

KEY PARTNER

Lead Partner / Owner:



International Water
Management Institute

<https://www.iwmi.org>

Contributing Partners:

Technical
University
of Munich



TIAME
NATIONAL RESEARCH UNIVERSITY

CARTIF



OVERALL PROJECT

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Coordination:

Technical University of Munich
eMail: coordination@hydro4u.eu

www: <https://hydro4u.eu/>

LinkedIn: [Hydro4U](#)
X: [@Hydro4Uproject](#)
YouTube: [Hydro4U](#)



„Uncovering unique insights into small hydropower nexus benefits and tradeoffs“

Situational Analysis of Nexus Implications of Small Hydropower in Central Asia

► Key Messages

Situational analysis for nexus between small hydropower plant (SHP) and the irrigation sector in the context of small rivers creates a framework for cross-sector decision-making by quantifying and comparing benefits and tradeoffs. The analysis includes technical, socio-economic, environmental, and resource conditions.



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- A situational analysis of the Shakhimardan demonstration site indicates that the new SHP generates 11.5 gigawatt hours (GWh) annually. This capacity is sufficient to cover the local demand of 9 GWh while providing a surplus for export to neighboring Kyrgyz settlements. The estimated annual economic value of the new SHP will exceed \$500,000.
- In the At-Bashi demonstration site, a situational analysis revealed that SHP can generate some \$300,000 per year. Such benefits may nonetheless require sacrifices to other sectors.

► DEMONSTRATION SITES

Country: Kyrgyz Republic
Region: At-Bashy district
River: At-Bashy
Technology: Kaplan EVO

Country: Uzbekistan
Region: Shakhimardan enclave
River: Koxu River
Technology: Francis Container

Site Parameters:

- Existing Diversion weir with around 7 m head and three pressure segments
- Emergency spillway for water diversion during construction in place
- Elevation at 2,400 m

Site Parameters:

- Partially developed small hydropower project with existing intake structure and steel-penstock. The initial project was abandoned in the 1980's in an unfinished condition.

CONTEXT

Hydro4U overall...

... is an EU-funded project with 13 partners from 8 countries with the goal of implementing sustainable small-scale hydropower in Central Asia.
... focusses on the modularity and pre-fabrication of hydropower plants to enable a fast and simple implementation also at remote sites.
... will demonstrate EU quality standards and create entry points in developing markets for the European small-scale hydropower industry.

International Water Management Institute (IWMI) - Role in Hydro4U

- IWMI is a research for development organization with a wide global network as well as network across Central Asia where it works since 2001
- IWMI leads research on water governance and WEF Nexus analysis
- Supports engaging regional experts and communities
- Contributes to developing educational materials
- Assists disseminating project results

DETAIL ON RESULT

Novelty

The situational analysis departs from traditional, isolated technical assessments by providing a *multidimensional* template for investigating nexus linkages within the complex landscape of full or sub-basin scale in data-scarce regions.

Its primary innovation lies in the *synergistic integration* of *high-resolution geospatial modelling* with *granular socio-economic insights* gathered through targeted stakeholder participation and interviews.

The *hybrid approach* enables the quantification of the type of benefits and trade-offs that are often invisible in macro-scale studies.



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Value Proposition

The situational analysis serves as a *critical diagnostic tool* that gathers the empirical evidence necessary to understand competing priorities such as the energy security, food production, and transboundary cooperation. By quantifying the specific nexus linkages at the focus sites, it moves the analysis beyond theoretical benefits to gather insights into gains and losses.

By integrating different types of data to juxtapose high-level observations with the on-the-ground realities, this solution offers a *holistic roadmap* for navigating the complex nexus benefits and tradeoffs. The resulting insights help identify specific opportunities for expanding the benefit-sharing and reducing unwanted losses, such as ensuring that the hydropower generation does not inadvertently compromise downstream irrigation production.

Ultimately, the situational analysis ensures that interventions are not only technically and financially sound, answering the fundamental question of project feasibility, but also strategically designed to remove various bottlenecks that may hinder success.

FURTHER DEVELOPMENT

Building on the success of utilizing the approach in two demonstration sites, the next phase focuses on the methodological transition from site-specific applications to regional-scale expansion. While a larger scale implies greater complexity, it also allows for integration of broader datasets. The development path involves synthesizing high-resolution geospatial modelling with insights from targeted stakeholder consultations to capture macro-level Nexus dynamics. To ensure technical rigor, the framework will be validated against results from existing situational analysis developed under the Hydro4U project. Ultimately, this process will refine the framework into a standardized blueprint for quantifying Nexus benefits and trade-offs, offering a template that is readily deployable across different scales within the Central Asian context.

► REPLICABILITY ASPECTS

To demonstrate the scalability of the standardized blueprint, the situational analysis framework will be replicated across diverse hydrological contexts that fit the criteria of the current situational analysis approach. This includes selecting a major river in Central Asia and another river from South Asia, both representing high-priority regions where the urgency of Nexus trade-offs, transboundary complexity, and data fragmentation require a standardized, reliable framework for decision-making.



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