

# SOLAR DECOMMISSIONING

Like all infrastructure, solar facilities have a limited operational life. The decommissioning of solar facilities is a natural phase in their lifecycle that ensures responsible land management and preservation of agricultural resources.

Decommissioning is essentially the construction process in reverse. Much of the material that comprises the facility, including increasingly the solar panels themselves, can be re-used or recycled. After decommissioning, the landowners will be able to return any of the farm fields to crop production should they choose to do so.

Decommissioning of solar facilities is practicable because they include very few foundations and most of the land within a solar facility is actually open ground. Solar facilities like Grange typically are scheduled to be decommissioned after the expected useful life of the panels (35-40 years).

Both state law and the solar leases between Grange and landowners have strict requirements regarding decommissioning of facility components and restoration of the land to agricultural conditions.

“Modern solar facilities may be considered a temporary, albeit long-term, use of the land, in the sense that the systems can be readily removed from the site at the end of their productive life.” Solar “is a viable way to preserve land for potential future agricultural use.”

— Study by N.C. State University



# DECOMMISSIONING PROCESS



**Effectively, the decommissioning of the Project proceeds in reverse order of the installation.**

- 1 The solar facility is disconnected from the utility power grid.
- 2 Solar panels are disconnected, collected, and either shipped to another project, salvaged, or submitted to a collection and recycling program.
- 3 Aboveground and underground electrical cables are removed down to a depth of at least 3-feet and recycled off-site by an approved recycling facility.
- 4 Metal piles that support solar panels and racking are removed and recycled off-site by an approved metals recycler.
- 5 Electrical and electronic devices, including transformers and inverters, are removed and may be recycled off-site by an approved recycler.
- 6 Any concrete foundations or footers (ex. under the inverters) are removed and may be recycled off-site by a concrete recycler.
- 7 Fencing is removed and recycled off-site by an approved recycler.
- 8 Interior project roads may remain onsite should the landowner choose to retain them, or be removed and the gravel repurposed either on- or off-site.



# DECOMMISSIONING PERFORMANCE BOND

**A performance bond in favor of the State must be posted to guarantee the necessary funds to decommission a solar project at the end of its life.**



- State law requires that the cost estimate for the performance bond be accurate and conservative.
- An Ohio-licensed professional engineer approved by the State must develop the cost estimate.
- Despite the fact that the facility will contain many valuable components and materials at the time of decommissioning, the value of those materials may not be accounted for in the cost estimate.
- The cost estimate must be recalculated every 5 years, and the bond amount may be increased as needed, but not decreased.
- Example, a 144 MW project approved by the state in 2023 included a decommissioning and restoration cost estimate and resulting bond amount of \$14,296,000.

## RETURN TO FARMING

**Solar facility construction will have only limited impact on the farm parcels that host it. A variety of efforts are undertaken through the design, construction, operations, and decommissioning process to maximize the project parcels' future agricultural value and viability.**

- Drain tile mapping and preservation or restoration
- The majority of the site will not be graded because the project area is mostly flat and the racking systems can be installed to conform to moderate changes in slope.
- The racking systems that support the solar panels will be installed on steel piles driven directly into the ground about every 10 feet and without the use of concrete.
- Topsoil will remain on site and will be moved only for limited grading, installing temporary laydown yards, building internal roads, limited equipment pads (ex. inverters), and the project substation, and trenching buried lines. Disturbed topsoil will be used to establish the vegetative ground cover for the project and will remain in place for cultivation following decommissioning.
- The project will establish and maintain native vegetation below and around the solar panels for decades, similar to the kind of vegetation used in USDA's Conservation Reserve Program, which pays farmers to fallow land with vegetation to achieve various agricultural and environmental benefits.
- Decompaction following decommissioning
- Removal of infrastructure down to 3-feet of depth (to allow for cultivation and installation of drain tile)



# STATE DECOMMISSIONING REQUIREMENTS

- Projects like Grange must submit an enforceable and financially-backed decommissioning plan to the State prior to construction
- The plan must ensure that the land be returned to farming at the end of the useful life of the solar facility.
- State law requires that decommissioning be completed and the land restored to its pre-construction condition within 12 months of when the facility ceases to operate.
- A performance bond in favor of the State must be posted to guarantee the necessary funds to carry out the plan.
- Decommissioning must include the physical removal of all components above and below ground down to a minimum depth of 3-feet to ensure compatibility with future farming activities, with the only possible exceptions being project roads that may be used in the future by the landowner.



## RECYCLING DID YOU KNOW?

- Solar panels no longer producing enough energy for optimal commercial power generation can still generate some electricity for decades. For this reason, the solar panels from a decommissioned solar facility may be used for many years in other locations and applications.
- Increasingly, panels can be cost-effectively recycled. The largest U.S. manufacturer (which is OH-based) takes back and recycles its own panels. The ability to cost-effectively recycle panels and the recycling industry will only grow with time.
- The vast majority of components of solar panels are recyclable. By weight, most solar panels are around 80 percent glass and aluminum which are easy components to recycle at general-purpose recycling centers. Solar panels also contain at least one rare or precious metal which may be recycled at the end of its useful life.
- The majority of the other components of solar facilities also can be recycled, like metal racking, framing, copper wire, and other equipment
- The largest U.S. solar manufacturer has recycling processes that recover over 90% of the semi-conducting material and more than 90% of the glass material for re-use.
- The recoverable value of glass, metal, and semi-conductor material from recycling panels is significant. By 2030 it is estimated to be \$450 million per year nationwide. Economic analysis provides strong evidence that the scrap value of a solar facility far exceeds the cost to decommission it, making decommissioning a value-add at the system's end of life in 30-40 years.
- A study by the International Renewable Energy Agency estimated that \$15 billion worth of raw materials may be recovered by 2050 when the first installed solar panels reach end-of-life.
- The Solar Energy Industries Association (SEIA) sponsors a nationwide collection and recycling program that provides pre-screened and preferred pricing with recycling facilities who accept solar panels for collection and recycling.



# RESOURCES



N.C. Clean Energy Technology Center, N.C. State University, “Balancing Agricultural Productivity with Ground-Based Solar Photovoltaic (PV) Development” (August 2017), p. 4, available at <https://nccleantech.ncsu.edu/wp-content/uploads/2019/10/Balancing-Agricultural-Productivity-with-Ground-Based-Solar-Photovoltaic-PV-Development-1.pdf>.

International Renewable Energy Agency, “End-of-life management: Solar Photovoltaic Panels” (June 2016), available at <https://www.irena.org/publications/2016/Jun/End-of-life-management-Solar-Photovoltaic-Panels>

Best Practices at the End of the Photovoltaic System Performance Period" (February 2021), available at <https://www.nrel.gov/docs/fy21osti/78678.pdf>



## Contact Us

[grange@openroadrenewables.com](mailto:grange@openroadrenewables.com)

[www.grangesolarproject.com](http://www.grangesolarproject.com)

# FREQUENTLY ASKED QUESTIONS



## **What happens at the end of the useful life of the solar panels?**

After the productive commercial life of the panels, which is 35-40 years, the solar project will be decommissioned and the land can be returned to roughly its current condition.

## **How can you guarantee that the solar project can be returned to crop farming after its operating life?**

First, our solar leases include a contractual obligation to decommission and restore the ground at the end of a project's useful life. Second, the equipment has significant reuse and scrap value in excess of the cost of decommissioning (steel, copper, aluminum, and the panels themselves will have significant value in the future), so there is a strong economic incentive to decommission a facility that is no longer producing enough power. Finally, the State requires decommissioning and an associated performance bond to guarantee funds to carry it out.

## **What if the owner of a solar project goes bankrupt and abandons the project?**

If an owner went bankrupt, it is very likely that a new owner would take over. Solar projects are expensive to build, but reliable and relatively inexpensive to operate. So, there are strong incentives to continue a solar project's operations. In the event of abandonment, the same decommissioning procedures would be followed and fully financed with the performance bond.

## **What assurance is there that the owner will carry out the decommissioning?**

State law requires that projects like Grange submit to the State an enforceable and financially-backed decommissioning plan and performance bond so that the land may be returned to farming at the end of the project's useful life.

## **Can solar developers credit a solar project's substantial salvage value when calculating the decommissioning bond amount?**

No, state law does not permit consideration of salvage value in calculating the decommissioning cost of a solar project.

## **What measures are in place to ensure that land under a solar project can be returned to agricultural use decades from now?**

Before construction begins, drain tile is mapped, and during construction it is either avoided, repaired or even improved to the extent that is needed to protect neighbors from drainage problems. Grading is limited due to the flat nature of the site, and topsoil will be preserved onsite. Removal of infrastructure and decompaction of impacted areas following decommissioning enable restoration of the site for agricultural use.

## **What happens to topsoil during construction, operations, and decommissioning?**

During construction, topsoil is kept on site and is moved only for limited grading, installing temporary laydown yards, building internal roads, limited equipment pads (ex. inverters) and the project substation, and trenching buried lines. Disturbed topsoil is used to establish the native vegetative ground cover for the project which will remain in place over the life of the project. After decommissioning, the topsoil remains in place for future cultivation.