

Synchronised operation of power plants along the Drina and its tributaries could markedly increase production downstream, according to an integrated resource assessment. A multi-country electricity system model was developed for the three countries sharing the river basin as part of a comprehensive intersectoral or nexus project covering water, energy, food and environment.

Montenegro, Bosnia and Herzegovina, and Serbia all have a great opportunity to increase power trade, says professor Mark Howells from the Royal Institute of Technology. The institution based in Stockholm, Sweden, developed an analysis for the Drina Nexus Assessment conducted for UNECE (United Nations Economic Commission for Europe). Professor Howells, the team lead and chair of the division of Energy Systems Analysis, was assisted by Youssef Almulla, Francesco Gardumi and Eunice Ramos. The Drina is a major tributary of the Sava, for which a basin level nexus assessment report has been published earlier. The projects provide necessary insights for the countries to identify opportunities for mutual benefits to enhance their cooperation.

The three countries are also parties to the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes. They are cooperating in the framework of the International Sava River Basin Commission. The study in the Drina River Basin focuses on the links and impacts between sectors. It is financed by the Italian Ministry of Environment, Land and Sea, and supported by the UNECE secretariat.

Energy security and poverty

Hydropower is highlighted as essential for meeting the goals from the Energy Community Treaty, which also includes commitments related to international transmission systems and the creation of a single market for energy. Energy security and energy poverty were also highlighted as challenges. Improving the situation requires substantial investments in hydropower plants and other renewable energy generation facilities, energy efficiency as well as water management and rural infrastructure, authors noted. Coordination at the basin level, taking into account the different sectors plans as well as ecosystem preservation needs, would improve the effectiveness and sustainability of development efforts, they said. The water resources of the Drina River Basin support different activities in each of the countries sharing the basin. One of them is the generation of electricity.

Status of the energy sector in the Drina basin

Installed hydropower capacity in the basin is 1.72 GW and thermal power plants operate turbines of a total of 604 MW. Serbia's hydro units dominate with 1.03 GW, while Bosnia and Herzegovina has 334 MW in the region and Montenegrin utilities operate 360 MW. Thermal power capacity in the three countries is 54 MW, 225 MW and 325 MW,

respectively.

There is 419 MW in installed hydro capacity included in the analysis for the basin, where the eight units have reservoirs of an overall 1.85 billion cubic meters. The biggest one, at 880 million, is controlled by Piva plant at the river of the same name in Montenegro, the only hydro facility in the Drina basin in the country. The system has 360 MW in capacity, trailing only HPP Bajina Bašta from Serbia which has 4 MW more and operates a reservoir of 218 million cubic meters. The Višegrad facility in Bosnia and Herzegovina, also located on the Drina, ranks third in power - 315 MW, and is placed in the middle of the scale with its 161 million cubic meters of water. The second-largest reservoir, with 250 million, is in the Kokin Brod hydro system on the Uvac river in Serbia, which has two turbines of 22 MW in total.

Together with uncommitted projects, hydropower facilities could eventually increase up to 4.3 GW in total, compared to 2.23 GW in units powered by fossil fuels, but the authors acknowledge the scope of the former may become hampered by „difficulties in accessing funding and varying interest from neighboring countries for electricity exports.”

Furthermore, they note there is significant uncertainty related to realization of a number of planned projects.

Prospective expansion of hydro and thermal power capacity in the Drina River basin
So while there are many hydropower projects planned, many of them would require updating in the light of the current needs, the economic outlook and revised estimates of the hydropower potential. In the list of projects in the pipeline in the whole territory of the three states, Bosnia and Herzegovina accounts for 6.5 GW from 60 power plants. Montenegro is seen adding 884 MW in 12 units and the plans for Serbia are estimated at almost 4.5 GW from a total of 20 projects. Although the modelling focused on the effect of optimizing the operation of existing power plants, the evolution of power system from 2017 until 2030 - including capacity expansions - was taken into account on a least-cost basis.

Benefits of cooperation in hydropower plant operation

The cooperation between the three countries regarding operation of hydropower plants is at an informal level, with a particular challenge in flow regulation, unlike during the coordinated management before the dissolution of the Socialist Federal Republic of Yugoslavia. There is divided competence between different authorities and a lack of data and information exchange, according to the analysis. The study underscores the need for an integrated approach that takes into account natural hazards, notably floods and droughts, and climate change.

“The Drina nexus study encourages to explore cooperation opportunities. One of the

recommendations of the study was to use the existing platforms, like the ISRBC or the energy community task force meetings, to enhance and continue the cooperation dialogue. Moreover, different actions to enhance cooperation were suggested. This of course will need the governance support to move the cooperation dialogue from the experimental and study zone to become a reality," said analyst Youssef Almulla from the KTH team.

"The modelling exercise in particular focused on the potential benefits deriving from increased transboundary cooperation in the operation of hydropower plants, increased interconnections between the countries and energy efficiency measures to reduce the electricity demand. A reference case of non-perfect cooperation was established, where Piva hydropower plant is assumed to control a large part of the available water flow to store it in the dam. As expected, that cooperative operation of hydropower dams could deliver more than 600 GWh of electricity over the 2017-2030 period, with highest impact on the operation of Bajina Bašta HPP" in Serbia, Almulla stated.

Energy savings

Energy efficiency is an area where there are unused opportunities for beneficial action. The current Energy Efficiency Action Plans consider an indicative energy savings target of 9% of the final primary energy consumption by 2018. As part of the energy efficiency obligation schemes, each contracting party of the Energy Community Treaty is now required, under the updated legal framework, to define energy saving targets for the period from 2017 to 2020.

Analyst Francesco Gardumi explained: „Insights derived for the energy efficiency scenario accounted for savings of 0.7 TWh for Bosnia and Herzegovina, 0.2 TWh for Montenegro and 3.2 TWh in Serbia, equivalent to between 4% and 8% reduction of gross electricity demand in 2020. With a rise in savings to 7 TWh by 2025 and 8 TWh by 2030, the drop in electricity generation in thermal facilities will become clearer. The decommissioning of Kostolac coal power plant in Serbia in 2027 will cause a drop in thermal production, the model predicts.“ He added that pressure on hydropower generation could be reduced by increasing energy efficiency - by as much as 4.1 TWh in the combined Drina Basin in the 2017-2030 period - and that it would, in addition, deliver significant reductions in greenhouse gas emissions. „With energy efficiency included, carbon dioxide emissions could decrease a total of 21% from the 2015 level: from 38 million tonnes in 2017 to 28 million in 2030,“ according to Gardumi.

Exports

In a perfect cooperation scenario, power generation at all facilities downstream rises substantially, with no adverse development upstream. Bajina Bašta could increase output by

520 GWh between 2017 and 2025 or 27% of average annual generation. In the case of Višegrad in Bosnia and Herzegovina and Zvornik in Serbia, gains from bolstered cooperation can reach 28% and 26%, respectively, of annual production.

The new trade project connecting Montenegro with Italy opens the opportunity for the Balkan country to shift from a net electricity importer to a net exporter after 2020, depending on export prices, the study found. „This is conditioned by maintaining a stable base generation of cheap hydro and coal and the exploitation of biomass and wind potential as aimed at in its national renewable energy action plan (NREAP),“ Howells stated.

Environment

Sustainability of water resources utilization depends heavily on coordinated flow regulation, research results reveal. At best the flow regulation should help to control damage from high or low water flows, in addition to improving hydropower generation, and without significantly affecting negative impact on the environment. Thermal power plants use significant quantities for cooling, but also for process, anti-fouling and general wash, where wastewater affects the ecosystem.

The region has suffered devastating floods in 2014. Still, progress in flood and drought management since the launch of the regional initiative in 2010, which is highlighted in the document, was not the scope of the modelling, according to Eunice Ramos from the KTH. But what can be concluded from the study and workshops discussion is that the need is still very high to mitigate flood and drought effect and more work needs to be done, again warranting enhanced cooperation between the countries, she noted.

Ramos explained the environmental flows are getting more attention but that implementation is still at an early stage. „One main dimension of the solution is related to the harmonization of the environmental flow legislations between the countries. Currently each country has its own way of defining environmental flows and their own method of calculation. Another dimension is related to the effecting monitoring system that assures the consideration of environmental flow at different phases of projects and not limiting it to the permitting phase of projects, which is the case currently.“

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Open Source Energy Modelling System, the long-term energy planning tool that was used, focuses on the least cost optimization of the electricity generation mix to meet demand. The authors of the study underscored the energy efficiency component was limited to the production sector. The dead storage level or the minimum in reservoirs is assumed to be 10% of capacity. While local data was used to the degree possible, gaps in the technical and economic parameters of power production such as capital costs and variable costs had to be

complemented with average costs by technology from literature. The analysis could be refined with additional site-specific data.

The project was the first nexus assessment for the Drina River Basin and great interest was shown by stakeholders to carry on the nexus dialogue and to consider this project as a first step towards an enhanced cooperation between different sectors and countries in the sustainable management of natural resources, Almulla revealed and noted a number of ideas were discussed in the final workshop in regard to possible follow up activities.

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