Solar panels over canals could provide benefits beyond energy

Two projects in the western US are testing the feasibility of installing solar farms over sun-drenched irrigation canals.

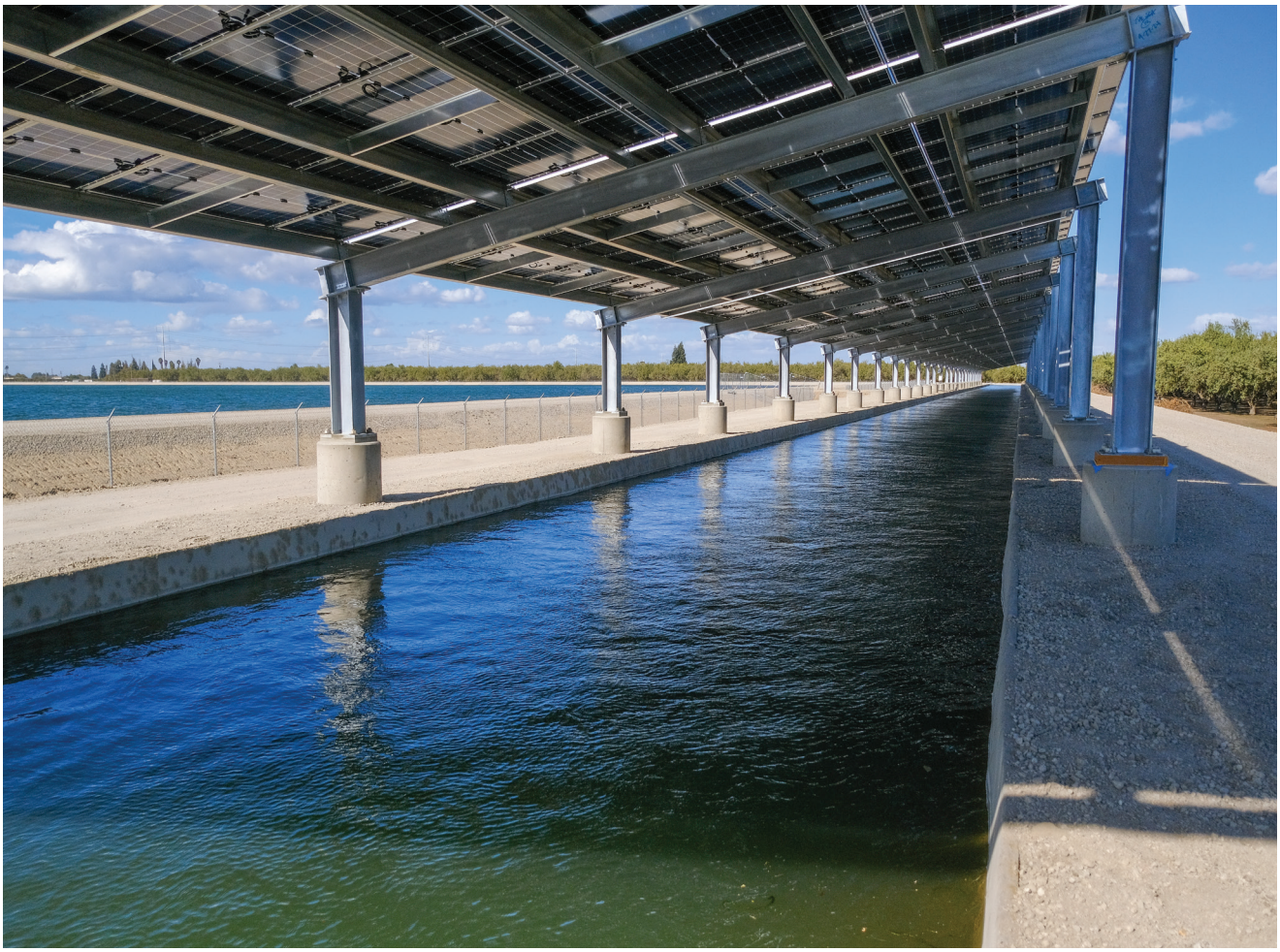
Building new solar photovoltaic farms in the US has become cost-competitive with new fossil-fuel projects, but coating the landscape in solar panels can get expensive on in-demand land, especially near population areas and farmland. Finding ways to repurpose existing infrastructure, like parking lots, canals, and rangeland, for solar generation is an active research area globally.

Two newly constructed solar photovoltaic projects over irrigation canals, in California and Arizona, offer insights into a water-based solution. The projects' scientists are conducting cost-benefit analyses of the energy and environmental benefits to see if they outweigh the considerable installation costs.

One of the new projects is a pilot built as part of the Turlock Irrigation District, an agricultural community in California's Central Valley where land comes at a premium. The $20 million solar farm began generating electricity across a 6-meter-wide canal earlier this year, and energy generation at its other site (over a 34-meter-wide canal) will come online later this year. The 1.6-megawatt installation will be enough to power 60 homes for the region's existing customers, says Brandon McMillan of Turlock Irrigation District.

The other pilot is run by Arizona's Gila River Indian Community, which plugged in its $6 million solar project over a 9-meter-wide canal last November. Project director David DeJong says the 1.3-megawatt, nearly 1-kilometer-long installation produces power for the community and offsets costs for its irrigation district. "For the community, land is sacred, and the canal is already disturbed, so placing solar panels over them does not disturb any additional land," says DeJong.

Scientists at both sites are measuring meteorological parameters, solar panel



SOLAR PANELS shade a Turlock Irrigation District canal in Stanislaus County, California. Researchers studying pilot projects in California and Arizona are quantifying the advantages and disadvantages for water and land conservation. (Photo courtesy of Turlock Irrigation District.)

performance, water quality, and other metrics. Solar power over canals could reduce evaporative losses from the canals, according to a 2021 feasibility study in *Nature Sustainability* by Brandi McKuin, of the University of California, Merced, and colleagues. Yet the mounting system for solar power over canals is more costly than that for land-based solar systems, and financing future installations could be more expensive now that Congress has rolled back Inflation Reduction Act funding and solar-farm tax credits through the legislation known as the One Big Beautiful Bill Act.

The data will help researchers determine if the benefits of solar panels over canals outweigh the high costs of the steel, cable-mounting components, and other building materials. The solar panels shade the canal, repressing algal growth that clogs the canal's outlets. In turn, the water cools the air below the solar panels, increasing solar panel efficiency (which decreases at extreme temperatures) and lessening solar panel degradation.

DeJong estimates that mounting solar panels over the canal is 33–40% more expensive than doing so on land, but he argues that the economic and social benefits of water, energy, and land conservation and gains from higher solar panel efficiency will partially or fully offset the cost.

In 2012, India became the first country to install solar power over canals. The 1-megawatt pilot in the state of Gujarat inspired some small-scale copycats within the country, but large-scale projects haven't materialized, partly due to high costs of mounting the panels, according to reporting by *Mongabay India*.

Much of the western US is facing a severe water shortage: Years of overuse along with drought and higher-than-average temperatures exacerbated by climate change have reduced water availability to record lows. Based on their *Nature Sustainability* analysis, McKuin and colleagues project that covering California's 6300 kilometers of canals with solar panels could save up to 240 billion liters of water annually, enough for the homes of 2 million people. DeJong estimates that expanding the Gila River Indian Community's solar pilot project to cover all its Casa Blanca Canal would save enough water to irrigate about an additional third of a square kilometer annually and power 70% of the community's energy needs (excluding its casinos).

University of Exeter renewable energy researcher Aritra Ghosh says that the US projects "serve as a valuable case study not only for solar energy programs in the US but also for academic and research institutions worldwide." Ghosh is not involved with either project.

The final analysis of the California-based project, which is funded by the state and led by the University of California, Merced, is expected to be completed by the middle of next year. National Renewable Energy Laboratory scientists studying the Gila River Indian Community's solar project plan to publish results annually for the next three years as the system is evaluated.

Jenessa Duncombe

Global renewable energy use continues to grow

More than 12% of the energy consumed globally in 2021 came from renewable sources, according to the latest data from the International Energy Agency (IEA). That's up from about 7% in 2000.

As shown in the figure, hydropower accounted for the majority of electricity generation from renewables (excluding the burning of biofuels and waste, not shown) in 2022. From 2012 to 2022, annual electricity generation by hydropower grew from nearly 3.8 million GWh to nearly 4.5 million GWh. But the output from solar photovoltaics and wind is surging. The two were the source of about 43% of the noncombustible renewable electricity produced in 2022, up from about 14% a decade prior. Declining manufacturing costs for solar panels and wind turbines have made renewables a more competitive source of electricity generation.

Fossil fuels (coal, oil, and natural gas) accounted for about 65% of the total energy that was consumed worldwide in 2022, according to the IEA. At 30%, industry was responsible for the largest share of global energy consumption, followed by transportation (28%) and residential use (20%). From 2000 to 2022, annual global electricity consumption per capita climbed nearly 50%, to about 3.4 MWh.

For more on global energy generation and consumption, including breakdowns by energy source and use by sector, see the interactive charts at https://www.iea.org/world.

Tonya Gary

Global noncombustible renewable electricity generation by source (2022)