Floating solar's potential to support sustainable development

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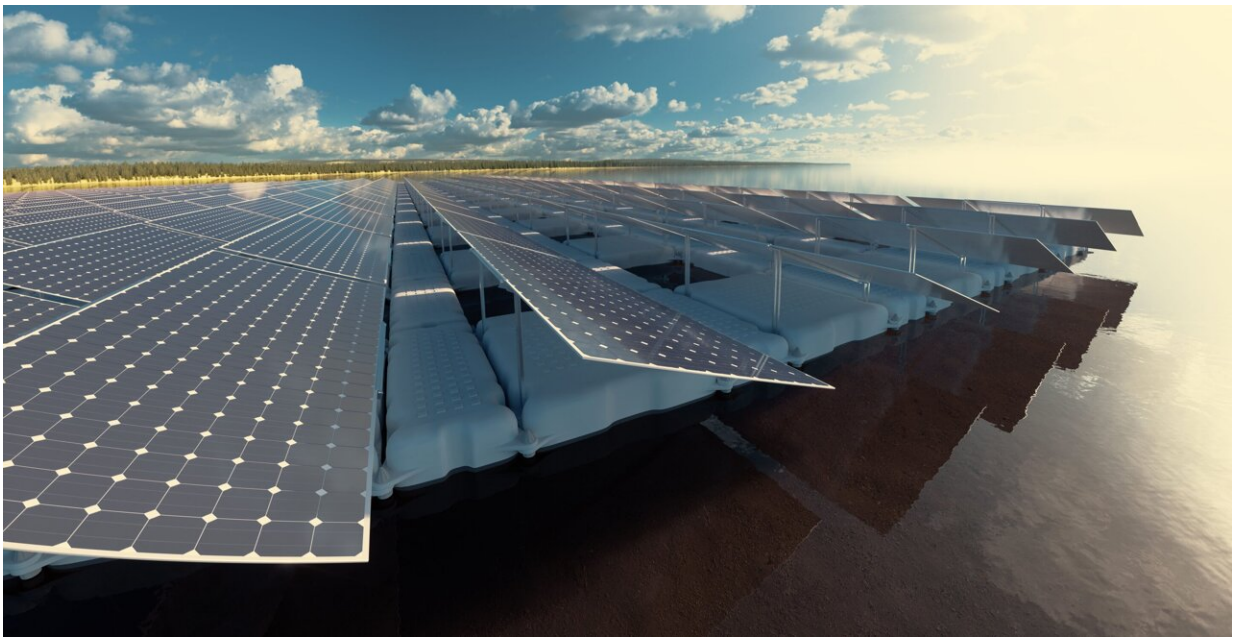

Floating solar's potential to support sustainable development in Africa by addressing climate, water, and energy goals holistically. Credit: Politecnico di Milano

A study, published in *Nature Energy*, is among the first to explore the floating photovoltaics (FPV) at the continental scale, finding that FPV

installed at existing major reservoirs could produce 20–100% of the electricity expected from Africa's planned hydropower dams. Using a state-of-the-art energy planning model covering the continent's entire energy system, the researchers found that FPV is cost-competitive with other renewables and thus a key part of Africa's future energy mix.

"Floating solar is fast becoming cost-competitive with land-based solar, and our results suggest it could conceivably avoid the need to build many of the dams planned for hydropower across Africa," said lead author Wyatt Arnold. "This would allow nations to meet future electricity demands while sidestepping the damaging environmental and social impacts of large dams."

The researchers conducted a detailed case study on the transboundary Zambezi watercourse, finding that the capital investment slated for new dam projects could be deployed more efficiently by building fewer reservoirs and supplementing the energy supply with floating solar. Compared to dam-intensive solutions, this approach yielded 12% less interannual variability in electricity supply and proved more robust against potential long-term drought conditions exacerbated by climate change.

"By embracing floating solar and reducing the reliance on hydropower, developing economies can ensure a more stable energy supply that is robust to hydrological uncertainties brought about by climate change," said Prof. Andrea Castelletti. "Moreover, floating solar avoids many of the negative impacts new dams may have on downstream communities and river ecosystems."

The authors emphasize that the work highlights the importance of integrated resource planning and considering transboundary impacts

when navigating sustainable development pathways. Traditional energy-water modeling often looks at single sectors like hydropower in isolation. However, this study showcases advanced multisector modeling that can reveal and balance tradeoffs across energy, agriculture, environmental protection, and economic development objectives within transboundary river basins.

"Our findings suggest the benefits of avoiding new dams through strategic floating solar deployments could outweigh the potential impacts on existing reservoir uses like fishing or recreation," said Prof. Matteo Giuliani, "but a collective effort is still needed to continue improving FPV technology and ensure its responsible deployment through robust integrated planning and stakeholder engagement processes."

While the environmental case for FPV is compelling, the authors acknowledge technical and social factors that may constrain its adoption at certain sites. However, they argue these potential impacts would be far less severe than those of new hydropower dam construction and reservoirs that can irreversibly disrupt river ecology, displace communities, and exacerbate regional tensions over shared water resources.

More information: Wyatt Arnold et al, Floating photovoltaics may reduce the risk of hydro-dominated energy development in Africa, *Nature Energy* (2024). DOI: 10.1038/s41560-024-01510-0

Wyatt Arnold, Data and code in support of "Floating PV Reduces Risks of Hydro-Dominated Energy Development in Africa", *Zenodo* (2024). DOI: 10.5281/zenodo.10576226

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