Solar Panel RECYCLING.COM

The Pioneer in Solar Farm Decommissioning and PV Module Recycling Solutions

2023

Locations
HQ/Processing Plant: 1325 Litton Drive, Salisbury, NC 28147
Receiving Plant: 220 Ryan Patrick Drive, Salisbury, NC 28147
Processing/Receiving Plant: 111 Fredrix Alley NE, Lawrenceville, GA 30046

1-888-RE-PANEL | 704-322-3093 | SolarPanelRecycling.com

Solar Panel Recycling

Background

Headquartered in North Carolina, PowerHouse Recycling Inc. (PHR) has been servicing the public and private sectors, nationwide, since 2008 in certified electronics recycling, secure data destruction, and IT Asset Management services. Bringing together decades of established internal compliance teams, advanced recycling capabilities, best practices, and resources to handle high volumes of solar panels, PHR officially branded its solar services division in 2023, to SolarPanelRecycling.com (SPR).

SPR is among early pioneers in solar panel (photovoltaic modules) recycling in the United States due to strategic partnerships and other longstanding business relationships formed through our electronics recycling services.

The commonalities of raw materials, recycling processes, recycling challenges, and regulatory framework between electronics and solar panels uniquely positions SolarPanelRecycling.com as a high momentum, early pioneer in research and development in the rapidly developing solar panel recycling industry. To date, SPR has recycled over one million pounds of solar panels, spanning multiple states, for large scale utility companies, O&M providers, EPCs, solar installation contractors, and more.

1,000,000+

(pounds) recycled

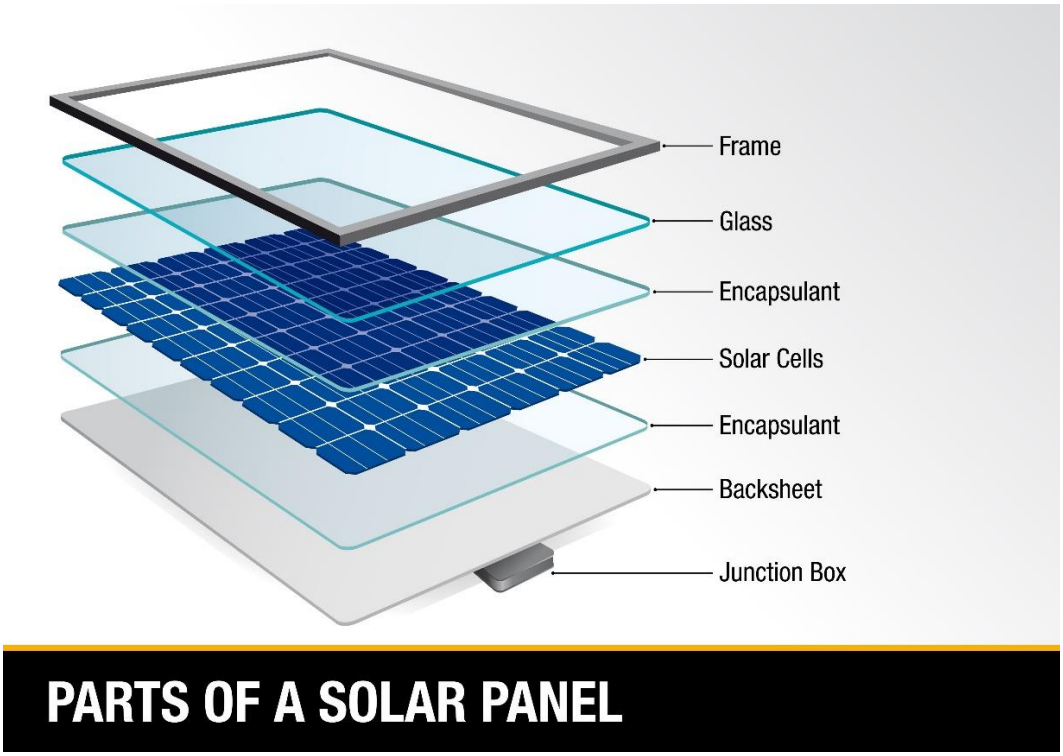
Solar Panel Composition

There are two types of solar panels that are commonly seen in our recycling processes:

Silicon Solar Panels: Mono-crystalline and poly-crystalline

According to the US EPA, crystalline-silicon solar panels represent over 95% of solar panels sold today. PHR's early solar panel recycling processes have seen mono and poly-crystalline solar panels comprise over 90% of our throughput.

- 90% of panel weight is glass panel, aluminum frame, silicon cells
- Small traces of copper, zinc, lead, silver, and tin



Thin-Film Solar

According to the US EPA, thin-film solar panels, and more specifically Cadmium Telluride panels (CdTe) are the second most common solar panel after Silicon panels. Ultra-thin, semiconductor layers are stacked on top of a base material, such as glass, plastic, or metal.

- 98% of CdTe panel weight is glass, polymer, and aluminum
- Small traces of cadmium, copper, zinc, tin and other metals.

Solar panel invertors and junction boxes contain items more easily recycled, and similar to generated output from our electronic recycling processes: PCB (circuit boards), copper wiring, plastics, and metals.

Solar Panel Recycling:

The solar panel recycling industry is currently in its **infancy stages.** Chemists, professors, engineers, and manufacturers, worldwide, are working to develop technology and/or a process to cleanly separate the silicon (the solar cells) into a clean enough commodity to be directly reused in manufacturing of new solar panels. Upon this occurring, SPR forecasts the costs of solar panel recycling to lower from current market pricing. Currently, the recovered silicon is not pure enough to be reused in the solar cell manufacturing supply chain.

SPR is in our PHASE 2 of solar recycling, meaning, we can recycle over 95% of the entire panel. Glass, aluminum, and metals can be recycled and recovered. We are currently setting up the industries most advanced solar processing and separation lines in Georgia and North Carolina (operating Q4 of 2023) while developing plans to have a dedicated solar processing and separation line in the Western US and Central US by Q4 2024 (or sooner). Finally, SPR is continuously developing new partnerships for additional applications of our output; glass, aluminum, silicon, and metals (see below).

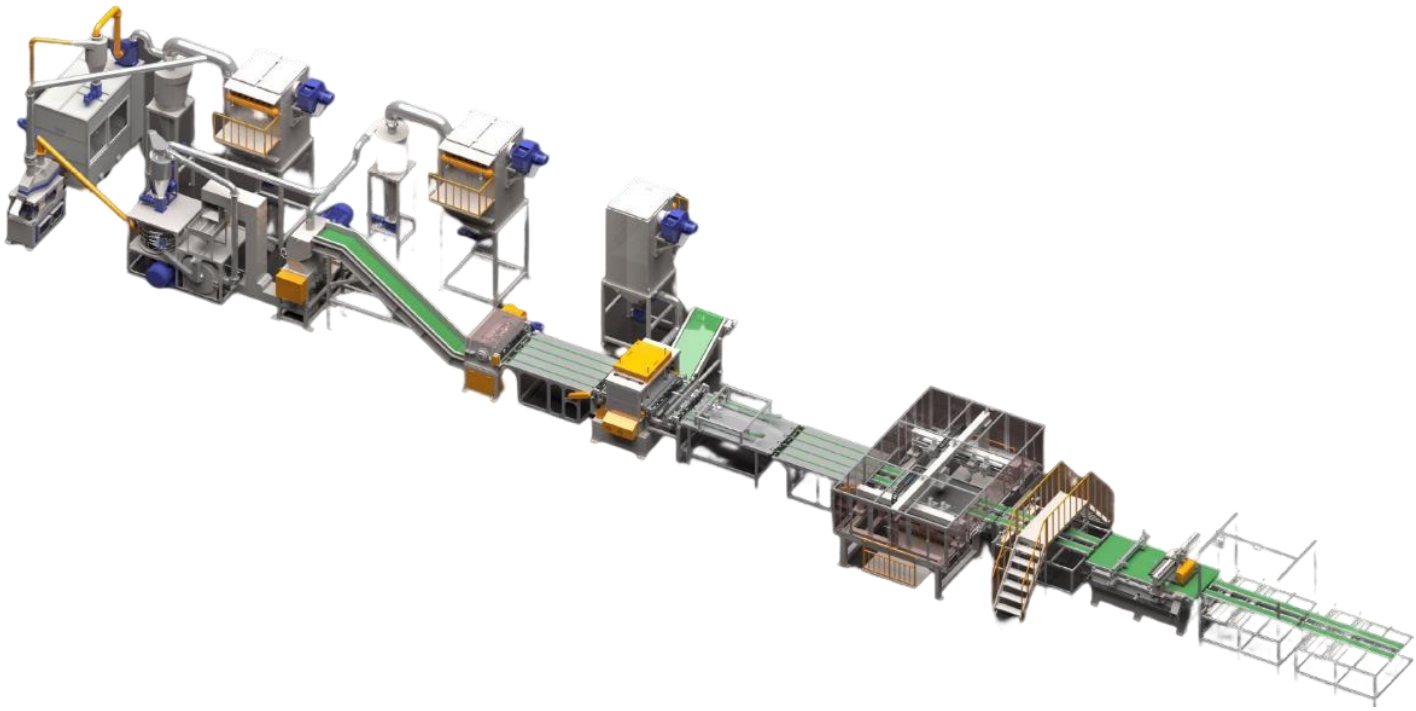
Copper

Plastic

Silicon Powder

Glass

Advanced Solar Recycling System (GA/NC Q4 2023)



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- Mechanical removal of the panel's aluminum frame and junction box.

2

- Glass is separated from solar cells and encapsulant and size reduction occurs

3

- Silicon, metals, and plastics separated for reuse in the circular economy

ALUMINUM:

The aluminum frame is then sent through our recycling channels to be smelted and processed into new aluminum products.

GLASS:

PHR has a strategic partnership with glass processors to further size reduce clean glass and circulate it back into various glass reuse markets; i.e., media blasting, fiberglass production, and as a bonding agent in other product manufacturing.

Metals, Plastics, Circuit Boards, and Wire:

As a national, large scale, certified electronics recycler, PHR has longstanding, well established relationships for the recycling of metals, plastics, circuit boards, and copper wire generated from solar panels.

Solar Panel Recycling: Challenges

Transportation Costs:

Solar panels are heavy, wide, and typically consolidated at solar farms without loading docks and warehouses leading to higher costs of transportation and more technical loading coordination and skills needed.

Service Solution: Solarpanelrecycling.com is experienced in working on-site to palletize, band, and load solar panels of all sizes utilizing all-terrain equipment. SPR has worked in sandy surfaces, grass, gravel, and dirt with proper industrial, all-terrain equipment. Our crew is efficient, safe, experienced, and equipped to work on site with proper PPE; hard hats, high visibility attire, cut sleeves, gloves, eyewear, and more. Furthermore, SPR's on-site team is experienced working side-by-side solar installation contractors and coordinating efficient staging prior to our team's arrival.

Re-use Markets:

Currently, global re-use markets in solar are very limited, and grossly unestablished. Finding a volume end-user for used solar panels in a challenge, but testing, warranty, and transportation costs typically stop any opportunity in its tracks if found. Due to the lack of a viable, secondary, high volume re-use market, costs to recycle cannot be subsidized through re-use opportunities.

Silicon Recovery and Panel Variables:

Currently, there is not a viable, developed technology and or process to allow the cleanly separated silicon (the solar cells) to be directly reused in manufacturing of new solar panels. The recovered silicon has been used in other applications and supply chain. Furthermore, there are such a wide variety of sizes, compositions, bonding agents, and overall solar technology in panels hitting the recycling stream that requires constant expansion, updates, and development in solar recycling machinery and technologies.

Solar Panel Laws, Regulations, and Policies

Some states have enacted laws, regulations, policies, or initial research. SPR's internal compliance team in constantly staying current in the everchanging landscape of solar panel waste classification, transportation regulations, and more.

These current states have some sort of solar panel policy:

- California
- Hawaii
- New Jersey
- North Carolina
- Washington

Federal and State Hazardous Waste Regulations

Federally, discarded solar panels are currently considered solid waste, and may be regulated under the RCRA Subtitle D as well as state and local programs and regulations. If a solar panel is determined to be hazardous waste, by failing the TCLP test, it will more than likely meet regulatory exclusions under the RCRA, designed to encourage recycling of solar panels while providing regulatory framework that prevents mismanagement.

From a state regulatory perspective, most TCLP testing shows common solar panels pass, and have very low amounts of hazardous materials, and do not need to be labeled as hazardous waste. SPR's compliance team is staying current to this ever-changing landscape to assure compliance, and most importantly, promote recycling of solar panels versus landfilling. Furthermore, SPR is currently working on obtaining our TBE (transfer base exclusion) to be able to pick-up, transport, and recycle solar panels that either do not pass TCLP testing, or, do not have test results available.

Decommissioning Plans, Local Permitting, Landfill Bans

North Carolina is currently passing a bill to require solar farms to have decommissioning plans in place by 2025 (with many states expected to follow). This requires to have a cost estimate, bond and or insurance, a recycling vendor with viable markets, and more in place. In many states, at the local permitting level, decommissioning plans, as aforementioned, are required for permitting for new solar farms and other return land to use regulations. Finally, although official state landfill plans are not quite in place, many states environmental quality divisions are trending that way. Even ahead of state mandated landfill bans, many private landfills across the country are already implementing the banning the acceptance of solar panels, highlighting capacity and unknown composition as the main drivers.

SPR can assist in the creation of these decommissioning plans and handle the ongoing recycling of solar panels created by weather events, panel failure, and upgrades.

RECYCLING SOLAR WITH SolarPanelRecycling.com: How to Get Started

Contact a SPR representative today for more information on our process!