

## Technical, Environmental and Financial Assessment for Optimal Sizing of Run-of-River Small Hydropower Project: Case Study in Colombia

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**Abstract :** Run-of-river (RoR) hydropower projects represent a viable, clean, and cost-effective alternative to dam-based plants and provide decentralized power production. However, RoR schemes cost-effectiveness depends on the proper selection of site and design flow, which is a challenging task because it requires multivariate analysis. In this respect, this study presents the development of an investment decision support tool for assessing the optimal size of an RoR scheme considering the technical, environmental, and cost constraints. The net present value (NPV) from a project perspective is used as an objective function for supporting the investment decision. The tool has been tested by applying it to an actual RoR project recently proposed in Colombia. The obtained results show that the optimum point in financial terms does not match the flow that maximizes energy generation from exploiting the river's available flow. For the case study, the flow that maximizes energy corresponds to a value of 5.1 m<sup>3</sup>/s. In comparison, an amount of 2.1 m<sup>3</sup>/s maximizes the investors NPV. Finally, a sensitivity analysis is performed to determine the NPV as a function of the debt rate changes and the electricity prices and the CapEx. Even for the worst-case scenario, the optimal size represents a positive business case with an NPV of 2.2 USD million and an IRR 1.5 times higher than the discount rate.

**Keywords :** small hydropower, renewable energy, RoR schemes, optimal sizing, objective function

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