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Kusu Island fully powered by solar energy, with Pulau Hantu to follow suit

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The solar photovoltaic panels on Kusu Island are installed on concrete beams in a shallow lagoon in front of the Da Bo Gong Temple. The goal is to retain the rustic surroundings of the temple while maximising the amount of sunlight that can be captured to generate electricity.
ST PHOTO: CHONG JUN LIANG

Kusu Island, home to the popular Da Bo Gong Temple and three Malay *keramat*, is now completely self-reliant in using solar power to produce its own water and electricity, setting a precedent for other southern islands like Pulau Hantu.

The island's solar photovoltaic (PV) and desalination systems became operational in the fourth quarter of 2022, in time for the island's annual pilgrimage season, and could even support the surge in demand when a record 22,523 visitors went there in October 2023.

As backup, batteries housed in two 40-foot containers can store enough power to last two days in the event that the solar panels cannot produce electricity because of issues such as cloud cover or rain.

Kusu Island – meaning Tortoise Island – is managed by the Singapore Land Authority (SLA), and is the site of the annual Kusu pilgrimage season, when thousands of devotees visit the temple and *keramat,* or shrines. There are no permanent residents on the island.

Covering an area of 780 sq m or about the size of two basketball courts, the solar panels have a power output of 140 kilowatt peak (kWp) or 230 megawatt hour (MWh) – enough to power 52 four-room HDB flats annually. The electricity is used in common facilities such as toilets and shower areas, as well as a food centre that is open only during the pilgrimage season.

The electricity produced is also used for an energy-intensive desalination plant that can produce 20,000 litres of water a day, enough for 140 people. Water produced by the plant is now in its final stages of being certified drinkable.

Before the plants were built, water and diesel had to be transported to the island by boat, a process that was becoming prohibitively expensive, SLA deputy director of estate management Lilian Chua told The Straits Times during a media tour of Kusu on Dec 7.

For instance, water ferried by boat cost seven times more than on the mainland.

In 2019, SLA signed an agreement with Nanyang Technological University (NTU) to collaborate on a $2 million research project to customise renewable energy systems on the offshore islands.

The desalination plant is remotely monitored and controlled from NTU's Smart Campus in Jurong West.

Dr Srikanth Narasimalu, the team lead in the development of the solar systems on Kusu Island, said this allows the monitoring team to take action if, for example, the water source becomes contaminated by an oil leak from a ship in the area.

Dr Srikanth, the programme director at NTU's Energy Research Institute, said: "Through remote monitoring of the seawater, our alarms can prompt us to shut off the water source before it gets processed at the plant."

To avoid having to clear any vegetation, the solar PV panels were installed in a shallow lagoon in front of the temple.

SLA's Ms Chua said: "Because of the history, the legacy of Kusu Island, we thought having the solar panels assembled in a tortoise shape would pay tribute to the legacy of this island."

The solar panels are installed on concrete beams in the lagoon, at heights ranging from 1.8m to 3m. The goal was to retain the rustic surroundings of the temple while maximising the amount of sunlight that can be captured to generate electricity.

The cooling effect of the water in the lagoon improves the efficiency of the solar panels, which can produce 10 per cent to 15 per cent more electricity than solar panels that are typically installed on rooftops, said Dr Srikanth.

SLA and NTU are setting up a similar system of solar panels with battery capacity and a desalination plant on Pulau Hantu.

When completed in 2024, the system will have a smaller capacity as the island is visited only occasionally by divers and nature lovers. It can desalinate 365 cubic m of water from a 40kWp solar photovoltaic system, and produce 69MWh of electricity annually.

Ms Chua said the solar panels will be installed on land as Pulau Hantu does not have a suitable lagoon. The location was chosen after consultations with the National Parks Board and nature groups had determined that the impact on the island's ecology would be minimal.

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