Success Story

CI Server Brings Efficiency and Reliability to Floating Solar PV Project

Solar Energy Public Company

Industry: Solar Energy

Executive Summary

The solar energy public company recognized the importance of providing clean, stable and sustainable power through a mixed portfolio of conventional and renewable energies to meet the increasing power market demand. Since its establishment, the company has set the target of becoming a world-class regional leader in providing renewable energy through reliable leading-edge technologies to serve the needs of both industry and society.

The company aims to establish a solid foothold in the solar power industry while delivering other renewable solutions not only in the region but also internationally. Currently, its total power production capacity of over 145 MW consists of a mixed energy production portfolio of 16 solar photovoltaics (PV) utility plants, 14 solar PV rooftop projects, 3 biomass power plants and the most recently built floating solar PV plant. This floating solar project is the company's first private pilot project with an installed capacity of 8 MW peak (MWp). The total project area exceeds 11 hectares with an investment value of over 5 million dollars.

Challenge

The end-user of the electricity from the PV plant operates various industrial plants in a broad range of businesses such as agriculture, food, and consumer products, and these process plants are usually equipped with water supply storage ponds, cooling ponds and wastewater treatment ponds. Seeing the opportunity to maximize usage of the pond surfaces by adopting a floating solar power plant for clean power production, The solar company proposed its floating solar plant, which is designed to produce 8 MWp of clean power for use at the end-user's factories. The idea was readily accepted, and both companies concluded a 25-year private power purchase agreement (private PPA).

The floating solar PV project makes the most of the ponds within the factory sites which supply water for plant production, by generating clean electricity using photovoltaic technology, thus adding value. Moreover, this hybrid utility setup has the further benefit that the pond water can be used to remove the excess heat generated on the surface of the solar panels.

At present, the project can produce peak power of 6.475 MWAC. With the installation of 16,492 mono-bifacial PV modules with power capacity of 8.081 MWp in two ponds with an area of 57,094 m_2, annual power generation is 12.54 GWh, or an average of 34,356 kWh/day.

This floating solar PV project, a collaborative partnership between private companies to produce solar power on water surfaces, is closely aligned with the renewable initiatives to promote clean energy and sustainable energy.

This is the energy company's first floating solar project connected to a private grid in collaboration with an end-user. The energy company aims to expand its solar power business expertise and build more solar plants to feed power exclusively to private companies in conjunction with the policies of supporting environmentally friendly and energy efficiency initiatives.

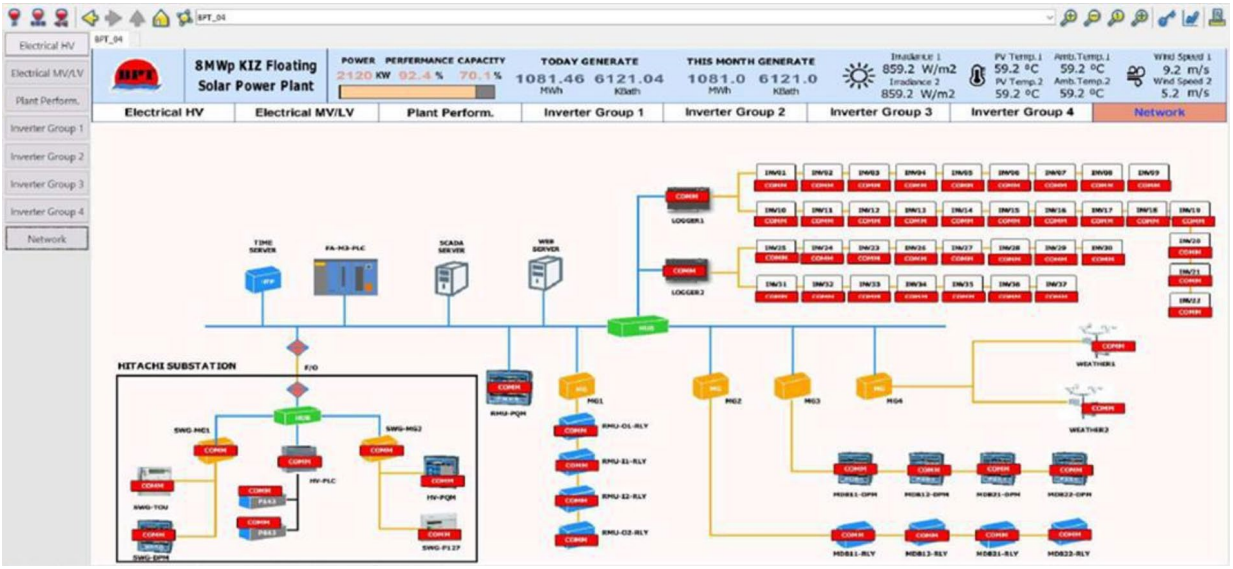
Project Summary	
Installed Capacity (MWp)	Selling Capacity (MWac)
8	8
PPA Type	PPA Period
Private PPA	25 years
Location	Off-taker
Kabinburi Industrial Estate Prachinburi, Thailand	Hitachi
SCOD	Operated by
2Q 2021	SV

Solution

Yokogawa CI Server monitors and controls the solar power production facility including the substation and major equipment such as inverters, meters, weather stations, and motor protection relays (MDB). CI Server also manages the "Zero Export" function to the grid. Zero export is a common control function for private grid type solar projects whereby PV energy is 100% consumed exclusively by the off-taker with 0% limitation on active power feed-in to the grid.

The CI Server-based monitoring and control system is engineered to control active power generation in reaction to active load changes to minimize power leaks to the transmission line that could cause power trips. The CI Server platform is also equipped with comprehensive monitoring functions including automatic daily alarms and alerts via email, switch gear on-off control and performance ratio calculations.

The FA-M3 controllers used in this project are provided with two types of CPU: the new e-RT3 CPU runs Python scripts for the communication link to the CI Server; and the standard CPU is used to connect hardwired discrete inputs/outputs for status monitoring and sequence control.



The energy company was challenged by the intermittent power supply profile of solar power generation failing to match the load profiles, causing frequent power trips and reductions in plant efficiency. Yokogawa proposed the implementation of a new CPU-based Python-programmable PLC to communicate with inverters and meters to collect data from the field and deliver it to the supervisory control and data acquisition system (SCADA, now the CI Server is used). Communication in Python enables more stable and quicker data retrieval compared to Modbus communication. The included sequence CPU also enables inverter data processing and executes power limit calculations.

The total power consumption is estimated to be 10 MW during working days (Monday to Friday). The floating solar site is expected to generate 8 MWp of that 10 MW load, with the remaining 2 MW to be supplied by the national grid.

During commissioning, however, Yokogawa's commissioning team found that on Sundays when the factories are closed, and from 11:00 am to 2:00 pm during the lunch break on working days, the power consumption falls to 2 MW. During these periods, power generation far exceeds power demand, resulting in excess power flow on the transmission line and causing the circuit breaker to trip frequently. As a result, the energy company was losing the opportunity to sell electricity during those trips, making the solar powerplant less efficient.

Immediately after advising the energy company of this challenge, Yokogawa worked closely with the company's engineering, procurement and construction contractor (EPC) to add an algorithm for tuning the inverters as quickly as needed to prevent tripping of the breaker. The Yokogawa FA-M3 and e-RT3 enabled stable two-way data communication, quick ramp rate tuning, and swift response to inverters, helping to optimize the plan to operation and increase plant efficiency.

Customer Satisfaction

Yokogawa and the EPC made the right approach by focusing on solving problems and optimizing operations. The solution has helped eliminate the customer's problem of frequent power trips that lowered the plant efficiency.

Yokogawa and the EPC were involved in this project from the initial phase and planned and worked on the project specifications and design together with the energy company. This helped Yokogawa comprehend the project goal from the customer's perspective and provide an appropriate solution tailored to the customer's needs. The solution packaged with CI Server and FA-M3 controllers running Python enables stable two-way data communication and quick tuning and control of inverters, thus minimizing power trips and indirectly improving plant operation efficiency. Yokogawa is committed to providing reliable remote engineering support to ensure that opportunities are not lost to sell electricity to end-users.

With such commitment and mutual understanding, the energy company is very satisfied with Yokogawa products and services and intends to continue working with Yokogawa and the EPC for the upcoming 1 MW solar plant expansion involving a SCADA for monitoring, control, and engineering for integrating the upper system of the existing floating solar plants.

Explore More

CI Server

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