Ghana rooftop solar system

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The 5 megawatt facility at the Bui generating station in the Bono region deploys photovoltaic modules on water infrastructures, conserving land and avoiding the need to cut down trees. Its engineers say the panels also create a healthy environment for fish spawning underneath, promoting fingerling production and supporting aquatic ecosystems.

However, the development of the hydro-solar PV hybrid system has been controversial. More than a thousand people from eight communities had to be resettled, and critics are concerned about its environmental impact: its dam flooded around a fifth of the bordering national park as well as fertile farmland, and fishermen living downstream say conditions have worsened since it was built.

But the plant is helping Ghana become more energy independent and shift away from fossil fuels --and towards its goal of generating 10%of its electricity from renewables by 2030.

The first West African hydro-solar plant was deployed in Ghana in January, with technical support from the United States Agency for International Development (USAID) and the U.S. Department of Energy"s National Renewable Energy Laboratory (NREL). Once its full capacity is brought online, this hydro-solar plant will put Ghana on track to cut its power sector greenhouse gas emissions by 235,000 tons per year.

As energy demand increases in Ghana, its government is seeking to diversify the country"s energy mix and find innovative ways to integrate variable renewable energy (VRE) into its national grid--particularly wind and solar--to reach its target emissions goals, shift away from fossil fuels, supplement hydro resources during drought periods, and lower energy costs.

Building on those discussions, USAID"s Power Africa West Africa Energy Program (WAEP) and NREL collaborated with BPA to operationalize the first 50 MW of PV within the existing Bui Generating Station hydroelectric dam site in 2021, with plans to grow PV capacity to 250 MW. Scheduled for completion by late 2022, the plant will also contain a 20-MW-hour battery energy storage system and controls, which the NREL team suggested so the plant can meet existing grid codes for renewable energy resources, manage the variability of solar, and increase the country"s power sector reliability.

"The global challenge of climate change, as well as the need to secure energy supply, makes the development of the hydro-solar plant very important for Ghana and West Africa," said Peter Acheampong, deputy director of renewables at BPA who closely collaborated with the NREL-WAEP team.

"We are equipping them with all the tools and lessons we learned in the United States about VRE integration, and, in some cases, helping them to avoid some of the challenges we had with the latest technology and standards. Having this type of partnership is an effective way to streamline the process of integrating advanced

technologies," said David Corbus, the Wind Grid Integration Lead at NREL and a member of the NREL-WAEP team supporting the Ghana solar project.

This project represents a major advancement in West Africa"s efforts to integrate larger shares of renewables into its regional energy mix. As Ghana President Nana Akufo-Addo stated in a speech read on his behalf, "This further shows my government"s commitment to deliver on the promise to increase the renewable energy component in our energy mix to 10 percent by 2030."

The first 50 MW of the plant generates energy onto the national grid during the day, with 1 MW of the installed system consisting of floating solar PV. Overall, the hydro-solar hybrid installation allows Ghana to harness its immense solar resources, combat low water levels during the dry season, and provide grid operators more flexibility to run the hydropower plant at night.

In parallel to the large-scale utility PV installation, the NREL-WAEP team is also supporting deployment of decentralized PV in Ghana, enabling consumers to tap into the savings of rooftop solar. The team is providing electric distribution companies with the tools needed to understand and plan for distributed PV, recognize the financial impact for utilities and consumers under different scenarios, and rapidly assess the benefits and challenges of capacity-hosting analysis and new customer solar installations.

"We worked with the Electricity Company of Ghana and the Northern Electricity Distribution Company, where we transferred open-source software to them and gave them training, capacity building, and workshops with utility engineers where we assessed plans and looked at studies for integrated distributed PV," Corbus said about the team"s contributions to Ghana"s behind-the-meter PV planning.