

Potential location assessment of Small Hydropower Plants in Chubu region

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Introduction

promotion of renewable energy for decarbonization, becomes a wide consensus all over the world. Hydropower, as the most widely utilized one, provides substantial electricity and multiple values such as flood reduction^[1]. However, the capacity of traditional hydropower is increasing gradually due to the high budget and environmental concern^[2]. As a result, the Small Hydropower Plants (SHPs) are emerging as viable solutions due to their operational simplicity, low carbon footprint and ecological impact^[2]. This study presents a novel location assessment framework that integrates machine learning and GIS systems which focus on the assessment of SHP preference sites which improves the objectivity on preference analyses of previous studies^[2, 3], based on multi-source geospatial data including climate social and environmental data. Moreover, the Shapley Additive exPlanations (SHAP) method based on game theory will also be adopted for a comprehensive consideration on the role of social and environmental impacts^[4], providing better understanding for the selection of SHP location.

Experimental Procedures

To construct the assessment framework of SHP potential. 200 sample data of current SHP locations (10kW-10mW) are Collected and will be utilized in this study. Multi machine learning models are selected in this study, and 70% of the whole data will be utilized for training and the other 30% will be tested by R², RMSE, NSE, Bias, to make sure the accuracy of models. After calibration, we try to use the model to seek the remaining potential sites among the study area and analyze the potential contributions from each metric by SHAP^[4]. Also, we adopted Soil& Water Assessment Tool (SWAT) model into this study for a long-term simulation and involves the evaporation and swamp processes, and other variables for machine learning prediction include land use type, DEM are collected from the official website and treated.

Expected Result

The methodology will be applied to assess potential SHP locations and capacity across in the Chubu region, considering the effect of anthropogenic and climatic impact alongside the topography characteristic in Japanese rivers. This approach provides comprehensive analysis of regional hydropower potential while reducing computational requirements compared to conventional simulation methods, delivering robust evidence-based policies for water resource development and renewable energy promotion.

References

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