Summary Report

Technical Assistance Integrated Water and Hydropower Development in the Drina River Basin

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by
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Disclaimers and Acknowledgement

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Contents

Acronym and Abbreviation

BiH	Bosnia and Herzegovina
BOT	Build-Operate-Transfer
CAPEX	Capital Expenditure
CIA	Cumulative Impact Assessment
DG NEAR	Directorate-General for Neighbourhood and Enlargement Negotiations
DRB	Drina River Basin
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EDF	Électricité de France
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EPCG	Elektroprivreda Crne Gore
EPS	Elektroprivreda Serbia
ERS	Elektroprivreda Republike Srpske
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESS	Environmental and Social Standards
EU	European Union
E&S	Environmental and Social
HPP	Hydropower Project
ICOLD	International Commission of Large Dams
IFC	International Finance Corporation
KfW	*Kreditanstalt für Wiederaufbau*
kWh	Kilowatt-hour
MCA	Multi-Criteria Analysis
MW	Megawatt (1 million watts)
MWh	Megawatt-hour
m^3/s	Cubic meters per second
NOx	Nitrogen Oxides
OIP	Other Interested Party
OPEX	Operating Expenditure
SEF	Stakeholder Engagement Framework
SO_2	Sulfur Dioxide
TA	Technical Assistance
WBDRBM	West Balkans Drina River Basin Management Project
WBG	World Bank Group
WWF	World Wildlife Fund

Technical Assistance on Integrated Water and Hydropower Development in the Drina River Basin

Overall Summary

BACKGROUND, RATIONALE, AND OBJECTIVE OF THIS TECHNICAL ASSISTANCE

This ESMAP[1]-funded technical assistance (TA) complements the Global Environment Facility and Special Climate Change Fund-financed *West Balkans Drina River Basin Management Project (WBDRBM)*.[2] WBDRBM was approved by the World Bank in 2016 to help improve mechanisms and capacity of countries to plan and manage the transboundary Drina River Basin (DRB), incorporating climate change adaptation. There is a need to enhance coordination between energy, water, and related responsible sectors within a country and among countries of the DRB. To address diverse future needs, it is necessary to establish the hierarchy of water uses, with drinking water supply as the highest priority, followed by flood prevention, irrigation, energy generation, transport, tourism, and so on. Therefore, a significantly improved balance between hydropower generation and other uses of water resources in the DRB is required more than in the past, particularly in light of the riparian countries needing to build dialogue and manage the river basin as three separate countries following their independence in 1990s.

Hydropower generation is dominating DRB management. Eight hydropower plants are currently operating in the DRB with a combined capacity of about 1,400 MW. The hydropower facilities, including reservoir operation, were primarily designed to optimize hydropower production in line with historical demand and mitigate flooding impacts, but not for other uses. Due to limited development over the last few decades, the DRB still represents an abundant regional source of unutilized hydropower potential.

In 2019, *the Regional Strategy for Sustainable Hydropower in the Western Balkans* (the 'Strategy') was developed with support from the European Commission (EC), Directorate-General for Neighbourhood and Enlargement Negotiations (DG NEAR). The Strategy includes lists of existing large hydropower projects (HPPs) for rehabilitation and potential greenfield HPPs across the region, including in the DRB. As pointed out in the Strategy, increasing hydropower generation could help reduce carbon emissions in the power sector by offsetting coal-fired power generation which currently dominates the energy mix in the region. Furthermore, hydropower plays a critical role in increasing penetration of variable renewable energy (that is, solar and wind) through provision of energy storage and therewith associated power system balancing services. This makes hydropower an indispensable element of energy transition in the region toward the 2050 European Union (EU) climate neutrality and objectives of European Green Deal.

This TA aims to inform a number of big picture questions including the following:

- Is the management of the DRB carried out in an integrated manner, considering the hierarchy of water uses?
- Are the potential HPPs in the DRB prioritized through a basin-wide approach? If they were not, how to address the gaps for their further preparation?

[1] Energy Sector Management Assistance Program - https://www.esmap.org/node/70853

[2] Among other activities, this TA provides a gap analysis of the series of study *Support to the Water Resources Management in the Drina River Basin* (COWI, Stucky and JCI, 2017 - COWI reports). In addition, this TA supports the consultation on and encourages the application of the hydraulic and hydrological models prepared under WBDRBM for hydropower purposes.

- Who are the main stakeholders in water and hydropower development in the DRB? And how to enhance stakeholder engagement?
- In Bosnia and Herzegovina (BiH), the long-planned Buk Bijela-Foca HPPs are ranked high on the prioritized list. Is there still a need for new utility-scale hydropower generating capacity in BiH? What are the gaps in the feasibility and environmental impact assessments (EIAs) of the projects, and what are recommended to close the gaps?
- Existing hydropower capacity in the Western Balkans, including those in the DRB, was developed before 1990 and requires periodic rehabilitation and safety improvement. Which projects in the DRB may need rehabilitation or safety works in the short term?

Under this TA, the following documents have been reviewed and prepared:

- The series of study *Support to the Water Resources Management in the Drina River Basin (COWI, Stucky and JCI, 2017* - COWI reports) assessed multipurpose water resources utilization scenarios. Furthermore, the COWI reports compared their own assessment with the aforementioned *Regional Strategy for Sustainable Hydropower in the Western Balkans* (Mott MacDonald and IPF 2017) that assessed HPPs in multiple river basins, including the DRB.[3]
- The *feasibility study of hydropower projects in the DRB, Buk Bijela and Foca Hydropower Projects* (Stucky 2012) assessed technical and financial viability of the two projects.
- The *Environmental Impact Assessment of Buk Bijela and Foca Hydropower Projects* (IG and Institute for Protection, Ecology and Informatics Banjaluka) and the environmental permits (2013, renewed in 2018). There are neither detailed social impact nor resettlement-related documents available since their development is not required by the local legislation.
- Furthermore, the following have been prepared/carried out:
    - (i) A DRB stakeholders map
    - (ii) Report - *Introduction to Stakeholder Engagement Framework, Integrated Water and Hydropower Development in the Drina River Basin*
    - (iii) Updated scenarios of the 2017 least-cost power generation expansion plan for BiH, to complement further dialogue on hydropower development in the DRB (see Annex 2)
    - (iv) An assessment of the rehabilitation and dam safety improvement requirements of the Piva HPP in Montenegro and Visegrad HPP in BiH.

ABOUT THIS SUMMARY REPORT

This TA was extended by about one and a half years partly due to the coronavirus pandemic, which resulted in intermittent dialogue with multiple counterparts including government authorities, power utilities, and water agencies in BiH, Montenegro, and Serbia. The envisaged consultations on the TA findings with a wider group of stakeholders did not proceed as expected. However, this Summary Report

[3] The comparison was made on the basis of the *Regional Strategy for Sustainable Hydropower in the Western Balkans* report, prepared in December 2017.

is made publicly available so it could be an input for further consultations among stakeholders on Integrated Water And Hydropower Development in the Drina River Basin, including specific projects such as Buk Bijela and Foca.

This Summary Report compiles the key findings from multiple technical studies carried out under this TA (see Annex 4) and is structured as follows:

- Section A summarizes key gaps in the current practices of the DRB management with emphasis on hydropower development and the recommendations in addressing those gaps.
- Section B summarizes gaps in the feasibility assessment of the Buk Bijela and Foca HPPs. The utility Elektroprivreda Republike Srpske (ERS) in BiH proposed to review these projects.
- Section C summarizes gaps in the existing EIA documents of the Buk Bijela and Foca HPPs from the lenses of the World Bank Group (WBG) Environmental and Social Framework (ESF); guidelines on environmental and social (E&S) impacts of HPPs; and transboundary guidance per the Espoo Convention (1991), Bucharest multilateral agreement (2008), and WBG Operational Policy OP 7.50 concerning Projects on International Waterways.
- Section D describes the social aspects of hydropower and provides an overview of a Stakeholder Engagement Framework (SEF) in the DRB to help inform social assessments. The framework has been designed to serve as a road map for development of specific stakeholder engagement programs or plans for prospective HPPs when the specific locations, stakeholder groups, types and technologies, and schedule of activities are known.
- Section E shifts the focus to describe the findings of the rehabilitation and safety requirements of two existing HPPs reviewed under this TA: the Piva HPP in Montenegro and Visegrad HPP in BiH. The utilities Elektroprivreda Crne Gore (EPCG) in Montenegro and ERS in BiH proposed these projects for this TA.
- The Summary Report is concluded with the overall recommendations for the next steps.

Figure 1 - The Drina River Basin

MAIN FINDINGS

A. Drina River Basin Management and Hydropower

This section describes gaps and recommendations for gap closing in the current practices of the DRB management, including the prioritization of HPPs in a basin-wide and integrated water resource management manner.

1. The water resource of the DRB is not managed in an integrated manner and could benefit from a formal consultation structure among the riparian countries. The DRB is part of the wider Sava River Basin, extending over the territory of six countries. At present, the DRB is not managed as an integrated entity and water resources are managed by each country in its own territory. There is limited exchange of information and consultation among the riparian countries on their plans for hydropower or any other water resources related development. Even though BiH, Montenegro, and Serbia are parties to international multilateral agreements on water resources management, participate in the Framework Agreement on Sava River Basin, and are parties to the Espoo Convention and Aarhus Convention, a formal consultation structure for the DRB, preferably a River Basin Commission, is recommended.

2. It would have been optimal to rank hydropower development scenarios for the entire DRB irrespective of countries or territories, so this analytical gap should be addressed further. The hydropower development scenarios in the DRB are proposed at the national level. These national development scenarios could mean that the basin-wide and transboundary management of water resources is not yet optimized. Further, the potential impacts on flooding, species, habitats, and biodiversity are insufficiently studied. As the DRB riparian countries are aiming for EU membership, it is recommended to follow EU Directives relevant for water resources management and hydropower development.

3. The COWI reports recommended multi-criteria analysis (MCA) framework in ranking scenarios for new HPPs for each country in the DRB and then consolidating them at the basin level only. The MCA covers (a) cost of electricity; (b) environmental impacts on ecosystems, hydrology, hydraulic, water quality, climate, and so on; and (c) social impacts on population, agriculture, forestry, health, cultural heritage, and so on. The MCA is also extended to include parameters on security of water supply (domestic, industrial, and irrigation), flood regulation, water quality (sediments), air quality (potential closure of thermal power plants), minimum environmental flow guarantee, support for tourism industry, and climate/drought mitigation. However, instead of ranking projects for each country first and then integrating them at the basin level, it would have been optimal to rank hydropower scenarios developed across the entire DRB. Nevertheless, the review has found, it is not likely that redoing the MCA exercise at the river basin level would eventually lead to choosing a different developmental scenario. This is because the MCA scores for the recommended projects are substantially better than the next batch of projects.

4. Two groups of experts have separately assessed HPP candidates in the DRB and reached similar results on their potential for further preparation. This TA has noted different methodologies employed in the COWI reports and the *Regional Strategy for Sustainable Hydropower in the Western Balkans* but both reports yielded similar results. Moreover, both reports did not study flooding and biodiversity impacts sufficiently.

5. The following two tables are taken from the COWI Roof Report, showing two groups of potential greenfield HPPs considered as 'recommended' and 'reasonably good' within *the Regional Strategy for Sustainable Hydropower in the Western Balkans* (referred to as the Master Plan Project in the tables). Existing hydropower plants are not included.

Hydropower projects in the DRB recommended within the Master Plan Project are given in the table below.

Project name	Country	Capacity (MW)	MCA	MCA2 score
Foča	BiH	44.2	A	52.3
Paunci	BiH	43.2	A	55.9
Buk Bijela	BiH	93.5	A	52.5
Sutjeska	BiH	44.1	B	45.8
Komarnica	MNE	172.0	A	57.6

Hydropower projects in the DRB considered reasonably good within the Master Plan Project are given in the table below.

Project name	Country	Capacity (MW)	MCA	MCA2 score
Rogačica	BiH/SER	113.3	B	44.6
Tegare	BiH/SER	120.9	B	38.5
Dubravica	BiH/SER	87.2	B	35.5
Kozluk	BiH/SER	88.5	B	42.8
Drina 2	BiH/SER	87.8	B	44.5
Drina 1	BiH/SER	87.7	B	43.0
Drina 3	BiH/SER	101.0	B	44.0
Ustikolina	BiH	60.5	B	47.9

6. Under this TA, a gap analysis of documents on Buk Bijela and Foca HPPs from the first group has been carried out. Technical and environmental studies for Buk Bijela and Foca HPPs are available in a relatively advanced stage and were provided by the developer ERS. In addition, this TA updated the scenarios assessment of the 2017 BiH least-cost power generation expansion plan.[20] This latest update estimates that a few hundred megawatts of new hydropower capacity will be needed in BiH until 2040, including those with reservoir or pumped storage. The additional capacity of hydropower will be needed to replace the retiring old thermal power generators (totaling 1,105 to 1,888 MW) in the coming decades. The limited capacity means that only a limited number of locations could be selected for development, thus minimizing the E&S impacts associated with developing HPPs. Annex 2 contains a summary of the updated least-cost assessment. Finally, the feasibility study for the planned Komarnica HPP in Montenegro is being prepared by EPCG and not yet available at the time of this TA.

7. To ensure that an HPP is prepared in line with a river basin wide and transboundary approach, cumulative impact assessments (CIAs) supported by E&S due diligences should be carried out. As HPP projects are not stand-alone projects, their river basin wide environment and potential impacts should be assessed adequately. For the next steps, instruments such as CIAs supported by E&S due diligences that focus on basin-wide flooding and ecosystems should be carried out. To complement CIAs, the hydraulic

and hydrological modeling[4] will further inform optimization of hydropower operations and detailed designs and any investment decisions of new HPPs in the DRB.

B. Review of Feasibility Assessment of Buk Bijela and Foca Hydropower Projects

This section presents gaps and recommendations for gap closing in the feasibility assessment for the Buk Bijela and Foca HPPs. These projects are 'recommended' for further preparation in the 2019 Regional Strategy for Sustainable Hydropower in the Western Balkans. Annex 2 of this Summary Report summarizes the assessment of power generation plan for BiH, including new hydropower capacity.

8. The Buk Bijela HPP has been considered for development for over 50 years. In June 1975, the World Bank approved a loan for the 450 MW HPP (3×150 MW, a net head of 94 m) and a compensating reservoir with a dam near Foca with an estimated project cost of US$242.5 million. However, the World Bank loan was terminated for failing to become effective in February 1976. The underlying problem was a dispute between the Republic of the Former Yugoslavia, BiH, and Montenegro on riparian rights and their conflicting interests in using the water resources of the Tara and Drina rivers.[5] Over the last 10 years, ERS has decided to redesign the project and initiated a pre-feasibility study in 2009 and a feasibility study in 2012.

Salient features of both HPPs are presented in Annex 6 of this report.

Technical assessment

9. The redesigned Buk Bijela HPP is four times smaller in terms of rated capacity and intended to operate as a daily peaking plant, owing to the storage capacity of its reservoir (11 million m^3 of live storage). Unlike the old design which had foreseen significant flooding of the Montenegro territory, the reduced dam height enables the reservoir to remain entirely on the BiH territory with the full supply level reaching the state border with Montenegro. Foca dam, located immediately downstream of Buk Bijela HPP, is intended to operate as a regulating dam to dampen the variations of water discharge in the Drina River. This operation mode of the Buk Bijela-Foca complex is well described and justified by the economic assumptions made at the time of the study.

10. Further assessment is required to inform whether Buk Bijela should be a peaking power plant or not. The need for peaking power generation capacity in the regional power system should be reassessed in light of the current electricity market (intraday electricity price variations) and should be balanced with the effort of minimization of E&S impacts. In case there is no strong demand for peak energy in the system, a pure run-of-river operation mode could be considered. This would have several consequences for the project concept, including the following:

- The possibility to implement Buk Bijela project alone, or at least to phase the implementation of both Buk Bijela and Foca projects
- The reduction of E&S impacts, thus improving the project's bankability

[4] This hydraulic and hydrological modeling was implemented under the World Bank-funded *West Balkans Drina River Basin Management Project*.
[5] World Bank Project Completion Note, Buk Bijela Hydropower Project, May 1993.

- The elimination of the need for environmental flow releases.

11. The redesigned Buk Bijela and Foca HPPs are robust and their construction is technically feasible but they could benefit from optimizations to reduce the project cost. Some possible optimizations were identified, which could reduce the volume of concrete, shorten the construction schedule, and make the projects more competitive. In addition, the projects should be updated with more modern design concepts, completed E&S input data, and up-to-date economic assumptions.

12. The design may need to be enhanced to further mitigate potential E&S impacts, addressing environmental flows, fish passage, and excavation of riverbed. Regarding the assessment and management of E&S impacts, on the technical side, special attention should be paid to the following:

- The environmental flow studies are not compliant with international standards and should be redone (except if the operation mode is changed to run-of-river), which could lead to changes in environmental flow values, possibly imposing constraints on operation modes of the complex.
- The potential need for fish passage facilities at both sites should be assessed according to international standards. The current project layouts do not include such facilities.
- The proposed excavation of the riverbed downstream of both dams, to lower the water level and to increase the net head and energy generation, is not a good practice from an E&S perspective and should be reassessed.

13. The seismic design criteria need to be revised. The geological contexts at both sites are properly described and handled in the design, with special attention to the risk of landslides in the reservoirs. Preliminary seismic hazard assessment, carried out under the feasibility study, found no significant geological issues at the proposed sites and is deemed sufficient for a feasibility level of technical design. Some of the seismic design criteria, including the Safety Evaluation Earthquake, are not fully compliant with the recommendations of the International Commission of Large Dams (ICOLD) and should be revised. The return period selected for the Operating Basis Earthquake is higher than 145 years and complies with the ICOLD recommendations.

14. Regarding hydrology, the values of extreme flood discharges are likely underestimated and need to be revised to reconciliate flood estimates at Foca, Buk Bijela, and Paunci sites and ensure consistency with data from the 1896 historical flood.

15. The selection of design discharges (350 m^3/s at both sites) is based on simplistic and outdated economic criteria. Therefore, the approach could be reassessed and optimized with updated project data (revised design, updated environmental flow); updated market conditions (energy market value, need for peak energy vs. base energy); and more adequate optimization criteria.

16. The civil works cost estimate of both projects should be updated in line with current construction prices in the region, addressing the suggested optimization measures at the same time. The unit costs of the proposed civil works seem low, and the cost estimates of both projects are likely underestimated. On the other hand, many civil works concepts and structures could be reassessed and optimized in a value engineering perspective, including river diversion, spillways, and powerhouses, possibly leading to cost savings. Finally, the methodology proposed for the longitudinal cofferdam protecting the spillway construction during the first phase of the river diversion at Foca site should be revised.

17. The electromechanical equipment should be updated as part of the overall design optimization. The envisaged electromechanical equipment does not raise major concerns but should be redesigned and updated in case the suggested optimization measures and E&S-related enhancements are undertaken.

18. Project financial assessment

- The Buk Bijela and Foca HPPs were together considered as an electricity generation complex. The complex was designed as a peaking power generator. The cost estimate in 2012 was EUR 195 million for Buk Bijela HPP and EUR 119 million for Foca HPP.
- The project was studied as a build-operate-transfer (BOT) scheme and to be financed on a project financing basis, assuming 75 percent debt and 25 percent equity financing. The assumed term of borrowing was 21 years (6 years grace period on principle repayment plus 15 years).

19. Project economic assessment

- The average economic cost of electricity (LCOE) of the Buk Bijela-Foca HPP complex was EUR 8.25 cents per kWh with an operation period of 25 years and EUR 7.45 cents per kWh with a 50-year operation period.
- The WBG team notes that these LCOEs are not low compared to the prevailing wholesale electricity market prices in the region and final electricity prices in BiH,[6] even though cost assumptions and additional cost categories could be revised upward (for example, fish passage facilities, river diversion, and sediment management). Therefore, further optimizations of project design and review of cost savings should be carried out.

20. State aid rules and project development

- It should be noted that the project development and its financing must consider the state aid rules to support energy from renewable sources in the Energy Community, for which BiH is a contracting party.
- According to the Energy Community Secretariat, measures constitute state aid if they (a) are granted by the state or through state resources (such as grants, preferential loans, interest subsidies, capital/equity measures, guarantees, taxes); (b) give selective advantage to certain undertakings or production of certain goods; (c) distort or threaten to distort competition; and (d) affected trade between member states. Furthermore, aid for promotion of electricity from renewables may be granted in competitive bidding process, aid shall be granted as a premium in addition to the market price, aid beneficiaries shall be subject to standard balancing responsibilities, and so on.[7]
- For further development of Buk Bijela and Foca HPPs as a BOT scheme, the following aspects, among others, related to state aid will need to be considered:
    - The competitive selection of the BOT entity
    - The maximum shareholding by ERS in the BOT entity
    - If applicable, the share of energy to be sold under power purchase agreement(s) and on the wholesale electricity market(s)

[6] In the second quarter of 2020, electricity prices in BiH averaged EUR 7.46 cents per kWh for household consumers and EUR 7.02 cents per kWh for non-household. *Source:* Eurostat.

[7] https://www.energy-community.org/dam/jcr:d835005d-e092-4d86-8d52-453538ab603f/RECG032016_ECS.%20Application.pdf

- If applicable, the selection of market price benchmark[8]
- If applicable, the auction/determination of tariff premium and a reference tariff for hydropower
- If applicable, the revenue source for the tariff premium and the duration to be provided
- Balancing responsibilities.

21. Given the gaps identified, it is recommended to proceed with a general revision and update of the feasibility studies of both HPPs in two phases, as follows:

Phase 1: Project update and optimization (estimated timeline is 6 months):

- Development of the electricity market study (definition of realistic electricity prices scenarios, assessment of the need for peak energy)
- Revision of flood hydrology and flow time series, including simulation of future scenarios of climate change uncertainties, change in land use or water abstractions for other purposes, to inform HPP design parameters across a range of future scenarios
- Development of a detailed sediment management study with numerical modeling coupling hydraulic and sediment transport, and assessment of the impact of sediment management on the capital expenditure (CAPEX) and operating expenditure (OPEX)
- Revision of E&S design criteria: environmental flow and operation mode, potential need for fish passage facilities
- Revision of project optimization: operation mode (run-of-river vs. daily peaking), design discharge
- Revision of energy generation assessment, and potential monetized benefits of integrating variable renewables and flood control
- Update of construction cost assumptions and parameters
- Revision of construction cost estimate with up-to-date construction prices, based on the current design but including an assessment of the impact of the above studies on the construction quantities
- Revision of preliminary economic and financial assessment, considering the above studies (revised hydrology, revised operation mode and associated energy generation assessment, revised CAPEX, revised OPEX due to sediment management)
- Hold-point—assessment of project viability and, if the project is deemed viable, outline of the project to be developed further: Buk Bijela alone or Buk Bijela and Foca; run-of-river or daily peaking operation mode; design discharge.

Phase 2: Basic design (estimated timeline is 12 months):

- Rehabilitation or replacement and continuous monitoring of meteorological and hydrological stations at the proposed Foca and Buk Bijela HPP locations
- Revision of seismic hazard assessment

[8] In Albania, the market benchmark for private hydropower generators with power purchase agreements is the Hungarian Power Exchange.

- Completion of design update at basic design level of Buk Bijela alone or Buk Bijela and Foca (depending on the outcomes of Phase 1) once all previous bases have been established, with state-of-the-art design principles and criteria
- Development of the CIA at the Drina River (sub-)basin level
- Update of bill of quantities and construction cost estimates
- Update of the economic and financial assessment
- Preparation of a stakeholder engagement plan.

The above two phases are aimed at addressing the gaps in projects' feasibility design identified under this TA and enabling a transition to the next stage of project design. These activities could be carried out in parallel with additional E&S activities such as the CIA and the preparation of a stakeholder engagement plan (see sections C and D).

Figure 2 - Proposed location of Buk Bijela dam, June 2019

Dam site seen from bridge left bank looking downstream

Figure 3 - Proposed location of Foca dam, June 2019

Foča right bank and river near dam axis seen from left bank

C. Review of Environmental Impact Assessment of Buk Bijela and Foca Hydropower Projects

This is a gap analysis of existing EIA documents to inform project sponsors, relevant government authorities, and other stakeholders of any documentation gaps from the lenses of the World Bank Group Environmental and Social Framework as well as International Finance Corporation (IFC) and WBG guidelines concerning the assessment and management of E&S impacts of HPPs. In addition, the gap analysis considers provisions concerning EIA content and processes related to possible transboundary effects of the projects. This purpose is framed notably by the Espoo Convention (1991), Bucharest multilateral agreement (2008), and WBG Operational Policy OP 7.50 concerning Projects on International Waterways.

22. The review of existing EIA document (2013) has indicated key gaps in the assessment of flooding impacts, environmental flows, fish migration and habitat connectivity, and CIA. These gaps were identified through comparison of the existing EIA and environmental permits documentation with the best international practices and also the requirements of the World Bank Environmental and Social Standards (ESS). In terms of potential transboundary impacts, the focus is especially upstream in Montenegro on fish stocks, flooding areas, and environmental flows disruption. It is noted that the transboundary consultation and EIA is governed by the Espoo Convention and will need to be continued during project preparation for Buk Bijela and Foca HPPs.

23. It is also noted that a social impact assessment is not required under the BiH national legislation or the Republika Srpska Laws on Environmental Protection and EIA, therefore the existing EIA document lacks a social assessment. A social assessment would need to be carried out with persons who are immediately affected by project activities and also to cover relevant broader issues that go beyond direct impacts. This TA recommends that social impact assessment be carried out for both Buk Bijela and Foca HPPs and to supplement the existing EIA documentation to the levels of the World Bank required Environmental and Social Impact Assessment (ESIA), guided by the World Bank ESS. Addressing the E&S

assessment gaps will help ready the projects for the next stages of preparation and eventually expand the financing options for these HPPs. The European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), IFC, *Kreditanstalt für Wiederaufbau* (KfW), the World Bank, and many other international financial institutions are committed to the same core idea regarding stakeholders' open and transparent engagement.

24. Key findings from the review of existing EIA document are as follows:

- **Socioeconomic data.** The socioeconomic data presented in the EIAs are too old (2012) and their content insufficient to correctly describe the current E&S situation of the HPPs. They need to be updated and completed. This data update and completion should include a current survey of activities, housings, and inhabitants affected by the flooding areas of the reservoirs and their surroundings.
- **Social impact assessment.** The social impact assessment, which is not required under national legislation, is barely mentioned in the reviewed EIAs. The social impact assessment must be included in the EIA process and meet the specific requirements of the ESS regarding stakeholders and affected communities. This social impact assessment should detail the possible individuals or groups identified as disadvantaged or vulnerable. In addition, it should identify the risks or impacts associated with land and natural resource tenure and use, land access and availability, food security and land values, and conflict or contestation over land and natural resources. The issue of labor including labor influx and workers' safety also has to be assessed, along with community safety and a comprehensive and robust stakeholder engagement plan through the life of the projects. It is estimated that the scope of the social issues that remain to be addressed is manageable and can be addressed within a reasonable budget and time frame.
- **Impacts on fish migration, habitat connectivity, and mitigating measures.** Because of limited description of the current state concerning life cycle, fish migration, and locations of spawning areas within the upper DRB, the consequences of fragmentation on fish populations due to designed dams are insufficiently assessed. Vulnerable fish species include Brown trout and *Hucho hucho* (Danube salmon). The cumulative impacts on fish migration of both potential projects and the existing dams/obstacles in the DRB (such as Visegrad HPP in BiH and Piva HPP in Montenegro) are not assessed. The EIA indicates the need to implement fishways to mitigate adverse effects of each project on fish migration, but insufficient information is provided concerning their feasibility and possible efficiency.
- **Land use, ecosystem services, and the use of living natural resources.** Current vegetation cover, natural habitats (terrestrial and aquatic), and land use in the reservoir areas must be correctly described and mapped. Existing maps in the current EIAs do not even show the limits of the projected reservoirs at an accurate scale, although these perimeters' delineation are available at a 1/10,000 scale on topographic background map. Land uses and users on slopes along the concerned sections of the Drina river valley must be identified. The possible benefits of the future areas of the reservoirs should be described in the EIAs, notably the socioeconomic ones, which should consider the hydraulic operation of the HPPs, generating high fluctuations of the reservoir water levels. Over 1-meter daily fluctuations and several meters of seasonal cumulative variations are expected and should be described. The opportunities for local development of activities and

uses in the area and surroundings of the reservoirs, such as fisheries and tourism, should be assessed.

- **Environmental flows.** The EIAs of Buk Bijela and Foca HPPs refer only to the Republika Srpska current regulation that states a statistical value ($Q_{95\%}$, that is, minimum mean monthly flow of a 95 percent exceedance probability). This does not comply with the requirement of the WBG concerning environmental flow assessment. Further assessment of environmental flows, including sediment load and flows, is recommended.
- **Community safety.** During the construction period, the possible impacts on housing near Foca HPP are not sufficiently assessed. The flood risk assessment and safety measures for both Buk Bijela and Foca HPPs need to be improved. The flood risk assessment and accident prevention plan (for example, in case of a dam failure) for the operation period will need to be developed.
- **Involuntary resettlement.** The remaining involuntary resettlement impacts are relatively minor and modest as compared to other large dams. There is a need to assess the construction impact on inhabitants situated in the vicinity of the dam sites, more specifically Foca dam site (Buk Bijela dam site is less of a concern as no inhabitants are living in its vicinity). Based on the site visits undertaken, there are small number of homes and other infrastructure in the vicinity of the project sites. Since the planning for these projects, especially Buk Bijela, was undertaken a long time ago, the land has been cleared and acquired. The social assessment will need to verify any impacts related to illegal or legal land use in the buffer zone of the project. However, overall, these projects will not have to deal with complex resettlement issues which is often a challenging feature of many large dams.
- **CIAs.** Cumulative impacts (that is the cumulative effects of hydropower or other infrastructure developments in the same river, watershed, or region in the present and in the foreseeable future) are not properly assessed, for both Buk Bijela and Foca HPPs, and also for the existing HPPs of Visegrad (downstream) and Piva (upstream in Montenegro) and any other planned or ongoing infrastructure developments located in the upper DRB.
- **Transboundary impacts and permitting process.** The transboundary impacts downstream and especially upstream in Montenegro on fish stocks, flooding areas, and sediment environmental flows disruption will need to be assessed further. This could be done in conjunction with the aforementioned CIAs. The application of the Espoo Convention[9] provisions in the environmental permitting process and the involvement of the Montenegro authorities are simultaneously in progress for both HPPs. Montenegro authorities, as a potential affected party, have been involved since the initial permitting process in 2013. In 2018, during the renewal of the environmental permits, the Montenegro authorities requested for a new transboundary public consultation. It is recommended that the Espoo Convention application process be continued on the basis of the completed and relevant ESIAs. The transboundary impacts particularly on water quantity and quality both upstream and downstream, once assessed, would serve as a basis for the notification

[9] The transboundary consultation process is governed by the Convention on Environmental Impact Assessment in a Transboundary Context, called Espoo Convention (1991). The Espoo Convention sets out the obligations of parties to assess the environmental impact of certain activities at an early stage of planning. It also lays down the general obligation of states to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries. It also provides framework for dispute resolutions.

of riparian countries, in line with OP 7.50 in a process that is established as an open dialogue early in the project preparation but also for the duration of the project itself and beyond.

D. Introduction to Stakeholder Engagement Framework - Integrated Water and Hydropower Development in the Drina River Basin

To help inform social assessments for any development of HPPs in the DRB, this TA provides an introduction to a Stakeholder Engagement Framework. The framework has been designed to serve as a road map for development of specific stakeholder engagement programs or plans for prospective HPPs when the specific locations, stakeholder groups, types and technologies, and schedule of activities are known.

25. Development activities in water and hydropower often require the natural and human environment to be altered. These alterations and the overall success or failure of such projects have for quite some time now linked directly to the investment and efforts made at early stages into stakeholder engagement activities. The best scenarios tell us to develop, nurture, and maintain solid partnerships with stakeholders. The complexity of the HPPs, equally in design, construction, and operation, itself justifies any stakeholder engagement to be integrated into project management as a golden rule. This would enable a good analysis of the diverse impacts on different stakeholder groups and overall associated risks to be well understood and adequately considered during overall planning and adopting strategies for taking decisions. This includes bringing aboard expertise in the field. Geopolitical and economic context in the stakeholder engagement activities plays a key role and may be detrimental if neglected on the one hand but on the other is often dependent on factors residing outside the project and susceptible to changes particularly in the transboundary context.

26. Stakeholders need to be brought into projects by involving them in early stages and throughout the project cycle, which begins as early as planning and is followed by implementation and operation stages. As a starting point of this iterative process, under this TA an SEF has been prepared accompanied by a stakeholder mapping exercise laying down a strong foundation for future expansion of both. The work followed the World Bank's ESF[10] which came into effect on October 1, 2018, and the ESS[10] targets 'Stakeholder Engagement and Information Disclosure', in particular the Strategic Framework for Mainstreaming Citizen Engagement in WBG Operations,[11] and the World Bank Operational Policy OP 7.50 Projects on International Waterways that ensures that the international aspects of a project on an international waterway are dealt with at the onset. The document has also considered alternative approaches in recalibrating stakeholder engagement due to COVID-19 imposed restrictions. However, the documents also satisfy the core principles of stakeholder engagement—EBRD, EIB, IFC, and many other international financial institutions—which revolve around the fundamental stakeholder engagement idea: stakeholders need to be meaningfully consulted and support open and transparent engagement.

27. The regulatory and legal framework in a country greatly marks the approach to stakeholder engagement. The commitment to engage with citizens is not housed under a single self-standing law or regulation in either of the countries of the DRB.[12] However, recognizing the importance of citizen engagement is embedded in their legal systems and clearly recognized by the mandatory procedures provided by individual laws. BiH, Montenegro, and Serbia have accessed the Aarhus Convention on Access

[10] www.worldbank.org/en/projects-operations/environmental-and-social-framework/brief/environmental-and-social-standards
[11] https://consultations.worldbank.org/sites/default/files/materials/consultation-template/engaging-citizens-improved-resultsopenconsultationtemplate/materials/finalstrategicframeworkforce_4.pdf
[12] Albania's share in the total DRB area is negligible and has therefore not been considered in the Stakeholder Engagement Framework and Stakeholder Map.

to Information, Public Participation in Decision Making, and Access to Justice in Environmental Matter. This is also the case with 1991 Espoo Convention (in force since 1997), one of the most authoritative codifications of the EIAs in the transboundary context to which BiH, Montenegro, and Serbia are all party to.

28. The stakeholder engagement process needs to consider the national requirements of each of the three countries and the mandatory requirements of any financing institutions with the intent to support implementation. Under this TA, an SEF for the DRB has been prepared. This SEF may help guide the preparation of a project- and context-specific stakeholder engagement program, including a strong and appropriate grievance mechanism that serves as a key testing tool to the effectiveness, efficiency, and implementation of the SEF and the specific stakeholder engagement program itself.

29. The SEF methodology adopts a basin-wide approach with a line of sight on the Upper Drina potential HPPs (for example, Buk Bijela and Foca HPPs). However, the SEF's underlining principles are applicable to all three countries and guide preparation of any site-specific stakeholder engagement program focusing on water and energy. This project-specific stakeholder engagement program would detail a differentiated and tailored list of outreach and communication strategies to meet the needs of each project phase. The SEF has considered the transboundary context and needs to communicate with riparian states. Recommendations on how to advance with the notification process under the Espoo Convention have also been included. The SEF differentiates the needs of each of the two broad categories of stakeholders recognized, with the third cutting across both categories:

(1) **Project-affected parties.** These include persons likely to be affected by the project because of actual impacts (positive and negative) or potential risks to their physical environment, health, security, cultural practices, well-being, or livelihoods. These stakeholders may include individuals or groups, including direct project beneficiaries and local communities, that is, individuals or households most likely to observe/feel changes from E&S impacts of the project.

(2) **Other interested parties (OIPs).** These include individuals, groups, or organizations with an interest in the project, which may be due to the project location, its characteristics, its impacts, or matters related to public interest. For example, these parties may include regulators, government officials, the private sector, the scientific community, academics, unions, women's organizations, other civil society organizations, and cultural groups.

(3) **Disadvantaged/Vulnerable groups**. Persons who may be disproportionately affected or further disadvantaged by a project compared with any other groups due to their vulnerable status[13] may require special engagement efforts to ensure their equal representation in the consultation and decision-making process associated with the project.

30. The SEF has been designed to serve as a road map for development of specific stakeholder engagement programs or plans to be prepared for prospective HPPs when the specific locations, stakeholder groups, types and technologies, and schedule of activities are known. The screening of relevant information to understand the characteristics of people/communities that will be affected by a project is a part of the stakeholder engagement programs or plans.

[13] Vulnerable status may stem from an individual's or group's race, national, ethnic or social origin, color, gender, language, religion, political or other opinion, property, age, culture, literacy, sickness, physical or mental disability, poverty or economic disadvantage, and dependence on unique natural resources.

Annex 1 provides a Stakeholder Map for an Integrated Water And Hydropower Development in the Drina River Basin.

E. Rehabilitation requirements of Piva HPP in Montenegro and Visegrad HPP in Bosnia and Herzegovina

The utilities EPCG in Montenegro and ERS in BiH proposed the Piva HPP and Visegrad HPP for this TA. Piva HPP is upstream of the location where Piva River and Tara River merge to form the Drina River. Visegrad HPP is on the Drina River. Technical reports related to the rehabilitation of both projects were made available for review.

Over the course of this TA, the World Bank team also consulted with utilities EPBiH and EPHZHB in BiH and ERS in Serbia regarding rehabilitation requirements of existing HPPs, although they were not proposed for review under this TA. The World Bank has a long track record in supporting the rehabilitation of hydropower facilities and dam safety improvement in Southeast Europe and stands ready to support additional undertakings following this TA.

31. **Piva HPP in Montenegro**. This 342 MW HPP with a high, arch dam was commissioned in 1976 and is the second largest hydropower plant in Montenegro, with a planned generation of 860 million kWh annually (about 25 percent of electricity generated in Montenegro). It is in the northwest part of Montenegro, on the Piva River, about 10 km upstream of the location where Piva River and Tara River merge to form the Drina River. Piva HPP has been going through a comprehensive rehabilitation program in this past decade, covering electrical, mechanical, civil structures, and reservoir aspects.

Due to Piva HPP's design as a high, arch dam, continuing rehabilitation works of grout curtain that helps manage water seepages or leakages damaging dam and reservoir, and improves abutments stability—and modernization of dam monitoring system, including seismic monitoring, are of key importance for uninterrupted operation and are still required. The project is planned to continue operating for at least another 20 years.

In March 2021, EPCG confirmed its plan to move forward with the above-mentioned works on Piva HPP as a priority. Following the coronavirus travel restrictions, the World Bank and Électricité de France (EDF) eventually visited the project during July 20–21, 2021. The key findings from the visit are as follows: (a) there is a near-term need for a complete rehabilitation of the dam monitoring system due to the advanced age and condition of the existing system; (b) a quantitative risk assessment is recommended to be carried out, including hydrogeological, geotechnical, seismic, system response, and potential failure mode analysis. This quantitative risk assessment will help to target the performance criteria intended for grouting works to ensure or improve the safety of Piva dam; (c) the Emergency Preparedness Plan is recommended to be updated; and (d) given the geological context and according to available data, the Piva dam's grouting curtain is not fully efficient. Further grouting tests and limited rehabilitation are already envisaged and should be performed. The locations of the envisaged grouting tests seem well defined. The combination of the aforementioned risk assessment and grouting tests will then inform the necessary grouting rehabilitation works and complementary measures such as a water drainage structure.

Figure 4 - Piva Hydropower Plant, July 2021

General view from downstream

Dam instrumentation

32. **Visegrad HPP in BiH.** This 315 MW HPP was commissioned in 1990 and is currently the largest hydropower generator in BiH, generating about 1,070 million kWh annually (about 8 percent of electricity generated in BiH). It is located at a chainage 245 km on the Drina River, with the normal operating level set at an elevation of 331.5–336 m above sea level. Water leakages downstream of the dam were

increasing (from 7 m^3/s in 1996 to 15 m^3/s in 2012), which required remedial works that were completed in 2018.

The project operator ERS has been considering additional works to reduce water leakage through the dam foundation further, which has been recorded at 4 m^3/s compared to an average river flow of 342 m^3/s. According to ERS, the rehabilitation of electromechanical equipment could be needed in the next 10 years. The project is planned to continue operating for at least another 20 years.

In April 2021, ERS confirmed to the World Bank team that the next rehabilitation works for Visegrad HPP are expected to be carried out in the next 5 to 10 years.

Figure 5 - Visegrad Hydropower Plant

Source: https://www.quantum-corporation.com/energy/visegrad-power-station,23#dxig0.

OVERALL RECOMMENDATIONS FOR THE NEXT STEPS

33. The water resource of the DRB is not managed in an integrated manner and could benefit from a formal consultation structure among the riparian countries, preferably a river basin commission. This is to systematically increase the exchange of information and consultation among the riparian countries on their plans for hydropower or any other water resources related developments. However, international experiences have shown that establishing a new river basin organization would require complex geopolitical agreements to be reached; equally complex institutional arrangement to be put in place; and long-term financial, human, and technical resources for its operations. In addition, a river basin organization covering a large geographic area is not always effective for consultation and coordination of matters specific to a smaller area. For the DRB, a less complex formal consultation structure could be considered. This could be a consultation structure agreed among DRB riparian countries and established

under ongoing and future water or energy projects in the DRB or a technical sub-basin consultative group similar to the structure of the working groups within the International Sava River Basin Commission.

34. In early 2021, the power utilities in BiH, Montenegro, and Serbia had participated in the consultation of the hydraulic and hydrological modeling exercise of the DRB under the *West Balkans Drina River Basin Management Project*[2]. Going forward, these power utilities should be encouraged and supported by government authorities, water, and other relevant agencies in incorporating a basin-wide hydraulic and hydrological assessment in the planning, designing, and implementation of an HPP in the DRB.

35. All power utilities in BiH, Montenegro, and Serbia are already implementing their programs for the rehabilitation and safety improvement of existing HPPs in the Drina River and other rivers. These programs should be continued and additional projects be identified. The World Bank Good Practice Note on Dam Safety was published in 2020 and provides guidance on the application of relevant requirements under the ESF as well as guidance on using a risk management approach to the application of the dam safety requirements.[14] These activities will help extend the supply of hydropower for several decades, create enabling structures for supporting more electricity from variable renewable sources, and reduce reliance on electricity from fossil fuels. Furthermore, the expected substantial economic and financial benefits of these programs will provide flexibility for the countries to address electricity tariff sustainability and affordability. In turn, this will indirectly support the countries in addressing shared prosperity and extreme poverty among vulnerable electricity consumers and the general population. The improvement in E&S performance of HPPs and their climate change mitigation will also benefit the general population in the long term.

36. Under this TA, the gap analyses of the feasibility study and EIA for the Buk Bijela and Foca HPPs have identified gaps that are broadly agreed among officials from ERS, Elektroprivreda Serbia (EPS), EDF, and World Bank team. However, decisions are required from government authorities and project sponsors on implementing additional assessment and actions to close those gaps, for instance, the assessment of whether Buk Bijela and Foca HPPs should be a peaking or a baseload facility, the assessment to reduce construction costs, the CIA upstream and downstream, and the transboundary consultation per the Espoo Convention.

37. The gap closing exercise is recommended to be addressed by project sponsors and relevant government authorities to enhance the design feature and bankability of the projects from the perspective of investors and international financial institutions. It should be comprehensive as the different tasks identified to close the gaps are all interdependent. There is, for example, little benefit in carrying out an assessment of the type of operation to be recommended for Buk Bijela-Foca complex without ensuring that the final technical design parameters consider technical, E&S, transboundary, and economic considerations. The World Bank team stands ready to support decision-makers and project sponsors with gap closing assessment and actions and is open to a possible request from government authorities to help facilitate the dialogue with all parties involved in the projects.

[14] https://openknowledge.worldbank.org/handle/10986/35484

Annex 1 - Stakeholder Map: Integrated Water and Hydropower Development in the Drina River Basin

BASIN LEVEL	International Sava River Basin Commission		
STATE GOVERNMENT	BOSNIA AND HERZEGOVINA	MONTENEGRO	SERBIA
	Ministry of Foreign Trade and Economic Relations of BiH State Commission on concessions (for projects developed on the border between BiH and the Republic of Serbia) Focal Points for Administrative Matters regarding the Espoo Convention: Ms. Srebrenka GOLIC Ministry of Spatial Planning, Civil Engineering and Ecology of the Republic of Srpska Trg Republike Srpske 1 78000 BANJA LUKA Telephone: +387 5133 9592 Fax: +387 5133 9653 E-mail: kabinetministramgr@vladars.net Point of Contact (as per Article 3 of the Espoo Convention) Ministry for Foreign Affairs Sarajevo c/o Permanent Mission of Bosnia and Herzegovina 22 bis, rue Lamartine CH-1203 GENEVA Switzerland Telephone: +41 22 345 8844 or 58	Ministry of Sustainable Development and Tourism Ministry of Agriculture and Rural Development Ministry of Economy Inspectorate Focal Points for Administrative Matters regarding the Espoo Convention and Point of Contact (as per Article 3 of the Espoo Convention) Ms. Brankica CMILJANOVIC Head of the Directorate of the Horizontal legislation Ministry of Sustainable Development and Tourism IV proleterske 19 81000 PODGORICA Telephone: +382 20 446283 Fax: +382 20 446215 E-mail:brankica.cmiljanovic@mrt.gov.me	Ministry of Agriculture, Forestry and Water Management Ministry of Mining and Energy Ministry of Construction, Transport and Infrastructure Inspectorate Focal Points for Administrative Matters regarding the Espoo Convention and Point of Contact (as per Article 3 of the Espoo Convention) EIA: Ms. Sabina Ivanovic Head of Department for EIA Ministry of Environmental Protection 1 Omladinskih Brigada Str. 11070 NEW BELGRADE Telephone: +381 11 3131 356 Fax: +381 11 2601 034 E-mail: sabina.ivanovic@ekologija.gov.rs SEA: Mr. Miroslav TOSOVIC Head of the Group for Strategic Environmental Impact Assessments Department Ministry of Environmental Protection 1 Omladinskih Brigada Str. 11070 NEW BELGRADE Telephone: +381 11 2690 977

	Fax: +41 22 345 8889		Fax: +381 11 3132 547 miroslav.tosovic@kologija.gov.rs
ENTITY LEVEL (BiH ONLY)	Federation of Bosnia and Herzegovina: Ministry of Energy, Mining and Industry; Ministry of Agriculture, Water Management and Forestry; Ministry of Spatial Planning; Ministry of Transport and Communications Inspectorate. Republika Srpska: Ministry of Energy and Mining; Ministry of Agriculture, Forestry and Water Management; Ministry of Spatial Planning, Civil Engineering and Ecology; Ministry of Transport and Communications Inspectorate; Ministry of Labor, War veterans and Disabled Persons' Protection; Inspectorate of Republika Srpska (includes Labor inspectorate), Government.		
COMMITTEES AND AGENCIES AND INSTITUTES	State Electricity Regulatory Commission Regulatory Commission for Energy in the Federation of Bosnia and Herzegovina Commission for concessions of the Federation of Bosnia and Herzegovina Federal Hydrometeorological Institute	Regulatory Commission for Energy of Republika Srpska Commission for concessions of Republika Srpska Republic Hydrometeorological Institute of Republika Srpska	Energy Regulatory Agency Environmental and Nature Protection Agency Water Directorate Commission for concessions of Montenegro Institute for Hydrometeorology and Seismology of Montenegro	Environmental Regulatory Agency Energy Agency Republica Hydrometeorological Service Private-Public Partnership Commission of Serbia Institute for Nature Conservation, Joint Energy Committee between Serbia and Republika Srpska

	Environmental Protection Fund, Federation of Bosnia and Herzegovina	Environmental Protection Fund of Republika Srpska Joint Energy Committee between Serbia and Republika Srpska, Institute for Cultural-Historical and Natural Heritage Protection		
REGIONAL LEVEL		Republika Srpska Public Utility Vode Srpske Regional Office for DRB in Zvornik		Provincial Public Water management Company Srbijavode Public Water management Company Vojvodina Vode
ENERGY PRODUCERS	Elektroprivreda Bosne i Hercegovine	Elektroprivreda Republike Srpske	Elektroprivreda Crne Gore	Elektroprivreda Srbije
LOCAL LEVEL	Bosanko-Podrinjski Canton Local government water supply and sewage system Municipalities Foca and Ustikolina	Municipality of Foca Local government water supply and sewage enterprises	Local government water supply and sewage enterprises	Local government water supply and sewage enterprises
ESS5	The Government, Municipalities, Department for Administration and Property Affairs,	The Government, Municipalities, Department for Property Affairs, Accredited experts	The Government, Local Administrations (property Departments), Ministry of Finance, Appraisers	The Government, Local Administrations (property departments), Ministry of Finance, Cadaster office, Tax Administration, Administrative Courts, Appraisers.

	Accredited experts (individual appraisers), Assembly of Brčko District, Department for Environmental Protection and Property Affairs of the Government of Brčko and Financial Directorate of Brčko District.	(individual appraisers)		
ESS2	Federal Ministry of Labor and Social Policy, Federal Inspection Administration, each canton has its Ministry of Labor (in some of them labor issues are merged with justice depatments), some cantons have their own labor and occupational health and safety inspection	Ministry of Labor, Veterans and disabled persons Labor inspectorate	Ministry of Labor and social care Labor Inspectorate	Ministry of Labor, Employment, Veteran and social issues Labor inspectorate Local Labor inspectorates

Nongovernmental Organizations	Save the blue heart of Europe[15] Centar za životnu sredinu[16] Ekotim[17] Zeleni Neretva[18] Green Home Ozon Aarhus Centar Banja Luka Center for Environment Banja Luka World Wildlife Fund (WWF) UNESCO World Heritage Centre	Save the blue heart of Europe Centar za životnu sredinu Ekotim Zeleni Neretva World Wildlife Fund (WWF) UNESCO World Heritage Centre	Save the blue heart of Europe; Green Home[19] World Wildlife Fund (WWF) UNESCO World Heritage Centre	Save the blue heart of Europe World Wildlife Fund (WWF) UNESCO World Heritage Centre

[15] https://www.balkanrivers.net/
[16] https://czzs.org/
[17] http://ekotim.net/bs/
[18] http://zeleni-neretva.ba/index.php?option=com_frontpage&Itemid=1
[19] https://www.facebook.com/green.home.18

Annex 2 - Update of Scenarios 2017 Least-Cost Power Generation Expansion Plan for Bosnia and Herzegovina

Under this TA, the original 2017 scenarios of the least-cost power generation expansion plan for BiH[20] have been updated to incorporate the most recent power sector development, strategy, and plan in BiH. The results of this update are summarized below:

- BiH has an installed power generation capacity of around 4,460 MW with 2,073 MW thermal (mostly lignite), 2,076 MW hydropower (larger than 10 MW each), 159 MW of small hydro, 135 MW wind, and 20 MW solar. Approximately, two-thirds of the power generated comes from lignite, while one-third from hydropower, depending on the hydrological conditions.

Overall electricity generation expansion requirements

- Based on the 'Framework Energy Strategy of BiH until 2035', the country intends to progressively retire thermal power generators shortly: Tuzla 3/4 and Kakanj 5 in 2023, and Tuzla 5 in 2025. Tuzla 6 and Kakanj 6/7 will be retrofitted with emission controls (SO_2, NO_x, and particulates) by the end of 2027 to ensure compliance with the EU Industrial Emissions Directive.[21] Tuzla 6 is expected to operate regularly up to 2035 and as a backup afterwards up to 2050. While Kakanj 6 will also operate regularly up to 2035 and as a backup but only to 2045. Kakanj 7 will be similar to Kakanj 6, with the exception that it will operate during the heating season for district heating of Kakanj city. All these assumptions are subject to optimization in the least-cost expansion plan.
- Until 2040 it is estimated that 2,300 to 4,400 MW of new electricity generation capacity will be needed in BiH. The new capacity is needed mainly to replace the retiring old thermal power generators (totaling 1,105 to 1,888 MW of derated capacity) and the estimated growth in electricity demand of 0.4 to 2.2 percent annually. The existing stock of hydropower plants is estimated to continue operating through 2040, while several hundred megawatts of new HPP capacity are commissioned depending on the scenario.
- The selection of new generating capacity in terms of locations and E&S impacts is a main issue for further deliberation and decision-making.
- The pollutants associated with electricity generation from coal in BiH can be reduced substantially through replacing the retiring thermal power generators with solar, hydro, and wind generators. A 2019 World Bank assessment of air quality in BiH estimates that 19 percent of air pollutants (especially small particulate matters PM 2.5) are from thermal power and heating plants.[22] The potential to expedite the reduction of such pollutants would also depend on the speed of retiring thermal power generators and decisions on new thermal generators.
- The timing for retiring existing thermal power generators and decarbonization of the country's power sector could be expedited. Moreover, the proposed Tuzla 7 could be dropped and the envisaged capacity (450 MW starting 2025) be provided by already existing thermal power plants (TPPs), existing and new HPPs, new renewable generators, and limited imported electricity. The various system needs (for example, ancillary services, reserve margin) could be covered by

[20] https://openknowledge.worldbank.org/handle/10986/27464
[21] https://ec.europa.eu/environment/industry/stationary/ied/legislation.htm
[22] Based on emission factor data for existing thermal power plants in BiH, it is estimated that in 2018 BiH emitted 2,700 tons of PM 2.5, 21,000 tons of NO_X, and 164,000 tons of SO_2. These pollutants could be reduced to 300, 3,000, and 4,500 tons, respectively, in moderate scenarios.

remaining capacities on the grid, complemented by new hydro pumped storage plants and batteries, depending on the scenario.

- Without carbon taxes, the capacity of wind electricity generators will not increase significantly (less than 150 MW). Solar reaches its maximum of 2,000 MW in the least-cost plan but very late, toward the end of the time horizon. If assuming an introduction of carbon taxes in 2025, this would expedite new solar capacity in the least-cost plan, reaching 500–1000 MW by 2030, depending on the scenario. Carbon taxes do not support larger wind penetration since they are not adequately cost competitive compared to other generation technologies in BiH.
- With carbon taxes, BiH electricity sector could become carbon-neutral by 2040. Even if Tuzla 7 is eventually put in service, the carbon taxes would make its electricity uncompetitive in the least-cost plan.
- BiH will partially become a net electricity importer once the policy constraints (renewable energy and CO_2 targets) are introduced. Net electricity imports will increase significantly if carbon taxes become effective, and especially if commissioning of Tuzla 7 is not imposed in the least-cost plan (that is, optimized). To make the country energy secure, additional 2,000 MW is needed on top of other scenarios. Most of this new capacity is estimated to come from wind plants.

Thermal power generation

- The utilization rates of the majority of thermal power generators in 2013–2018 have been moderate, averaging around 60 percent.
- Only the privately owned Stanari TPP recorded utilization rates of approximately 85 percent in recent years.
- The top five largest operating thermal generators are as follows: (a) Stanari, (b) Ugljevik, (c) Gacko, (d) Tuzla 6, (e) Kakanj 7. Together they account for 85 percent of thermal power generation in 2019.
- The proposed Tuzla 7 is estimated to have utilization rates exceeding 80 percent in less than 8 years in the main scenarios. Tuzla 7 capacity factors in the last several years of the analyzed time horizon are quite low, ranging from 0 to 74 percent, depending on the scenario. The justification and feasibility for Tuzla 7 is therefore limited. This result is consistent with the original 2017 least-cost plan supported by the World Bank. Moreover, Tuzla 7 will not be financially feasible if carbon taxes are introduced in BiH and/or a border carbon prices mechanism is introduced for electricity exports and can end up being a stranded asset.
- Electricity and heat generated from natural gas is not competitive in the least-cost plan in all scenarios. This is mainly due to the relatively high CAPEX and OPEX of CCGTs, higher cost of imported natural gas (assumed EUR 7.1 per GJ[23]) than domestic coal prices, and carbon taxes under the applicable scenarios. However, the analysis of adding a new gas-fired thermal power plant in BiH should be further informed by a regional analysis considering different gas supply options.

[23] 1 Gigajoule is about 0.95 million British thermal units.

Hydropower generation

- The utilization of hydropower generators is subject to hydrology and water reservoir management as applicable. The utilization rates of HPPs in BiH in recent years averaged about 33 percent, with a wide range of 7–77 percent.
- The top five largest operating HPPs are as follows: (a) Visegrad, (b) Dubrovnik, (c) Jablanica, (d) Rama, and (e) Trebinje. Together they account for 69 percent of hydropower generation in 2020.
- It is estimated that a few hundred megawatts of new hydropower capacity will be needed until 2040, including those with reservoir or pumped storage. The relatively low capacity of new HPPs is due to existing excess power generation capacity in BiH, low expected electricity demand growth, and decreasing cost of solar power. The limited megawatt means that only a limited number of locations could be selected for development, thus limiting the E&S impacts associated with developing HPPs. The selection should be taken on a basin-wide, integrated water resource development approach, considering transboundary impacts on neighboring countries, and any electricity export costs and benefits tradeoff. Nevertheless, hydro projects with storage take a long time to plan and implement, so some of these projects may need to commence planning soon.

Variable renewable electricity generation

- By 2020, there will only be 87 MW of grid-scale wind power generators and no grid-scale solar generator in BiH.
- Without carbon taxes or other financial incentives, the capacity of solar and wind electricity generators will not increase significantly (less than 150 MW) in the least-cost plan until almost 2040. This is mainly due to existing excess power generation capacity in BiH and low expected demand growth. They are not adequately cost competitive compared to coal and hydropower in BiH. If assuming an introduction of carbon taxes in 2025, this would expedite new solar and wind generation capacity in the least-cost plan, exceeding 700 MW by 2030. The capacity of variable electricity generators, solar and wind, is capped at about 2,000 MW in the least-cost plan to ensure power system stability.
- Due to low electricity demand in BiH at night time in general, the least-cost plan selects much more new solar PV capacity than wind because of the lower levelized cost of solar PV generation. There is limited need for wind electricity at night time at the system-wide level. Nevertheless, the actual selection between solar and wind capacity must be nuanced by solar and wind resources, regional power generation capacity, energy security, geographic locations, and power grid absorption ability.

Hydro pumped storage and battery storage

- To cover the system needs, significant storage capacity will be needed. In all scenarios, pumped storage hydropower plants come online, notably in case carbon pricing is introduced (up to 500 MW), depending on the scenario. This is complemented by 90 MW of storage hydro in carbon pricing scenarios. To support provision of ancillary services, batteries come online as early as 2025, with somewhat limited capacity (for example, 37 MW in case of introduction of carbon pricing and optimized Tuzla 7).

Annex 3 - List of HPP Candidates from the Western Balkans Regional Strategy for Sustainable Hydropower Development (2019)

EXISTING LARGE HYDROPOWER PLANTS – REHABILITATION

Beneficiary	Hydropwer Plant	FA	PFS	FS	ESIA	Main Design	Permitting	River Basin	Capacity (MW)	Estimated Cost (€million)
Albania	Uleza	✗	🟡		🐟 🌿			Mat	25.2	TBD
	Shkopeti	✗	🟡		🐟 🌿			Mat	24	TBD
	Fierza	✓		🟢	🐟			Drin-Buna	500	32.3
Bosnia and Herzegovina	Jablanica	✗			🐟	🟢		Neretva	180	3
	Una-Kostela	✗			🐟		🟢	Sava	10.1	16.8
	Jajce 1	✗	🟡		🐟			Sava	60	TBD
	Jajce 2	✗			🐟	🟡		Sava	7.2	TBD
	Čapljina	✗	🟡		🐟			Trebišnjica	440	TBD
North Macedonia	Vrben	✗		🟡	🐟 🌿			Drin-Buna	12.8	4.6
	Shpilje	✗		🟡	🐟			Drin-Buna	84	3.9
	Globočica	✗		🟡	🐟			Drin-Buna	42	5.8
	Tikvesh	✗		🟡	🐟			Vardar	116	0.84
	Vrutok	✗		🟡	🐟			Vardar	165.6	4.05
	Raven	✗		🟡	🐟			Vardar	21.3	0.92
Kosovo	Ujmani !	✓		🟢				Velika-Morava	35	9.8
Montenegro	Perućica	✗	🟡		🐟			Morača	307	65.3
	Piva	✗		🟢	🌿			Sava	342	86.7
Serbia	Djerdap 2	✗	🟢		🐟			Danube	270	150
	Uvac !	✗	🟡		🌿			Sava	36	TBD
	Potpeć !	✓			🐟		🟢	Sava	54	50
	Kokin Brod !	✗	🟡		🐟 🌿			Sava	22.5	TBD
	Bistrica	✗		🟢				Sava	104	25
	Pirot	✗	🟡					Velika-Morava	80	TBD
	Vlasina System !	✓					🟢	Velika-Morava	128.5	48

FA = Financing Agreement PFS = Pre-feasibility Study FS = Feasibility Study ESIA = Environmental and Social Impact Assessment

🌿 Protected Area

🐟 Area of special importance for fish / (threatened and / or migratory species)

! In need of urgent rehabilitation (no previous interventions)

🟢 Current Status: Project preparation/ implementation as due

🟡 Current Status: Stalled project preparation /implementation (e.g. +3 year old studies; no construction)

1. Greenfield projects which do not face serious bottlenecks

Beneficiary	Hydropower Plant	FA	PFS	Feasibility Study	ESIA	Main Design	River Basin	Capacity (MW)	Estimated Cost (€million)
Albania	Skavica 385	✗		🟢	🐟 ⚠		Drin - Buna	132.0	255
	Katundi i Ri	✗		🟡	🐟 ⚠		Drin - Buna	49.0	255
	Mati 1	✓	🟡				Mat	14.7	18.0
	Mati 2	✓	🟡		🐟		Mat	14.8	18.9
Bosnia and Herzegovina	Skakala	✗	🟡		🐟 ⚠		Neretva	26.4	82.3
	Kovanici	✗		🟢	🐟 ⚠		Sava	13.3	38.8
	Janjici	✗		🟢	🐟 ⚠		Sava	13.3	55.0
	Vinac	✗	🟡		🐟 ⚠		Sava	11.5	25.1
North Macedonia	Tenovo - Kozjak Channel	✗	🟢		🐟 ⚠		Vardar	35.0	84.0
	Cebren	✗		🟢	🐟		Vardar	458.0	553
Montenegro	Komarnica	✗		🟢			Sava	172.0	178.3
Serbia	Ibar Cascade	✗			🟡 ⚠		Velika Morava	121.5	345.4
	Ribarice	✗		🟡	🐟		Velika Morava	46.7	97.3
	RHE Bistrica	✗		🟡	🐟		Sava	680.0	551.1
	Djerdap 3 - Phase 1	✗		🟡			Danube	600.0	418.0

FA = Financing Agreement PFS = Pre-feasibility Study ESIA = Environmental and Social Impact Assessment

🟢 Current Status: Project preparation/implementation as due

🟡 Current Status: Stalled project preparation /implementation (e.g. +3 year old studies; no construction)

🔴 Current Status: Serious stumbleblocks (e.g. litigations; permits/studies rejected)

🐟 Area of special importance for fish / (threatened and / or migratory species)

⚠ Potential resettlement

2. Greenfield projects which face serious bottlenecks (e.g. litigations) or environmental and social concerns

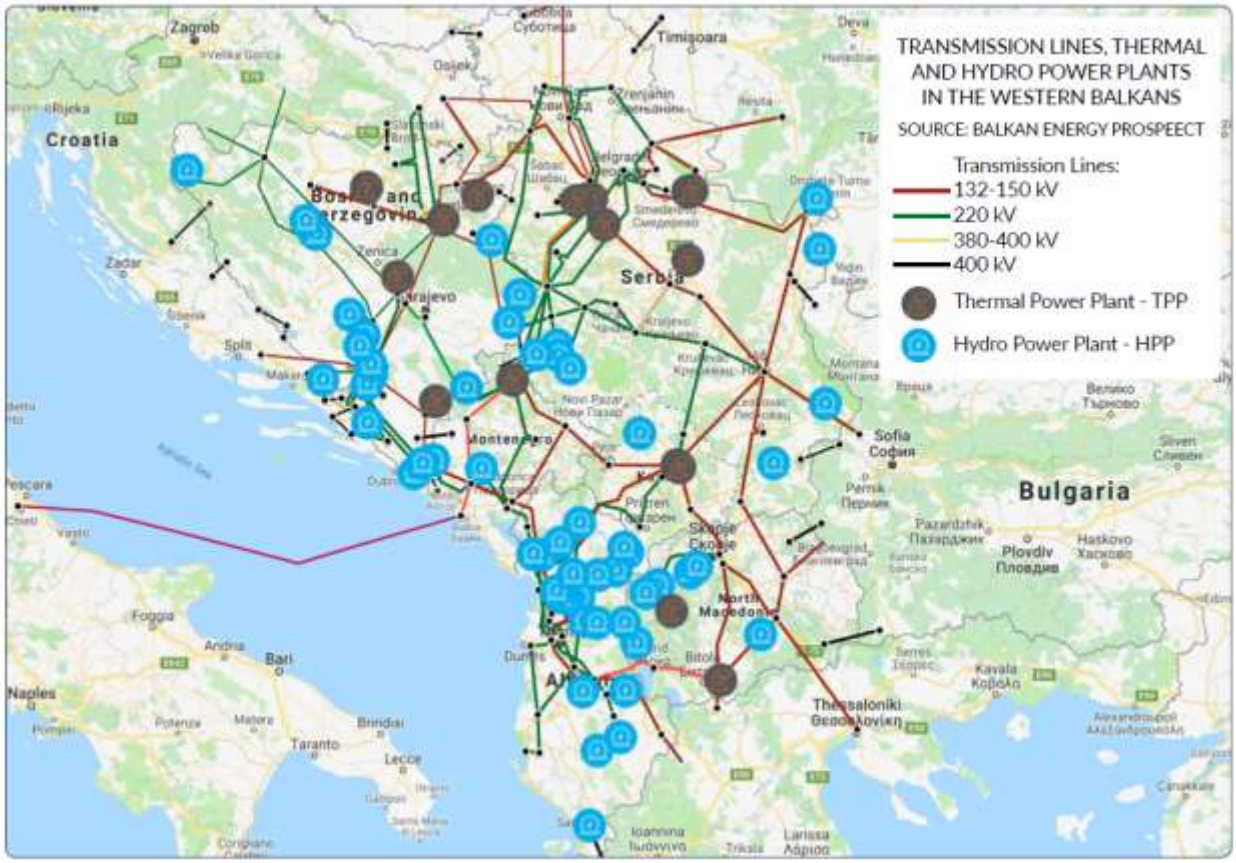
Beneficiary	Hydropower Plant	FA	PFS	Feasibility Study	ESIA	Main Design	River Basin	Capacity (MW)	Estimated Cost (€million)
Bosnia and Herzegovina	Bjelimici	✕		●	● !		Neretva	100.0	165.7
	Glavaticevo	✕		●	● !		Neretva	28.5	72.9
	Foca	✕		●	●		Sava	44.2	117.8
	Paunci	✕		●	●		Sava	43.2	124.4
	Buk Bijela	✕		●	● !		Sava	93.5	194.4
	Sutjeska	✕		●	●		Sava	44.1	138.1
	Rogacica	✕	●		● !		Sava	113.3	245.6
	Tegare	✕	●		● !		Sava	120.9	284.6
	Dubravica	✕	●		● !		Sava	87.2	348.2
	Kozluk	✕	●		● !		Sava	88.5	303.2
	Drina 1	✕	●		● !		Sava	87.7	287.1
	Drina 2	✕	●		● !		Sava	87.8	329.0
	Drina 3	✕	●		● !		Sava	101.0	427.2
	Ustikolina	✕			● !	●	Sava	60.5	139.9
	Gorazde	✕	●		● !		Sava	37.0	56.3
	RHE Bjelimici	✕		●	● !		Neretva	500.0	232.9
	RHE Buk Bijela	✕		●	●		Sava	600.0	376.1
	CHE Vrilo	✕		●	● !		Neretva	66.0	95.9
Kosovo	PSHP Vërmica	✕	●		● !		Drin-Bune	480.0	308.6
Montenegro	Zlatica	✕		●	●		Morača	37.0	98.1
	Raslovici	✕		●	●		Morača	37.0	85.2
	Milunovici	✕		●	● !		Morača	37.0	89.3
	Andrijevo	✕		●	● !		Morača	127.0	225.8
Serbia	Rogacica	✕	●		● !		Sava	113.3	245.6
	Tegare	✕	●		● !		Sava	120.9	284.6
	Dubravica	✕	●		● !		Sava	87.2	348.2
	Kozluk	✕	●		● !		Sava	88.5	303.2
	Drina 1	✕	●		● !		Sava	87.7	285.5
	Drina 2	✕	●		● !		Sava	87.8	329.0
	Drina 3	✕	●		● !		Sava	101.0	427.2

Annex 4 - List of Documents prepared under this Technical Assistance

Integrated Water and Hydropower Development in the Drina River Basin

1. *Slides - TA Launch Presentation, December 2018, World Bank Staff*: The presentation includes an overview of hydropower project financing, risk allocations, and examples of hydropower projects supported by the WBG.
2. *Gap Analysis Report, March 2020, EDF-EGIS*: Review of the series of study *Support to the Water Resources Management in the Drina River Basin* (COWI, Stucky and JCI, 2017 - COWI reports).
3. *Gap Analysis Report, June 2020, EDF-EGIS*: Review of the feasibility study of hydropower projects in the DRB, Buk Bijela, and Foca Hydropower Projects (Stucky 2012).
4. *Gap Analysis Report, March/June 2020, EDF-EGIS*: Review the Environmental Impact Assessment of Buk Bijela and Foca Hydropower Projects (IG and Institute for Protection Ecology and Informatics Banjaluka) and the environmental permits (2013, renewed in 2018).
5. *Report - Introduction to Stakeholder Engagement Framework, Drina River Basin, November 2020, World Bank Staff.*
6. *Slides and Spreadsheet Models - Scenarios Update to the 2017 Least-Cost Power Generation Expansion Plan for Bosnia and Herzegovina, May 2021, World Bank Staff.*
7. *Report - Assessment of the Rehabilitation and Dam Safety Improvement Requirements of the Piva HPP in Montenegro and Visegrad HPP in BiH, October 2021, EDF.*

Annex 5 - Transmission Lines, Thermal and Hydropower Plants in the Western Balkans



Source: The Warsaw Institute Review. 2019. *Western Balkans Infrastructure and Energy from a Geopolitical Perspective*. Conference Report.

Source: ENTSO - https://eepublicdownloads.entsoe.eu/clean-documents/Publications/maps/2019/Map_ENTSO-E-4.000.000.pdf

Annex 6 - Salient Features of Buk Bijela and Foca HPPs

		Buk Bijela HPP	Foca HPP
HYDROLOGY			
Catchment area	km^2	4,158	4,692
E-flow	m^3/s	25	27
Mean annual flow	m^3/s	162	178
10,000 years flood	m^3/s	5,484	5,601
RESERVOIR			
Full Supply Level (FSL)	masl	434.0	404.2
Reservoir volume	hm^3	15.7	6.7
Live volume	hm^3	11.0	4.6
Dead volume	hm^3	4.7	2.1
Reservoir area at FSL	km^2	1.23	0.91
Reservoir length	km	11.5	10.0
DAM			
Dam type		Concrete gravity	Concrete gravity
Dam height	m	36	21
Dam length	m	197	208
Dam crest elevation	masl	436.1	406.8
Diversion type		Tunnel	Longitudinal Cofferdam
SPILLWAY			
Spillway type		Bottom outlet + surface gates	Surface gates
1,000 years flood	m^3/s	3,790	3,790
Check flood (10,000 years)	m^3/s	5,484	5,600
Number of surface gates		2	4
Number of bottom gates		1	-
LARGE TURBINES			
Number units		2	2
Unit design flow	m^3/s	150	150
Type		Kaplan	Bulb
Nominal net head	m	29.0	13.7
Rated power	MW	40.11	18.95

		Buk Bijela HPP	Foca HPP
SMALL TURBINES			
Number of units		1	1
Unit design flow	m^3/s	50	50
Type		Kaplan	S-type
Nominal net head	m	29.0	13.7
Rated power	MW	13.30	6.25
LARGE GENERATORS			
Capacity	MVA	45.0	21.5
Voltage	kV	10.5	10.5
SMALL GENERATORS			
Capacity	MVA	15.0	7.0
Voltage	kV	10.5	10.5
TRANSMISSION			
Substation type		GIS	GIS
Evacuation voltage	kV	440/220/110	110
ENERGY GENERATION			
Design flow	m^3/s	350	350
Max power	MW	93.5	44.2
Total annual generation	GWh/year	332	176
Base generation	GWh/year	210	129
Peak generation	GWh/year	122	47
Operating mode		Daily peaking	Daily peaking