Operational experience of the first floating solar pilot plant in Sri Lanka

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The Sri Lanka's first floating solar PV system is operated at the premises of the Faculty of Engineering, University of Jaffna from January 2020. The pilot project was implemented with the support of the Current Solar AS under the partnership between the Western Norway University of Applied Sciences and University of Jaffna and supported by the Royal Norwegian Embassy in Colombo.

The floating solar plant consists of a 44 kW east west floating system and 2.5 kW south facing land-based reference plant. The floating system installed at the pond with the depth of around 2 m. High-Density Poly Ethelene (HDPE) pipes are used to lift the solar panel sets. The beams are made of glass fiber, which is steady and well adapted to the water environment. Four anchoring points are set to keep the panel system in the pond surface in case that the pond dried completely to avoid the structure dip into the clay. Further it also provide the slope required for the solar panels installation. This floating solution is specifically based on low cost and easy installation.

The solar modular base unit was made with 24 basic 8 – 12 kWh modules depending on the module type and size. There are also 4 modules; 2 Twin Peak and 2 N-peak. One Twin Peak and one N-peak module was mounted on the floating system, and one of each was placed on the land-based reference system. The data logger and the sensors are located to collect the data for future analysis. Solar irradiation and module temperature sensors are placed on east west orientation. Humidity, water temperature sensor and ambient temperature also measured separately. 50 kW SMA inverters used here, with 5 MPPT units was used in the design, as the data is collected separately for different type of module and different orientation. The data is being recorded for solar radiation, temperature and other measurements at 10 minutes time interval, using sensors located in the different location.

The study resulted that the temperature difference is the bigger effect when compare floating solar with land-based system. And the cooling temperature effect, created 4 – 5 % more power yield (kWh/kWp) for floating system than on the land-based system. It was interestingly observed that the power output from west facing panels produced more energy than east facing panels. Average PV system estimate for March, in this location, is 5.08 kWh/kWp/day at 28.4^{o} C ambient temperature. The average energy production per month from this floating solar plant is around 5,570 kWh.

In summary, this has proven that (i) the operational efficiency of the solar power plant is increased due to cooling effect when it is floating, (ii) the land use is effectively utilized as it was placed on top of the free water surface, (iii) evaporation of water is reduced, (iv) study on environmental effect resulted positively as it is a smaller plant covering the water surface and (v) currently the degradation of floating solar panel is being studied with time.

Figure 1: Floating Solar Plant at Kilinochchi Premises of the University of Jaffna