



A charged view

Using discarded solar panels to make buildings can help deal with PV waste and give the cells a new lease of life

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THE CENTRE for Sustainable Technologies, Indian Institute of Science (IISc), Bengaluru, is eager to unveil its new model residence. Located in Nelamangla, 30 km from IISc's campus, the house will not have occupants. Rather, it will be the site for a new research domain: sustainable use of solar panel waste as building materials.

"About 60 per cent of the building is made using decommissioned photovoltaic (PV) cells," says Monto Mani, associate

professor at the Centre for Sustainable Technologies. Other materials include Mangalore tiles for roofing, and tin sheets and packaging wood to case the PV cells. The residence will be ready by the end of May.

The idea to construct a building using discarded PV cells first occurred to Mani in 2018, when his team wanted to extend their thermal testing facility. The institute did not have enough funds to build the facility. So Mani proposed substituting brick

PHOTOGRAPHS: INDIAN INSTITUTE OF SCIENCE, BENGALURU



Researchers at The Centre for Sustainable Technologies, Indian Institute of Science, have shown discarded solar photovoltaic cells can be upcycled to make buildings or even furniture like tables (below)



and cement with PV cells, which were decommissioned in 2016 and lying on the terrace of the department. The extension now serves as an end-of-life PV laboratory.

Establishing the potential of PV cells as building materials has opened up several other research possibilities, particularly on the impact of temperature changes and residual capacity of PV panels. The Nelamangala unit is being set up to study these.

"At Nelamangala, we have used decommissioned cells sourced from a PV manufacturer, who asked us not to return them," recalls Mani. But these discarded cells can generate 40-50 per cent of the original 1.2 kilowatts. Even if they collectively generate 10-20 watts, it would suffice to power a Wi-Fi router or a mobile, he adds.

IISc's experiments could provide sustainable solutions for solar waste management in India. Increasing focus on clean energy means the country will have a solar PV capacity of 600 gigawatts by 2050, says a 2016 report by the International Renewable Energy Agency. Given that a PV cell lasts for 20 to 25 years and that recycling is not commercially viable—recycling a solar PV panel costs US \$20-30, as per US'

National Renewable Energy Laboratory—the country will generate 1.8 million tonnes of PV waste by 2050, according to a 2019 report by renewable energy consulting firm Bridge to India.

CLIMATE-PROOFING

Mani's team now plans to test the building's climate resilience. Their research since 2005-06 shows houses made from functional solar panels can heat up more in tropical regions as PV cells are only 3-4 mm thick. "If the climate of Bengaluru becomes like that of Chennai in 20 years, we need to know if such structures would be too warm to live in," says Mani. "We will estimate the amount of electricity required to heat or cool the PV waste building in peak weather conditions," says Roshan Rao, a PhD student at the Centre for Sustainable Technologies, who is part of the team. They will also assess its structural stability against wind gusts, rains and hail. Lower temperatures can contract PV cells while hot air can expand them.

Indoor air quality also needs investigation, says the team, as PV cells currently used are made of crystallised silicon. These have glass on the outside and plastic polymer on the inside to prevent toxic metals like silver, tin and lead from leaching out. But the polymer can break down to microplastics and raise the risk of cancer, diabetes and other diseases. Thin-film PV cells may be a good alternative as they have less polymer which is not used to cover cells. But they are new and will be discarded later. Although they have toxic metals like zinc, copper, gallium, selenium, lead, cadmium and tellurium, there is a low chance of these leaching out. [down2earthindia](#)