

EGU2020-7388

<https://doi.org/10.5194/egusphere-egu2020-7388>

EGU General Assembly 2020

© Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.



Intelligent management of reservoir and photoelectric ponds under water-food-energy nexus perspective

Wei-De Lee and Fi-John Chang

National Taiwan University, College of Bioresources and Agriculture, Bioenvironmental Systems Engineering, Taipei City, Taiwan

The world is in a crucial era of energy transition, and green energy will serve as a new engine that drives sustainable development in the future. Renewable energy becomes the core energy to cultivate green energy industries and promote energy self-sufficiency in Taiwan. In recent years, water, food and energy nexus (WFE Nexus) has gained global attention. Therefore, a multi-objective optimization framework is proposed in this study to explore the optimal solution to the WFE Nexus for improving the synergistic benefits of water, food, and energy (hydropower, small hydropower and solar power). The joint multi-objective operation of the Shihmen Reservoir and irrigation ponds in the northern Taiwan constitutes the case study. This study aims at achieving the optimal water supply to fulfill basic demands from different sectors as well as increasing green energy output by utilizing reservoir spilled water to lift up hydropower output, installing small hydropower in river channels, and setting up solar panels over irrigation ponds. The results support the high potential of photoelectric ponds because the installation of solar panels over irrigation ponds can 1) reduce evaporation amount and water temperature and 2) provide water quality conditions suitable for growing fish while increasing solar power output. The results also indicate that the optimal joint operation of the Shihmen Reservoir and irrigation ponds can promote reservoir hydropower output and the small hydropower output in river channels while increasing water supply and food production. This study demonstrates that the intelligent management of the reservoir and photoelectric ponds not only can increase green energy production, water supply and food production but also can enhance the synergistic benefits of the WFE Nexus, which provides long/short term policies for sustainable urban development.

Keywords: Multi-objective reservoir operation; Optimization; Water, food and energy nexus (WFE Nexus); Green energy; Greenhouse