6 in TENT A. Tim of consultants together with EPS prepared a tender for pre-qualification for this project that was issued in late 2012. Out of the participating companies / consortia, six of them were pre-qualified. In early 2014, a

tender was announced for submission of bids for pre-qualified bidders. The evaluation procedure for the selection of contractors was not completed during 2014. The deadline for completion of the entire project is the end of 2017. That would comply with the deadline defined by the LCPD (Large Combustion Plant Directive), when the operations of thermal power plants within EPS should be in compliance with the obligations arising from the directive.

Other large project which has not been in the implementation phase yet, but it has been planned, is the construction of FGD in the power units B1 and B2 in TPPNT B. During 2014, preparation and adoption of the investment- technical documentation was finished. Securing the funds is a key issue for this project. There is an idea that, according to a project that we now have with JICA, these funds are provided by the Japanese agency as well.

The construction of the FGD facility started in 2014 on the power units B1 and B2 in TPP Kostolac in order to reduce the emission of $\text{SO}_2 \leq 200 \text{ mg/Nm}^3$. The project is implemented within the first phase of the package project "Thermo Power Plant Kostolac B Projects" which is financed from the loan signed with the People's Republic of China. The completion deadline for this project is the end of 2016.

Primary measures for reduction of NOx emissions

In order to define the requirement defined by the IED (Industrial Emissions (nitrogen oxide emission ($\text{NOx} \leq 200 \text{ mg/Nm}^3$)) which is much stricter than our current Regulation on limit values of air pollutants and in comparison with LCP the introduction of primary measures for reducing NOx emissions has begun.

Accordingly, in the previous period, for the first time primary measures were implemented on the power unit A5 TENT A. During 2014, adjustment of the boiler operation was performed with "HITACHI" in order to optimize the boiler operation and reduce emissions of NOx and the official report on the effects of implemented primary measures has been expected.

In addition, within the capital overhaul of A3 in TENT A the introduction of primary measures was done to reduce emissions $\text{NOx} \leq 200 \text{ mg / Nm}^3$. On the block B1 TEKO B during 2014, within the implementation of the first phase of the Package Project, the introduction of primary measures was done to reduce emissions $\text{NOx} \leq 200 \text{ mg / Nm}^3$. The introduction of primary measures for the remaining boilers, in order to reduce emissions of NOx, has been planned.

During 2013 and 2014, in cooperation with the Ministry of Energy, Development and Environmental Protection (Ministry of Mining and Energy) and JP EPS with the European

Integration Office has begun on the preparation of the request for the use of the funds from donations of IPA 2014 -2020, which are necessary for the introduction of mentioned primary measures on the power units A4 and A6 in TENT A and on the power units B1 and B2 in TENT B.

The act of signing the Energy Community Treaty as well as the obligations arising from the process of EU accession ,which have been undertaken by the Republic of Serbia, clearly define responsibilities in the field environmental protection.

In order to ensure funding from the IPA Fund (Instrument for Pre-Accession Assistance-IPA 2007 - 2013), in cooperation with relevant ministries, PE EPS proposed projects in order to implement environmental protection measures. Similarly, the cooperation was established with the relevant ministries, Agency for Environmental Protection and Environmental Protection Fund, as well as the representatives of the European Bank for Reconstruction and Development (EBRD) and KfW Bankengruppe (KfW).

EF reconstructions were performed on all the power units of TENT A, TENT B, TEKO A, TEKO B and on the power unit A5 TEKO A. Reconstruction of the EF in TEM remains to be done in 2015. Total invested assets amount to: 93.087.442 euros.

Guarantees given by the supplier of the equipment (EF) for the mass concentration of powdery substances and for EF, which is ≤ 50 mg / Nm³, have been met during the warranty tests. During the period after the warranty period, EF of power units A1 and A2 in TENT A and power units A1 and A2 in TEKO do not meet the guaranteed output mass concentration of powdery substances.

Works on the construction of the FGD plant began in Kostolac B in 2014 and they will be continued as planned until 2016. Completion of FGD construction in TENT A and TENT B has been planned for 2019 or 2020. Planned funds for the construction of FGD in TENT A, TENT B and TEKO B amount to 430.000.000 euros.

Primary measures for the reduction of the mass concentrations of nitrogen oxides were implemented, in TENT A on the power units A5 and A3, and B TEKO on the block B1, where the expected value of NO_x (NO₂) ≤ 200 mg / Nm³). Total funds spent amount to 34.8 million euros.

Introduction of primary measures to reduce NO_x emissions has been planned on the remaining boilers: TENT A on the power units A4 and A6, TENT B on the power units B1 and B2, B TEKO, on the power unit B2 and TEKO A on the power unit A2. It is envisaged: 62.400.000euros.

For the construction of wastewater treatment facilities in TENT B, TENT A and B TEKO around 20.000.000 euros has been planned.

For the construction of the facility for purification of muddy wastewater and wastewater that contains oil and crude oil in TE TO Sremska Mitrovica during 2014/2015 has been invested about 407.738 euros.

In order to reduce the negative impact of landfills on air, water and soil the old technology has been replaced with new technology of thick mixture of ash and water. The new technology has been introduced in TENT B, TEK O B and TEK A - A5. Invested funds amount to: 64.000.000evra.

The replacement of existing technology with a new technology of collection, transport and disposal of ash and slag is planned in TEK O A in 2015 and in TENT A in 2016. Planned funds amount to: 73.600.000 euros.

Dry exclusion and separate disposal of ash and slag in silos have enabled a delivery of dry ash i.e. slag to the industry, which was one of the conditions for the application in the civil engineering and in the building construction.

Source; Serbia-energy.eu