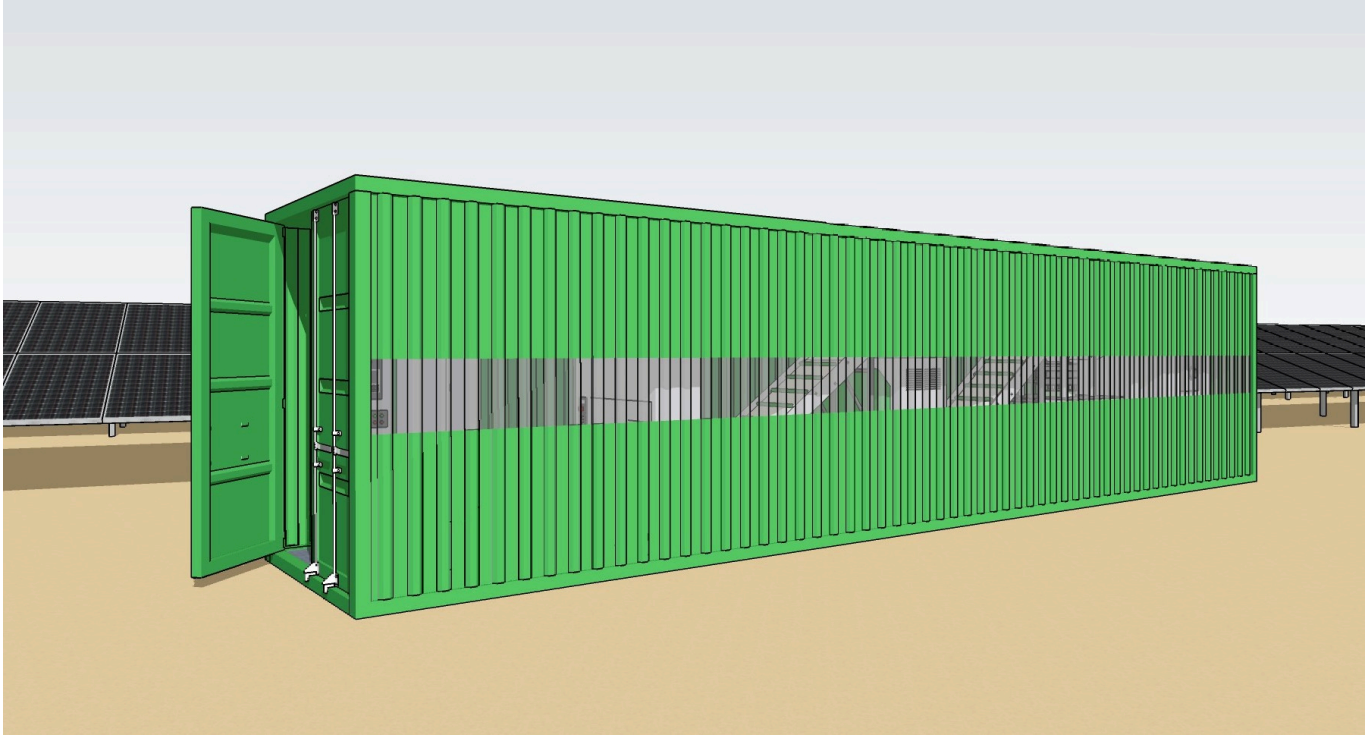


TECH OFFER

Eco-Friendly and Cost-Effective Modular PV Recycling Solution



KEY INFORMATION

TECHNOLOGY CATEGORY:

Waste Management & Recycling - Industrial Waste
Management
Energy - Solar
Sustainability - Circular Economy

TECHNOLOGY READINESS LEVEL (TRL): **TRL9**

COUNTRY: **SINGAPORE**

ID NUMBER: **TO175194**

OVERVIEW

The global demand for proper end-of-life management of photovoltaic (PV) panels is rising, with an estimated 78 million tonnes of PV waste expected by 2050. Singapore's rapidly expanding solar industry faces a growing challenge of sustainable disposal as it anticipates a solar capacity of over 1.2GW by 2024. According to International Renewable Energy Agency (IRENA), this could result in 3,000 tonnes of PV waste in 2024-2025 and up to 6,600 tonnes by 2030. Given Singapore's limited land space, there is an urgent need for efficient and profitable recycling solutions to minimize solar panel waste going to landfills.

This solution enables PV panel recycling through fully mechanical processes housed in a 40-foot shipping container. Unlike traditional methods that use thermal treatments or harmful chemicals, it employs customized robotic and mechanical processes, producing no chemical waste and consuming less energy. As a mobile solution, it can be deployed directly at decommissioning sites, eliminating the need for transport to centralized facilities and significantly reducing logistics costs. This environmentally

friendly, cost-effective solution turns PV waste into a profitable business opportunity. It offers a circular, plug-and-play solution for recyclers looking to quickly expand into solar panel recycling and meet market demands efficiently. It delivers environmental, technological, and commercial benefits.

The technology owner is keen to collaborate with local and international e-waste recycling companies with established material networks for aluminium, glass, and silicon, as well as partners with advanced extraction technologies or further upcycling capabilities for silicon and silver.

TECHNOLOGY FEATURES & SPECIFICATIONS

- **Modular and Scalable Design:** housed within a 40-foot shipping container for easy transport and setup
- **Plug-and-Play Deployment:** directly powered a single 3-phase, 415V power supply for quick operation
- **Mechanical-Based Recycling:** powered by an integrated power distribution board with an HMI panel for real-time monitoring and control of the recycling process
- **IoT-Enabled Tracking:** monitors material output and system throughputs, with data uploaded to the cloud for performance tracking
- **Integrated Dust Collection System:** ensures effective pollution control during the recycling process
- **Efficient Material Processing:** converts solar panels into ready-for-sale materials such as aluminium, glass, copper and silicon, achieving over 99% recovery rate

POTENTIAL APPLICATIONS

- **Mobile Recycling Units:** its plug-and-play design makes it ideal for temporary setups at different sites, providing a flexible and cost-efficient recycling solution
- **Large-Scale Solar Farm Decommissioning:** the decentralized PV recycling line can be deployed directly on-site, enabling in-situ processing of end-of-life solar panels. This reduces logistics costs, especially for large solar projects
- **Solar Panel Manufacturing:** helps manufacturers effectively dispose of defective panels produced during production, ensuring proper waste management practices.
- **Modular Scalability:** as demand grows, the recycling line can be expanded by adding more modular units, allowing it to adapt to both small and large-scale operations

MARKET TRENDS & OPPORTUNITIES

Globally, the solar panel recycling market is projected to be worth USD 385 million in 2024, with a forecasted growth to USD 931 million by 2029, at a CAGR of 19.3%. The largest markets for solar panel recycling are in the Asia-Pacific, North America, and Europe. Recent policy changes in the US and EU, promoting Extended Producer Responsibility for e-waste management, including solar panels, are driving increased demand for cost-effective recycling solutions.

UNIQUE VALUE PROPOSITION

The decentralized solar panel recycling solution offers four key advantages over conventional solutions available in the market:

- **Environmentally Friendly:** unlike traditional methods that rely on thermal and chemical treatments, this solution uses only robotic and mechanical processes, reducing energy consumption and eliminating hazardous gas emissions
- **Reduced Logistics Costs:** the patented containerized design enables easy transport to decommissioning sites like solar

farms, eliminating the need to move panels to a centralized facility and significantly reducing logistics costs

- **Streamlined Operations:** integrated AIoT features track material output and system throughput, simplifying the recycling process and enabling digital management of recycling operations for greater efficiency
- **Profit Maximization:** by minimizing operational costs and maximizing throughput, the solution turns solar panel waste into valuable materials, creating a profitable business opportunity from an industry challenge