TECHNICAL CONSULTING SERVICES - TERMS OF REFERENCE

Study on hydropower retrofitting potential in Romania

WWF-Romania (World Wide Fund for Nature România) is an internationally recognized non-governmental organization with the primary goal of global and local nature conservation, possessing expertise in various fields, including the energy sector and related policies.

1. General Information

In the context of both the energy crisis as well as the decarbonisation planning of the energy sector in the region (where, in some cases, hydropower is promoted as a RES that can stabilise the electricity system), discussions have already started on the implications and potential of hydropower retrofitting, for both increased energy output as well as improving environmental performance (eg. ecological flow) and for finding more sustainable alternatives to the current development plans to build additional HPPs on very sensitive river sections. Under an EFC grant, WWF Romania intends to subcontract a study with the aim to answer the following **key question**: what is the retrofitting potential (from an energy production perspective) and what are the implications (technical, economical and environmental) for hydropower in Romania in a climate change context?

The retrofitting potential study should aim to capture the baseload and balancing capacity of hydropower in the future and therefore, it should look at both hydroelectricity plants as well as pump storage facilities using the publicly available data and information as well as WWF Romania's databases containing information such as: project details (name, type, location, owner, current installed capacity (MW), current annual energy production (GWh), location potentially impacting a protected area, water body name, water body code, water body status, year of first operation etc.).

Objective

Understand the realistic low conflict-low impact nationwide retrofitting potential for hydropower, in Romania as an advocacy tool for C&E mitigation goals and freshwater goals. WWF-Romania will elaborate a visual (map) of the potential sites identified.

Scope of the study

The assessment will be focused to:

- medium and large hydropower electric plants in operation (more than 30 MW installed capacity).
- hydropower electric plants that are over 20 years old as they are likely to benefit the most from modernization. According to the Hydropower Special Market Report by the International Energy Agency (IEA) the average hydropower plant in Europe is 45 years old. Hydropower plants that are 20 - 40 years old are generally considered ideal candidates for retrofitting due to the balance of technological obsolescence and remaining operational life. Retrofitting these plants can lead to significant improvements in efficiency, capacity, and environmental compliance, ensuring their continued contribution to renewable energy goals.
- hydropower electric plants that are not located within designated protected areas such as protected areas of national interest (scientific reserves, national parks, natural monuments, nature reserves, natural parks), of international interest (Geoparks) and of European interest such as Natura 2000 sites. Also, avoiding sites that are critical habitats for endangered or vulnerable species.
- a buffer zone for retrofitting hydropower projects should be carefully defined to protect ecosystems and minimize environmental impacts. A recommended practice is to avoid implementing projects that involve changes to the course, flow, or water level within protected natural areas or within a 20 km upstream distance from these areas. The sensitivity of the local environment should be considered, with larger buffer zones for areas with fragile ecosystems, endangered species, or critical habitats. Implementing adaptive management practices will allow for adjustments to the buffer zone based on monitoring and ongoing environmental assessments, ensuring a balance between hydropower development and the environment.

The study will assess the retrofitting potential taking into consideration technical, economic and ecological perspectives/ criteria as detailed further:

- **Water scarcity impacts due to climate change on all categories of HPPs** and further assess technical options for retrofitting. This assessment should be based on a wide methodology and not specific data for specific river catchments, due to data challenges.
- **Technical retrofitting options for medium and large HPPs that can be retrofitted, including improvement in design for ecological benefits, where possible.**
- **Evaluation of impacts in terms of energy generation change** (what this means for baseload needs in the future and what it means for balancing needs of other variable

RES) after retrofitting and *if possible, environmental impacts (benefits) that can result from integration of impact mitigation measures.*

- The **economic implications of retrofitting** HPPs including possible impact mitigation components. The study will seek to see if it is economically viable (and, if possible, what are similar experiences globally).

Expected Outcomes

- A methodology will be developed outlining the steps, the research methods employed for the study and the data needed

- The study should conclude on:
    1. Technical retrofitting options (including outlook on technology in next decades) for certain HPPs and the results in terms of energy generation output and potential ecological impact mitigation;
    2. Propose a buffer zone for retrofitting projects near protected areas, to ensure minimal environmental impact during the retrofitting and to preserve the integrity of the protected ecosystem.
    3. Economic implications of HPP retrofitting based on technical options employed;
    4. Develop Environmental Performance Indicators for ecological improvements resulting from retrofitting;
    5. A cost-benefit analysis of retrofitting versus building new HPPs or alternative energy sources.
    6. Impacts of water scarcity on HPPs (water supply and energy generation) in Romania.

The study will first serve as an internal reference for policy and project work and certain elements of it can be further made public.

2. Detailed criteria to be considered

Energy sector

A. Technical Criteria

- age and condition of infrastructure - assess the age and condition of turbines, generators, and other critical components to determine the feasibility and benefits of retrofitting. HP with outdated or deteriorating infrastructure should be prime candidates.

- efficiency and performance metrics - evaluate the technical potential for performance improvements, efficiency gains, and capacity enhancements through retrofitting measures. For example, take into consideration as a starting point HP with efficiency levels below energy industry standards or identify HP with frequent maintenance issues or operational downtimes that could be mitigated through retrofitting.

- potential capacity - determine the possibility of increasing the installed capacity without significant environmental or social impacts and take if possible into consideration HP with declining/ suboptimal energy production relative to their designed capacity.

- technology compatibility - check if the new technologies (type, size, materials etc.) are compatible with existing infrastructure and operational practices.

B. Grid Integration and sustainability ***(any of the following criteria would be an added value to the study)***

- grid demand - look at the role of the HP in the local or regional grid and its potential to meet current and future demand.

- renewable integration - check if it has the potential to support the integration of other renewable energy sources (e.g., solar, wind and have a hybrid system) through improved flexibility and storage capacity.

- sustainability policies and standards - consider HPPs that contribute to broader sustainability and environmental goals, such as reducing carbon emissions.

Environmental sector ***(any of the following criteria would be an added value to the study)***

A. Environmental Impact

- resilience to support physical climate risks e.g. extreme weather, flooding, precipitation, water temperature, seasonal variations should be considered in the selection of the HP.

- current environmental affected areas - select if possible first the HP with significant environmental impacts that could be mitigated through retrofitting e.g., fish passage improvements, reduced emissions.

- compliance with regulation - prioritize HP facing regulatory pressures.

- area suitability - the selection should be considered also based on the topography of an area, the protection status or the social criteria (competing demands for water).

- cumulative impacts - take in consideration the cumulative impacts of retrofitting in the context of other regional/ national developments and infrastructure projects.

- restoration of the surrounding area - look at examples for riparian habitat restoration to improve biodiversity along riverbanks or wetlands in the reservoir area to support diverse flora and fauna.

B. Water status, use and availability

- water quality and ecological status - integrating considerations of this criteria is essential for ensuring environmental sustainability, regulatory compliance, and long-term viability.

- water efficiency - assess the potential for improving water use efficiency through retrofitting, to see if there is enough water flow to support an increase in capacity or improved operational flexibility.

- water availability - look at HP in regions with sufficient water availability to support enhanced operations post-retrofit; Also, pay attention to seasonal variations in water availability and their impact on hydropower production, as well the potential impacts of climate change on long-term water availability.

- environmental flow requirements - by adhering to established environmental flow standards, retrofitting projects can mitigate potential impacts on fish populations, water quality, and habitat connectivity, thereby promoting ecological sustainability and complying with regulatory frameworks.

- type of the HP - look at the geographical and geological factors, size of existing reservoir or distance between the reservoir, if applicable.

- sediments - pay attention to the transport rate and to the systems that prevent sediment from entering turbines and causing damage.

- competing demands for water, such as irrigation, drinking water, and industrial use should also be considerate.

Socio-economic sector

A. Economic Criteria

- safety
- cost-effectiveness

B. Social and Community Criteria ***(any of the following criteria would be an added value to the study)***

- community impact
- social benefits
- demand assessment

3. Profile

Required Qualifications of expert/team of experts:

- At least MSc in engineering in the energy sector.
- Preferably in hydropower or renewable energy systems.
- Relevant experience in hydropower/ hydrotechnical engineering.
- In-depth knowledge of national and international energy policies, regulations, and standards.

- Experience with environmental mitigation and enhancement measures related to aquatic ecosystems is a plus.
- Proven track record in leading or part of retrofitting projects or upgrades for hydropower facilities, is a plus.

4. Deliverables and deadlines

- Receipt of offers: July 30, 2024.
- Discussion about data that will be used: a commonly agreed date in the first part of August, 2024.
- Presentation of the preliminary report: August 23, 2024.
- Final report: no later than September 6th, 2024.
- Presentation of results in an online workshop organized by WWF-Romania - date to be commonly agreed.

5. Reporting

Contractual relations will be concluded with WWF Romania, and the contract and payments will be handled by WWF Romania.

6. Evaluation criteria (Financial Offers)

- As a non-profit organization, the financial criteria is important.

Selection Criteria: The service provider will be selected based on the best quality/price ratio, considering how well it responds to the requirements outlined in the terms of reference.

7. How to apply

Please send an email expressing your interest in this consultancy opportunity with “Study on Hydropower retrofitting potential in Romania” in the subject line to adanciu@wwf.ro and rserbanica@wwf.ro no later than 30 July 2024. This should include your offer (technical and financial), a brief cover letter explaining your interest and capacity and your CV.

8. Payment

A single payment will be made upon receipt and acceptance of the final report. Non-delivery of agreed-upon deliverables or exceeding agreed-upon deadlines may result in the withholding or reduction of payment.