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Techno-Economic Assessment of a Hybrid Power Plant : Floating Photovoltaic and Hydropower

To act against climate change, transition from conventional energy to renewable energy such as solar are now getting more attention. One of the latest solar technology, floating photovoltaic (FPV), continues to become more and more popular worldwide. Deploying it on an existing hydropower plant reservoir and hybridizing the power plant operation can be beneficial for both FPV and hydropower plant.

To observe the full potential of hybrid FPV-hydropower plant, it will be much more convenient to have an operation model of hybrid FPV-hydropower plant operation with some details involved. The objectives of this study is to develop such model and to identify the implication of the involved details, i.e. evaporation and FPV cooling effect. Another objective is to find out the economic attractiveness of such hybrid power plant by using the developed model to simulate an actual hydropower plant operation in a case study. In this case study, the developed model run with 3200 scenarios involving 40 inflow years, 4 complexities, and 20 FPV coverages.

The model results show that the hybrid FPV-hydropower plant model is working and it is able to show how the hybrid power plant generate electricity. The results also show the effect of FPV addition on hydropower plant to its power generation and reservoir operation. The details involved in the model are proven to have a considerable influence to the model result. FPV cooling effect have higher implication on cases with more FPV coverage (3.9% Revenue Difference at 90% FPV coverage), while evaporation have higher implication on cases with less FPV coverage (-1.7% Revenue Difference at 0% FPV coverage). The hybrid FPV-hydropower plant has considerable economic attractiveness, and for the case study, it would be the most attractive with 2% to 4% FPV coverage. The resulted IRR is higher in dry years and lower in wet years. The results from this study are highly relevant for the modelers and stakeholders in energy sector.

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