



Investigate the Optimization of Micro-hydropower in Agricultural Channels in the Water-energy-food Nexus

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Micro-hydropower is an excellent source of renewable energy. There is no need to build additional DAMs, so it has the advantages of lower setup costs and construction times and reduces greenhouse gas emissions during the generation process. Central and southern Taiwan is mainly developed by agriculture, especially the Zhuoshui River Basin, which has a large watershed area, developed agricultural irrigation system, abundant water source and stable flow, so it is suitable for the installation of micro-hydropower. Its micro-hydropower generation mainly uses the kinetic energy of water to drive the turbine to generate electricity, and the water in the agricultural channel does not disappear with the installation of the turbine.

Therefore, this study selected Linnei channel in the Zhuoshui River Basin in central Taiwan as the research site. It is Linnei channel, an agricultural irrigation channel with a stable flow rate, and the first group of micro-hydropower generation was installed in Linnei channel in 2018, and the second groups of micro-hydropower generation were installed in 2020. Therefore, this study measured the water level and flow of the Linnei channel from 2018 to 2022 to analyze the flow changes with or without micro-hydropower generation. Using rice planting evaluate the agricultural economic output value brought by irrigation water. Since 2019, the addition of hydropower generation increased the income brought by hydropower generation. The benefits and costs of each year are compared, and the economic analysis method is used to evaluate whether the installation of hydropower generating units is worth the investment and whether they can get benefits. The results showed that the increase of channel water volume could lead to more rice harvest, but there was no positive correlation between power generation and irrigation water volume. The addition of additional micro-hydropower in 2022 with sufficient irrigation increased net profit margin by only 0.02%, compared to 0.07% in 2019 with less irrigation. It shows that the relationship of the water-energy-food nexus has not yet been optimized, and in the future add the interaction between energy and water to optimize the profit of the system.

