



**TERREPOWER**  
*A BBB Industries Company*

# SOLAR COMES FULL CIRCLE with Sustainable Manufacturing

*TERREPOWER, a division of BBB Industries, LLC*



## Introduction

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*There is more to solar panels than free energy as panels must be sourced, installed, and disposed of at the end of their usable life.*

**“Installing a solar system provides free energy.”** As this statement is being read, experienced solar professionals laugh at its simplicity. Solar technicians may recount the times they were called to fix a damaged solar farm after hailstorms. Executives laugh at the term free as they have experienced high upfront capital costs and long payback periods when considering a solar installation. Finally, environmentalists, weary of the materials required to be harvested from Earth and the pounds of solar waste stacking up in the landfill, are skeptical. All three vantage points of solar system complexities are understandable from the perspective of newly manufactured solar systems, but are we considering sustainably manufactured panels for second-life use? What opportunities does a solar circular economy bring to the table? What on earth is sustainable manufacturing?

TERREPOWER, a division of BBB Industries, aims to bring a full lifecycle management solar solution to the market while considering the environmental impacts of its products. From bringing you your first clean energy source to buying back your panels at the end of their life, TERREPOWER looks to put clean, solar energy within the reach of all its customers.

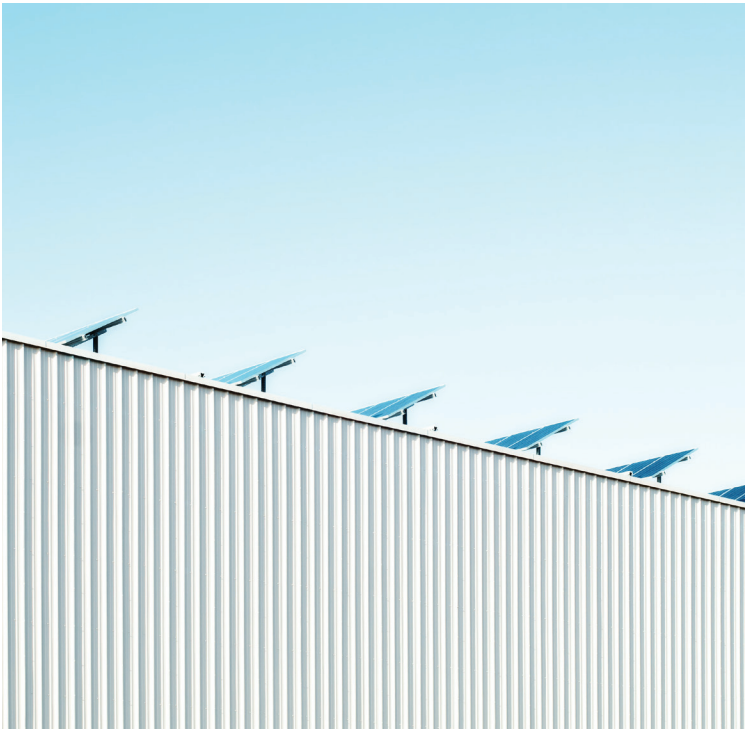
## What is Sustainable Manufacturing?

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Sustainable manufacturing is defined as the creation of manufactured products through economically-sound processes that minimize negative environmental impacts while conserving energy and natural resources (US EPA, 2023). This is exactly what a solar circular economy accomplishes. TERREPOWER goes beyond traditional remanufacturing, which focuses solely on material preservation and economic value, to also include the lifecycle environmental impacts of its products and the footprint of the production stage. Sustainable manufacturing includes the consideration of the full lifecycle and the value maximization of the product. To ensure a clean energy transition and a sustainable future, we must implement a solar circular economy through sustainable manufacturing.

## A Full Lifecycle Solution

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*TERREPOWER sees the the value of worn and broken solar panels and the importance to bring them back to life.*

When a picture of a solar farm is placed in a company's corporate sustainability report, not much thought is given to the impact nature has on it and the wear and tear the panels experience. Hailstorms crack the glass, and heavy winds bring debris crashing into the structures. Clearly, it is important to know a local provider that has the expertise to restore your system to its fullest potential. This is when the sustainable manufacturing of those broken panels can ensure minimal system downtime and a secondary strategy for your damaged panels. Furthermore, sustainably manufactured panels ensure that you are receiving a proven product that is equivalent in performance to new modules. The minimal downtime, a secondary strategy for your damaged panels, and the replacement of those panels compose the full lifecycle solution the TERREPOWER team brings for your solar system. If your solar system is damaged and not fully functioning, there is a solution.

## The High Investment Challenger

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Sustainably manufactured panels can present a more cost-effective approach to clean energy. Similar to the automotive industry's value proposition of second-life products, sustainable manufacturing brings post-consumer panels back to the market at a marginal rate with equivalent performance to new. Similarly, the TERREPOWER team further supports end-of-life management through a second-life buyback program. When solar users find it is time to repower or upgrade a solar system, the door is opened to decrease the cost of new panels. This brings untapped potential to the table for panels reaching the end of their first life. A strategy for second-life use can significantly lower the cost of clean energy projects and bring an opportunity for lower payback periods. Not to mention the security of sustainable end-of-life management.



*Panels that are given a second life open the opportunity for customers to implement a clean energy source at a lower cost than newly manufactured panels.*

## Impact on the Environment

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Carbon emitted in the production process and end-of-life management are two pivotal points of discussion for the environmentally driven buyer. A key point of sustainable manufacturing is to consider the carbon footprint of the entire lifecycle of a product. Through considerable research and running varied scenarios of post-consumer panels, the TERREPOWER team has found a production carbon footprint decrease of ~35% in comparison to new manufacturing. Similarly, the TERREPOWER team reports on the multiple critical materials required in new manufacturing that can be re-utilized. Silver, copper, and others make up some of the most demanded components inside a panel.



*When materials in solar panels are at times hazardous and most often highly valuable it is important to keep them out of our landfills.*

As sustainability focuses on meeting the needs of the future without compromising the needs of the present, we must consider the finite materials available and the demand on those materials for the products we are promising to bring to the market (UN Brundtland Commission, 1987). Furthermore, to ensure the greatest environmental focus, we must reutilize each pound of the post-consumer panel. This means that there must be a solution for panels that can be brought to market once more as quality, reliable solar panels (even if it is a subsection of a greater batch). Secondly, there must be a solution to recycle panels to their base materials for reuse. This maximum value strategy ensures that all panels are valued at their highest potential beginning with reuse in their initial function. Furthermore, some panels are taken to recycling and no panels end up in our landfills. Keeping critical materials out of landfills, ensuring maximum value recovery for post-consumer products, and keeping clean energy systems in use for as long as possible is the name of our game.

## Sustainable Manufacturing at Work in Sparta, TN

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*Sustainably Manufactured Solar Panels in Sparta, TN power the Automotive Component Sustainable Manufacturing Facility and the Facility's Energy Storage system made from second-life EV batteries.*

It is easy to bring forward an idea. It is more difficult to put it into practice. Delivering proven sustainable manufacturing to an entirely different market than the automotive industry is no easy task and must be tested rigorously.

Today, as the sun rises over BBB's manufacturing facility in Sparta, TN, an entire array of panels are ready to go to work. These sustainably manufactured panels were installed in March 2022 and are on their own second life. They provide this facility with an average of 39% of its monthly power needs, saving the plant significant electricity cost and lowering the plant's scope 2 emissions. Not only does this keep the post-consumer panels out of the landfill and bring cost savings to the site, it also avoids over 22 metric tons of emissions from entering the

atmosphere each month. That is the equivalent of taking 655,000 miles off the road or avoiding the emissions of 50 homes' electricity for a whole year. Furthermore, the panels are directly connected to a sustainably manufactured energy storage system made of second-life EV batteries (more to come on this topic in later case studies). To put this all into perspective, the Sparta site that sustainably manufactures automotive parts is partially powered by sustainably manufactured solar panels, which also feeds the back up power sourced by a sustainably manufactured stationary storage system. That is what we call a win-win-win for BBB Industries, TERREPOWER, and the environment. This is a mini picture of what we think a sustainable future will look like.

## Summary

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In summary, the proven capability that BBB Industries has with its automotive sustainable manufacturing has been proven in the solar industry through its TERREPOWER division. With clean energy sourcing projects like the Sparta solar farm, we can ensure that solar systems are kept in service for as long as possible, end-of-life components are reutilized, and all components are kept out of local landfills.

## About

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BBB Industries, LLC is an industry leader in the sustainable manufacturing of starters, alternators, hydraulic and air disc brake calipers, hydraulic and electronic power steering products, and turbochargers for the OEM, passenger, industrial, and commercial vehicle aftermarket industries. Through TERREPOWER, BBB brings its sustainable manufacturing process to the electric vehicle and solar energy sectors.

## References

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