Development of submerged solar power generation system
- Effects of water temperature, refraction, barnacles on power generation efficiency

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Abstract

In recent years, decarbonization to prevent global warming has become an urgent issue in countries around the world. Solar power is emerging as the most promising decarbonization solution. However, in small island countries like Japan, the effective area for installing solar panels is small, making it difficult to significantly increase onshore solar power generation in the future. Therefore, the authors have proposed submerged solar power generation and have conducted basic demonstration experiments in the ocean.

By submerging solar panels in water, the cooling effect can increase power generation efficiency. Additionally, the high refractive index of water reduces the exit angle of sunlight, increasing the irradiation density. It also prevents contamination on the panel surface caused by yellow sand, wild bird droppings, etc.   On the other hand, if panels are submerged in the sea, there is a risk that marine organisms may adhere to the functional surfaces of the panels or that power generation efficiency may decrease due to water turbidity.

Therefore, the authors first installed solar panels in closed sea areas and conducted submerged solar power generation experiments. This paper clarified the following effects of solar power generation. 1) Due to the cooling effect of sea water, solar power generation efficiency is increase. 2) High refraction of sea water increases the solar power. 3) Barnacles, marine fouling organisms, can be avoided by texturing between 20-30 μm pitch.
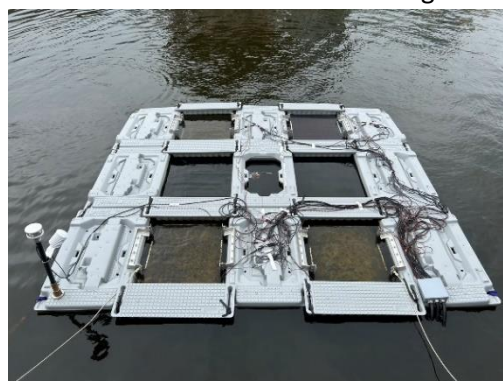
Fig.1 Submerged solar power generation system