Some countries could meet their total electricity needs from floating solar panels, research shows

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FPV on Langthwaite Reservoir (UK). Credit: Giles Exley

Floating solar photovoltaic panels could supply all the electricity needs of some countries, new research has shown.

The study, by researchers from Bangor and Lancaster Universities and

the UK Center for Ecology & Hydrology, aimed to calculate the global potential for deploying low-carbon floating solar arrays. The researchers calculated the daily electrical output for floating photovoltaics (FPVs) on nearly 68,000 lakes and reservoirs around the world, using available climate data for each location.

The researchers' calculations included lakes and reservoirs where floating solar technology is most likely to be installed. They were no more than 10km from a population center, not in a protected area, didn't dry up and didn't freeze for more than six months each year. The researchers calculated output based on FPVs covering just 10% of their surface area, up to a maximum of 30 km^2.

While output fluctuated depending on altitude, latitude and season, the potential annual electricity generation from FPVs on these lakes was 1,302 terawatt hours (TWh), around four times the total annual electricity demand of the UK.

The findings are published in *Nature Water*.

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FPVs have a number of additional advantages over land-based solar installations: they free up land for other uses and they keep panels cooler, making them more efficient.

There is some evidence for other environmental benefits, including reducing water loss through evaporation, by sheltering the lake surface from the sun and wind; and reducing algal blooms by limiting light and preventing nutrient circulation. However, the researchers warn that further research is needed on the overall environmental impact of FPVs. They suggest that decisions to deploy FPVs should consider the intended function of water bodies and how they are used, as well as the potential ecological impact.

Lead author of the paper, Dr. Iestyn Woolway of Bangor University said, "We still don't know exactly how floating panels might affect the ecosystem within a natural lake, in different conditions and locations. But the potential gain in energy generation from FPVs is clear, so we need to put that research in place so this technology can be safely adopted. We chose 10% of a lake's surface area as a likely safe level of deployment, but that might need to be reduced in some situations, or could be higher in others."

When the figures were considered country-by-country, five nations could meet their entire electricity needs from FPVs, including Papua New Guinea, Ethiopia and Rwanda. Others, such as Bolivia and Tonga, would come very close, respectively meeting 87% and 92% of electricity demand.

Many countries, mainly from Africa, the Caribbean, South America and

Central Asia, could meet between 40% and 70% of their annual electricity demand through FPVs. In Europe, Finland could meet 17% of its electricity demand from FPVs and Denmark, 7%.

The UK could produce 2.7 TWh of electricity each year from FPVs, the researchers found. While this is just under 1% of overall electricity demand, it would provide electricity for around one million homes, based on the current Ofgem estimate of average electricity usage per household of 2,700 kWh.

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There are currently very few FPV installations in the UK, with the

largest a 6.3MW floating solar farm on the Queen Elizabeth II reservoir, near London.

Dr. Woolway said, "Even with the criteria we set to create a realistic scenario for deployment of FPVs, there are benefits across the board, mainly in lower income countries with high levels of sunshine, but also in Northern European countries as well. The criteria we chose were based on obvious exclusions, such as lakes in protected areas, but also on what might reduce the cost and risks of deployment."

Co-author Professor Alona Armstrong of Lancaster University said, "Our work shows there is much potential for FPVs around the world. But deployments need to be strategic, considering the consequences for energy security, nature and society, as well as Net Zero."

More information: Decarbonisation potential of floating solar photovoltaics on lakes worldwide, *Nature Water* (2024). DOI: 10.1038/s44221-024-00251-4.
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