

Second Life Solar: Re-imagining value from used solar PV modules

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Australia leads the way in rooftop solar installations, but solar modules are emerging as a growing source of waste and many of the modules currently being disposed of have many years of service life remaining.

The International Renewable Energy Agency notes that solar PV modules are designed to operate for 25-30 years, but as people upgrade to larger systems for their homes and businesses, they are disposing of modules that are less than 10 years old, because they don't know what else to do with them.

In fact, 99.97% of Australia's PV capacity has been installed since 2010, meaning that almost 100% of PV waste streams that are being disposed of into landfill are less than twelve years old.

The NSW EPA forecasts that by 2025 NSW will generate 3,000-10,000 tonnes per year of waste PV modules and battery storage systems, with this growing to 40,000-71,000 tonnes by 2035. Globally, solar module waste is one of the fastest growing e-waste streams and could be up to 8 million tonnes by 2030, rising to 78 million tonnes in 2050, with many of these panels still having significant remaining service life.

We set out to address this rapidly growing waste stream by contributing to the creation of a circular solar industry, through creation of a pathway for the reuse of serviceable solar modules at scale.

Our vision is to establish a new whole-of-supply chain business model and secondary marketplace that will divert serviceable decommissioned solar panels from landfill for reuse in community solar gardens. Our initiative is offering an alternative to waste disposal into landfill that also provides clean energy and a source of income. Communities will be empowered to establish and run their own solar garden, thereby improving social equity and boosting the transition to a net zero emissions economy.

Our longer term vision also includes electric vehicle batteries being reused for stationary energy storage to support 100% circular renewables.

Reasons good solar PV modules potentially thrown away

- A whole system is removed when only a few modules are damaged, as the new modules must have similar electrical properties to the old;
- If the modules are still under warranty, the manufacturer often pays to replace the whole set, even when only a few are faulty. This means working modules are removed alongside the faulty modules and disposed of in landfill or as e-waste;
- PV modules have become a commodity; just like upgrading your mobile phone, homeowners are upgrading their systems to larger, newer, more efficient systems with a new warranty;
- Government incentives aimed at rolling out more solar systems have caused consumers to replace their entire solar array, since previous rebates didn't cover the replacement of only one or a few modules;

- The life of solar inverters is usually 10-12 years, much shorter than the 30-year lifespan of the modules themselves; some people use replacement of the inverter as an opportunity to install new modules.

Roadmap

In mid-2022 we installed a first-of-its-kind second life solar project, installing a small solar system made up of second hand (serviceable) solar panels at the Whylandra Waste and Recycling Centre in Dubbo NSW.

In 2023 we will scale up by a factor of 10 to recover solar panels from consumers in regional NSW that would otherwise be destined for landfill, test them, identify those that are serviceable and redeploy them to create a commercial scale (~100kW) 'second-life' solar system.

Our goal will be to then launch a new secondary marketplace that will divert 10,000 tonnes per annum of reusable end-of-life solar panels by 2030. The initiative also engages with key actors in the solar industry, with a view to advancing actions to address regulatory and related barriers to the reuse of second-hand solar panels.

First-of-its-kind demonstration

On 14 June 2022, Dubbo Regional Council (DRC) became a pilot site for a first-of-its-kind second life solar project, installing a small 7kW solar system made up of second hand PV modules that were destined for landfill on the Small Vehicle Reveal Centre at Council's Whylandra Waste and Recycling Centre.



Figure 1. Second Life Solar demonstration project at Whylandra Waste and Recycling Centre, Dubbo NSW.

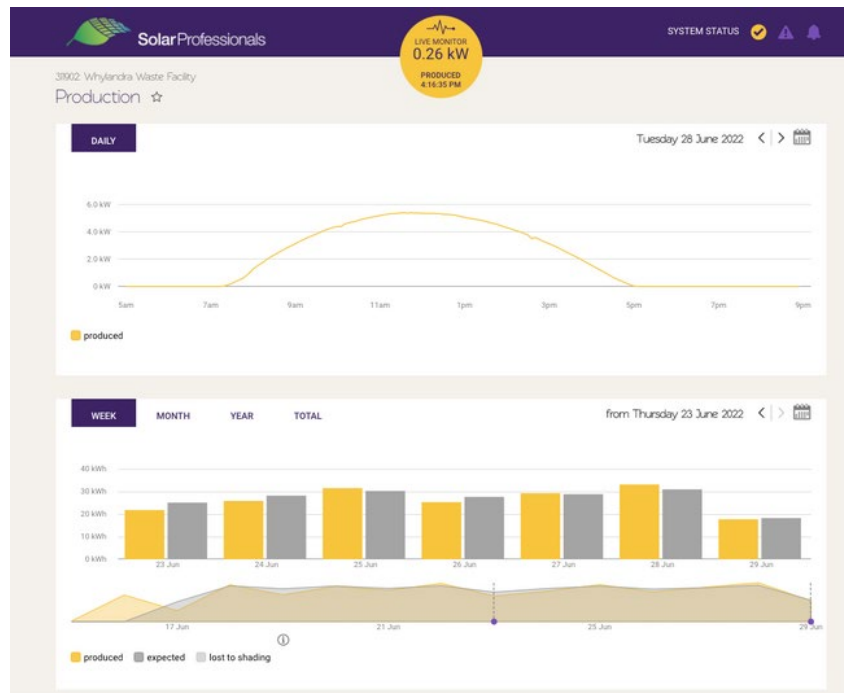


Figure 2. Performance of the demonstration system at Dubbo

Innovative inspection of modules to meet performance and safety standards

Under this project CSIRO is developing innovative methods for rapidly assessing the performance and safety of PV modules at collection points. CSIRO is also working with the relevant standards committees both domestically and internationally, to develop a world’s best practice approach to qualifying PV modules for re-use in Australia.

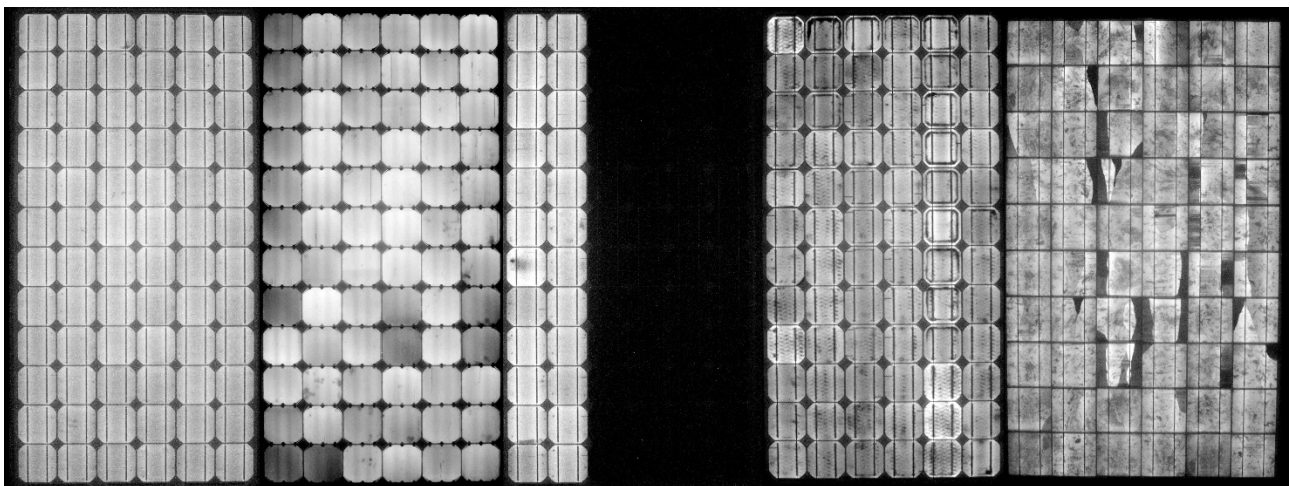


Figure 3. Electroluminescence images of used PV modules, showing good (left) and in various states of disrepair (remaining)

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