Aquavoltaics: Synergies for dual use of water area for solar photovoltaic electricity generation and aquaculture

Bodies of water provide essentials for both human society as well as natural ecosystems. To expand the services this water provides, hybrid food-energy-water systems can be designed. This paper reviews the fields of floatovoltaic (FV) technology (water deployed solar photovoltaic systems) and aquaculture (farming of aquatic organisms) to investigate the potential of hybrid floatovoltaic-aquaculture synergistic applications for improving food-energy-water nexus sustainability. The primary motivation for combining electrical energy generation with aquaculture is to promote the dual use of water, which has historically high unused potential. Recent advances in FV technology using both pontoon and thin film structures provides significant flexibility in deployment in a range of water systems. Solar generated electricity provides off-grid aquaculture potential. In addition, several other symbiotic relationships are considered including an increase in power conversion efficiency due to the cooling and cleaning of module surfaces, a reduction in water surface evaporation rates, ecosystem redevelopment, and improved fish growth rates through integrated designs using FV-powered pumps to control oxygenation levels as well as LED lighting. The potential for a solar photovoltaic-aquaculture or aquavoltaic ecology was found to be promising. If a U.S. national average value of solar flux is used then current aquaculture surface areas in use, if incorporated with appropriate solar technology could account for 10.3% of total U.S. energy consumption as of 2016.

Source

- Used: Solar floatovoltaics lit review and Dual use of water for PV farms and aquaculture literature review
See also

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Life cycle assessment of pasture-based agrivoltaic systems: Emissions and energy use of integrated rabbit production

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The potential of agrivoltaic systems

Do Agrivoltaics Improve Public Support for Solar Photovoltaic Development? Survey Says: Yes!

- Coal with Carbon Capture and Sequestration is not as Land Use Efficient as Solar Photovoltaic Technology for Climate Neutral Electricity Production
- Dual use of land for PV farms and agriculture literature review
- Sheep

- A Farmer's Guide to Going Solar (NREL)
- 2021 review
- Retrofitting solar parks for agrivoltaics
- Shading PV
- Alexis' talk at American Solar Grazing Association 2021
- An open source simulation of photovoltaic yield with r.sun over large regions
- Effects of floating photovoltaic systems on water quality of aquaculture ponds - "This study investigated the water quality of aquaculture ponds with and without simulated FPV systems (40% surface area shading) at three sites: Chupe"
FPV-covered ponds exhibited 1.1, 1.2 and 1.4 times greater yields in giant freshwater prawn, tilapia and milkfish without any effect on the growth of cultured species.

In the News

1. Floating solar farms: How 'floatovoltaics' could provide power without taking up valuable real estate - NBC News 787
3. Floating solar farms: How 'floatovoltaics' could provide power without taking up valuable real estate - Sneak Peak Reports
4. Floating Solar Panels Are Helping This Mining Company Save Water - The Weather Channel 236
5. La mina Los Bronces de Chile instala innovadores paneles solares flotantes - World Energy Trade (Spanish) 4k
6. Mina Los Bronces instala paneles solares flotantes - Avatar Energia
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