Case Study: Project Phoenix – Elevating Land Reuse with Solar Technology Innovation

By Watershed Geo

Aerial photo of Watershed Geo's Project Phoenix solar array. Photo by Tennessee Valley Authority (TVA)

Background

Project Phoenix is a 100 MW AC solar project on a closed coal combustion residual (CCR) landfill near Paducah, KY. Through this work, Watershed Geo is supporting the Tennessee Valley Authority (TVA)'s commitment to achieving 80% carbon-free energy by 2035, which includes adding 5,000 MW of solar by 2030 and 10,000 MW by 2035. The project enhances sustainability by repurposing existing industrial infrastructure, eliminating the need to develop on nearby greenfields or farmland.

Energy generation is possible even on the steep slopes of this closed coal ash impoundment thanks to Watershed Geo's unique technologies, transforming previously unusable terrain into a renewable energy asset. This innovative approach is reshaping the future of closed-site reuse and solar siting across the industry.

Site Challenges

Watershed Geo's approach involved the combination of two unique products, ClosureTurf® and PowerCap®, to satisfy key design criteria and overcome challenges:

- Regulatory pressure under EPA's Coal Combustion Residuals (CCR) Rule required a safe and effective site closure method.

- The site featured steep slopes and irregular terrain unsuitable for traditional, non-penetrating solar installations.

- Utility stakeholders needed a solution that supported both current closure and potential future ash harvesting.

-TVA's sustainability goals demanded minimized carbon footprint and clean energy output.

Innovative Technological Solutions

Two technological innovations were used to address these challenges. PowerCap® uses a friction-based, non-penetrating design to anchor solar arrays securely, eliminating the need for racking or cap perforations. Traditional solar farms avoid sloped areas due to racking challenges and soil instability, but PowerCap® has been successfully tested on up to 2:1 slopes and solar modules can be safely installed on steep, stabilized slopes without soil disturbance.

This turns previously unusable landfill geometry into high-value energy-generating real estate, preserves closure integrity, and complies with

A visual guide to the difference between the PowerCap® system and a traditional ballasted system. Photo by TVA.

environmental regulations. This system was deployed atop the ClosureTurf® final cover system, an engineered synthetic turf and structured membrane designed to address soil erosion, slope integrity, gas emissions, installation and maintenance cost control, EPA regulation compliance, and longevity of the structure and appearance.

Project Phasing

Phase 1 of this project closed over 5.49 acres and a total of 6,786 solar panels were installed using the technologies described above, maintaining the integrity of the closed site with no penetrations and delivering an output of 2.67 MW. The remaining 250+ acres of the site have been covered, with the remaining solar installations under construction, preparing to further expand the site's renewable energy capacity.

Results

Integrating these unique technologies has helped the solar installation on the site:

- Operate efficiently on side slopes and top decks.
- Function with phased solar installation, supporting potential ash harvesting in the future.
- Deliver clean energy without compromising cap performance.
- Achieve up to 300% greater power density per acre compared to traditional systems due to the low-profile design of the system on sloped areas, which eliminates potential shading from one row of panels to the next, thereby enabling higher panel density per unit of surface area.

What's Next

"TVA has shown great leadership in executing on innovative solutions to dramatically improve how renewable energy is developed. It's a green approach to green energy. We are honored to be a part of the innovative industry shift of applying beneficial reuse to what is typically unusable land," said Mike Ayers, CEO of Watershed Geo. "We believe TVA will lead the way in establishing a future best management practice for the global environment and local communities."

Once fully complete, Project Phoenix will represent one of the largest integrated solar landfill projects in the U.S., featuring:

- 130 MW DC capacity
- 100 MW AC capacity
- 245,910 solar panels
- Over 250 acres of landfill closure

Conclusion

Project Phoenix demonstrates how modern closure technologies and innovative solar integration can work hand-in-hand. With creative innovation, utilities and municipalities can meet environmental obligations while creating new energy assets, turning yesterday's waste challenges into tomorrow's energy opportunities.

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About Solar Scale

Solar@Scale is a partnership between the International City/County Management Association (ICMA) and the American Planning Association (APA) that aims to help cities, towns, counties, and special districts understand and realize the potential benefits of large-scale solar development.

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