Millions of solar panels have been installed in the last two decades—and since they typically last between 25 and 30 years, many will soon be ready for retirement and probably headed to a landfill. But new efforts to recycle these panels could reduce both the amount of waste and the new material that needs to be mined.

About 8 million metric tons of decommissioned solar panels could accumulate globally by 2030. By 2050, that number could reach 80 million. Recycling these panels could provide a new source for materials that would otherwise need to be mined (potentially under unsafe or exploitative working conditions), making solar a more sustainable piece of the clean-energy puzzle.

As per the report prepared by the National Solar Energy Federation of India, we generate over 34,600 tonnes of cumulative solar waste in India by 2030, The market value of raw materials recovered from solar panels could reach $450 million by 2030, according to a projection by the International Renewable Energy Agency.In other words, this amount of raw materials is approximately the same as that required to build 60 million new solar panels or to generate 18 GW of electricity.

The value of recoverable materials might surpass $15 billion by 2050, which would be enough to power 630 GW with two billion solar panels. Globally, it is expected that end-of-life (EoL) of solar panels will drive the solar panel recycling business in the next 10-20 years.

Then why are we not recycling more?

The large cost gap between recycling and discarding panels in landfills points to an unpleasant truth: The process generates roughly $3 in revenue from the recovery of certain materials. Recycling a solar panel cost between $20 and $30, according to the National Renewable Energy Laboratory; sending it to a landfill costs $1-2.

While photovoltaics generate only about 3 per cent of global electricity, they consume 40 per cent of the world's tellurium, 15 per cent of the world's silver, a substantial chunk of semiconductor-grade quartz and lesser but still significant amounts of indium, zinc, tin and gallium.

Waste from end-of-life solar panels presents opportunities to recover valuable materials and create jobs through recycling.

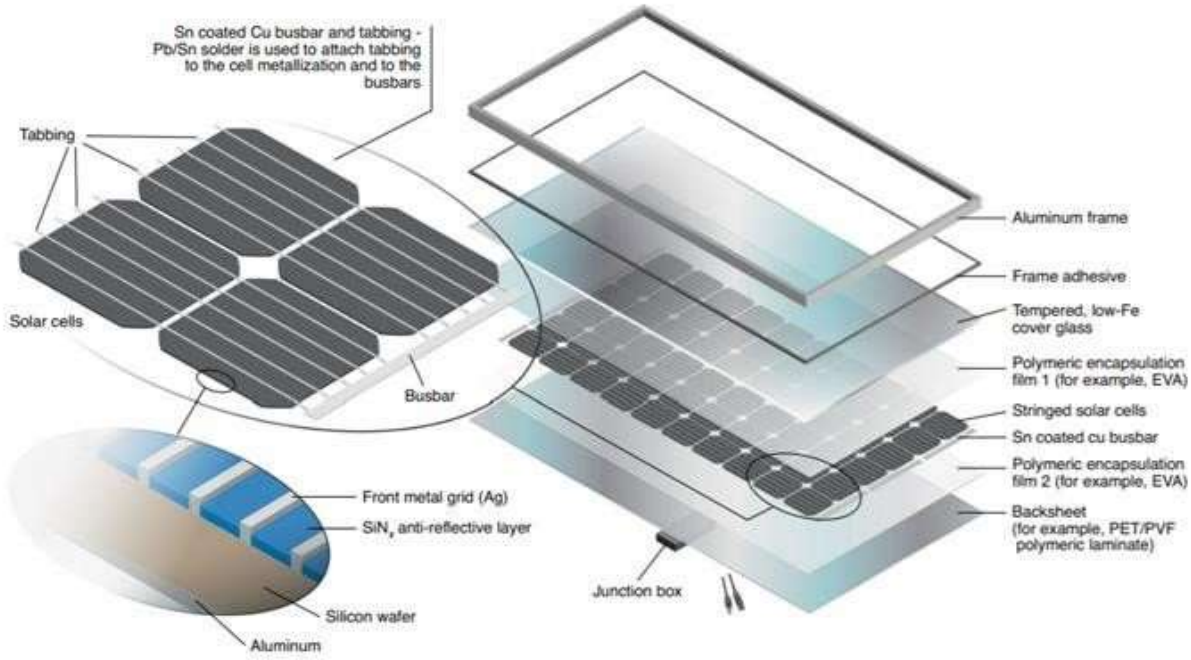
Diverting solar panels from landfills to recycling saves space in landfills in addition to capturing the value of the raw materials.

Recycling Overview

Crystalline-silicon solar technology represents most of the solar panel market share. This type of panel is constructed with an aluminium frame, glass, copper wire, polymer layers and a back-sheet, silicon

solar cells, and a plastic junction box. The polymer layers seal the panel from exposure to weather but can make recycling and panel disassembling difficult, as high temperatures are often required to loosen the adhesive.

Many of these components can be recycled. Glass composes most of the weight of a solar panel (about 75 percent), and glass recycling is already a well-established industry. Other materials that are easily recyclable include the aluminium frame, copper wire, and plastic junction box.



Other materials in the solar cells may be more difficult to recycle. Silver and copper are valuable components, but panels typically contain very small amounts of these materials. Toxic metals like lead and cadmium may also be present in solar panels.

Recycling Process

An ideal recycling system would recover as much material from solar panels as possible. There are different methods to recycle solar panels, which can include some or all of the following three steps:

1. Removal of the frame and junction box;
2. Separation of the glass and the silicon wafer through thermal, mechanical or chemical processes; and/or
3. Separation and purification of the silicon cells and specialty metals (e.g., silver, tin, lead, copper) through chemical and electrical techniques.

Recycling is already established in the glass, metals, and electronics industries, which can accommodate solar panels and other solar power system components. These processes typically involve crushing, shredding, and milling, usually after removal of the frame and junction box. In these processes, glass, aluminium, and copper may be recovered and the other materials, including the silicon solar cells, may be incinerated.

Thin film cadmium-telluride panels, which represent a smaller part of the solar market, undergo a different recycling process. At least one U.S. manufacturer runs dedicated recycling facilities for thin film panels which recover the semiconductor material (cadmium and tellerium) in addition to glass and copper.

Solar Panel Reuse

Another way to keep solar panels out of landfills is through panel reuse, either by direct reuse or after refurbishment. When reused, solar panels get a second life generating clean energy at a different location.