Decommissioning Plan for the Pine Grove Solar Project

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TABLE OF CONTENTS

APPENDICES

1 INTRODUCTION

Pine Grove Solar, LLC (Pine Grove), a subsidiary of AES Corporation (AES), is proposing to build an up to 50-megawatt AC (MWac) photovoltaic (PV) solar generation facility along Pine Grove Road, approximately 12 miles east of Richmond, Kentucky in Madison County (Project). The Project Area consists of 485.7 acres of predominantly undeveloped and agricultural land. The Project Area is shown on the topographic map provided in Appendix A: Figure 1 (Esri, et. al., 2021). The Decommissioning Cost Estimate is provided in Appendix B.

2 PROJECT DETAILS

The proposed Project would consist of 107,892 solar modules, associated solar module racking system and foundations, 36 solar inverters, 14 three-phase pad-mounted transformers, and associated electrical equipment and materials necessary to collect the energy produced. The project does not include any overhead transmission lines. The facility is assumed to be secured by a seven-foot-tall chain link and barbed wire fence.

3 DESCRIPTION OF WORK TO CONSTRUCT UTILITY SCALE SOLAR FACILITY

3.1 Major Construction Activities

The following provides an overview of the anticipated major construction activities associated with the proposed solar facility:

- **Cable Trenching:** Electrical cables and telecommunication lines would require installation of a trench up to approximately three feet deep and one to four feet wide. The trenches would be filled with base material above and below the conductors and communications lines to ensure adequate thermal conductivity and electrical insulating characteristics. The topsoil from trench excavation would be set aside before the trench is backfilled and would ultimately comprise the uppermost layer of the trench. Any excess material from the foundation and trench excavations is anticipated to be incorporated onsite and will not be exported.
- **Foundations:** The solar modules will be installed on steel racking structures. The posts for the racking structures will be driven an assumed 12 to 14 feet into the ground using a post-driving machine. The solar inverters and three-phase pad-mounted transformers will be set on concrete pads that are typically 12-18 inches deep.
- **Modules Racking System:** Galvanized beams and other structural components will be bolted to the foundation posts of the racking system. The solar modules are then mounted on these structural components using hardware.
- **Solar Inverters and Three-Phase Pad-Mounted Transformers:** The solar inverters and three-phase pad-mounted transformers will be offloaded from delivery trucks and bolted to concrete foundations. The underground electrical and communication cables will be routed and connected to these pieces of equipment.

3.2 System Overview and Components

PV solar modules absorb sunlight and use silicone cells to generate electrical current. The PV modules are mounted on a single axis tracking racking system which allows the modules to track the sun throughout the day. Components of the system include the following:

- **Combiner Boxes:** Combiner boxes allow paralleling of multiple conductors/feeder inputs, thereby requiring fewer outputs.
- **Inverters:** Inverters are high speed switching and power conversion devices that transform direct current (DC) to alternating current (AC). There are 36 solar inverters proposed for the Project.
- **Transformers, Recloser, Disconnect Switch:** Transformers are an apparatus for reducing or increasing the voltage of an alternating current. There are 14 three-phase pad-mounted transformers proposed for this Project to distribute energy to the electrical grid. The recloser and disconnect switch are protection devices that can isolate the solar facility from the wider distribution system in case of system-wide failure.
- **Underground Cables and Conduits:** Underground power (AC and DC) cables, communication and grounding cables on the Project will be either buried or placed in conduits. The cables will be rated in accordance with their application. The cables will be placed in a conduit as per National Electrical Code (NEC) 300-5 when transitioning from below grade to above grade.
- **Access and Internal Roads:** The Project will require construction of internal roads to access facility equipment. Internal access roads will comprise an aggregate base over compacted native soils.
- **Buildings and Enclosures:** The Project will not include any permanently occupied buildings or structures after construction is complete and the solar facility is operational. The site may include storage containers for spare parts and materials, but these will not be affixed to a foundation. Except for periodic maintenance, the facility will be unmanned.
- **Security Fencing:** To ensure security of the facility, the property will be fenced with seven-foot-high chain link fencing topped by one foot of three strands of barbed wire. Access to the site will be controlled via locked access gates.
- **Project Life:** The facility has an estimated useful life of at least 35 years with an opportunity for extension depending on equipment replacements or refurbishments.
- **Supervisory Control and Data Acquisition (SCADA) and Communications Equipment Enclosure**: SCADA refers to all communication and control components for the facility. The SCADA equipment for the solar facility will be mounted inside of an enclosure which measures approximately 24-feet long by 10.5-feet wide. The enclosure is affixed to a foundation or mounted on piles, depending on soil conditions. The SCADA system includes an internet router, server(s), a firewall, battery backup, and other hardware to monitor the solar facility.

4 DECOMMISSIONING PROCESS

Decommissioning consists of site preparation followed by the removal of above- and below-ground facility components, restoration of the ground surface and vegetation, and management of excess wastes and materials. The Project Area will be restored to reflect at least the pre-construction conditions or better.

Decommissioning activities are expected to take between six to eight months. Removal of all physical components will be done in accordance with applicable regulations at the time of decommissioning.

4.1 Site Preparation

Site preparation activities include installing erosion and sediment control best management practices (BMPs) and clearing on-site vegetation, where necessary. Prior to decommissioning, the site will be visually inspected to determine if vegetation clearance is needed to access equipment. Appropriate temporary construction-related erosion and sedimentation control BMPs will be employed during the decommissioning phase of the Project. The BMPs will be regularly inspected to ensure proper erosion and sediment control during the decommissioning effort.

4.2 Equipment Removal

After the facility has been disconnected and isolated from the utility power grid and all electrical components have been disconnected within the facility, equipment will be dismantled and removed. Decommissioning will be undertaken by licensed subcontractors using similar techniques and equipment to those used in the construction of the Project.

Primary equipment and materials to be removed as part of decommissioning are included in the following Table 1.

Table 1: Primary Equipment to be Removed

Component	Quantity
Solar Modules (JKM540M-72HL4-TV)	107,892 ea
Steel Trackers (SOLTEC SF7 BIFACIAL)	1,998 ea
Steel Piles	10,000 ea
Inverters and Foundations	36 ea
Transformers and Foundations	14 ea
Substation and Foundation	1 ea
Access Road	20,380 LF
Perimeter Fence	35,630 LF

Equipment removal of primary components is described further in the following subsections:

Disassembly and Removal of Solar Modules: Removal of approximately 107,892 solar modules will be completed manually. The module components will be mechanically disconnected from the solar array and transferred to a staging location prior to transportation to an offsite facility. Panels suitable for reuse will be sold for market value and panels not suitable for reuse will be processed at an offsite facility for recycling in accordance with local and State requirements. The Project will use silicon-based solar PV modules. The modules will be electrically and mechanically disconnected from the solar array and packaged for shipment per manufacturer's requirements.

Disassembly and Removal of Tracking System: The racking structure consists of approximately 1,998 steel trackers with an assembly that is assumed per the manufacturer's design specifications to include

6 piles per rack. These materials can be recycled and/or reused. Disassembly and removal of the racking structure will be performed manually.

Removal of Steel Piles/Posts: Piles will be included in the racking assemblies at an assumed rate of 6 piles per racking assembly. Steel piles will be completely removed by hoisting with a piece of heavy equipment. Steel piles are assumed to be 20 feet, driven to a depth of up to 14 feet below ground surface (bgs). Steel components will be segregated and transferred to a staging location for offsite recycling.

Removal of Inverters and Transformers: Thirty-six inverters,14 transformers, and associated concrete foundations will be removed from bases and transferred to a staging location for offsite disposal or recycling at an approved facility. The concrete foundations will also be removed and recycled.

Generation Tie-Line Cables: All above ground cables will be removed and transported off-site to an approved recycling facility or landfill. Underground cable runs will be removed in their entirety. Removed cable will be recycled or taken to a landfill as appropriate.

Removal of Substation: The substation will be mechanically disassembled with the use of support equipment for hoisting components. Steel will be sorted for offsite recycling or sold for scrap. The substation site restoration will include the removal of the gravel and concrete foundation, soil preparation, grading, and seeding.

Equipment Foundations: The inverter units and pile-driven support structures for the solar arrays will have foundations that require removal. Other underground infrastructure requiring removal may include concrete protective electrical structures. Any foundation structures and belowground concrete will be removed from the ground and the affected area will be backfilled as necessary with native soil.

Below-ground Electrical Cables: Electrical cabling is typically installed underground or in aboveground cable trays or attached to the module racking structure. It is assumed that all cabling and conduits will be installed at a minimum depth of four feet bgs, which will remain in place. Associated electrical cabling will be removed from the conduit, if practicable. Remaining conduit will be capped or filled with a finely graded aggregate.

Access Road Excavation and Removal: Landowners will be consulted to determine if any access roads are desired to remain in place for future use. Should roads be removed, all aggregate and other underlying materials will be excavated. As necessary, all compacted areas will be disc-ed or tilled to restore soil densities consistent with the surrounding area. Topsoil will be distributed to provide substantially similar growing media as was present within the areas prior to site disturbance, and this area will be seeded. The project includes an estimated 20,380 linear feet of access roads. Gravel associated with the access roads will be stockpiled for recycling or reuse.

Perimeter Fence Removal: Approximately 35,630 linear feet of steel fencing will be removed from the site. Gates will be removed as whole units and welded wire fabric will be cut to manageable sized pieces and staged. Fencing will be assessed prior to dismantling to determine if the fencing can be stored and reused on other construction sites. If reuse is not deemed practical, the fencing will be dismantled and recycled or sold for scrap.

4.3 Site Restoration

The current Project Area is primarily used for silviculture and agriculture. After decommissioning the solar facility, the site will be returned to its preconstruction state. Restoration activities include removal of access roads (if desired by landowner), backfill and grading of soil, soil decompaction, and native seeding. Soil will be graded to match surrounding topography and to allow for positive drainage. If soil compression from equipment use is visually observed, the impacted soil will be tilled. Bare soil will be seeded with an appropriate seed mixture for revegetation.

4.4 Managing Excess Materials and Waste

A variety of excess materials and wastes will be generated during decommissioning. To the extent practicable, Pine Grove Solar, LLC, will coordinate with manufacturers, contractors, waste firms, and other entities to maximize the reuse and/or recycling of materials. Those materials deemed reusable/recyclable will be transported offsite and managed at approved receiving facilities following all applicable federal, state, and county waste management regulations at the time of decommissioning.

All residual waste will be removed by a licensed contractor and transported to an approved landfill. No waste materials will remain on the Project site.

The following main waste streams will be generated from decommissioning the solar facility:

PV Panels: Pine Grove Solar, LLC, will coordinate the collection and reuse and/or recycling of the PV modules and will endeavor to minimize the potential for modules to be discarded. If there is no possibility for reuse, PV panels will either be returned to the manufacturer for appropriate recycling/disposal or will be transported to a recycling facility where the glass, metal and semiconductor will be recycled. Best management practices at the time of decommissioning will be utilized.

Racking and Supports: All steel racks and pile-driven supports will be transported offsite and recycled at an approved recycling facility.

Inverters: All metal components of the inverters will be recycled at an approved recycling facility to the extent practicable. Transformers will be transported off-site for reuse. If no reuse option is available, transformers will be recycled or disposed of at an approved facility.

Gravel and Aggregates: Should access roads be removed, gravel and/or aggregates will be tested for contamination prior to removal. All uncontaminated materials will be transported offsite for salvage processing and then reused for construction fill. In the unlikely event that the used gravel or aggregates are found to be contaminated, these will be disposed at an approved facility.

Concrete: All concrete, including all foundations, will be broken up, removed and transported to an approved landfill or recycling facility.

Cables and Wiring: Copper and/or aluminum wiring and associated electronic equipment (e.g., isolation switches, fuses, metering) will be recycled, to the extent practical. Any materials not deemed recyclable will be disposed of at an approved landfill.

Fencing: Fencing materials will be recycled at a metal recycling facility, to the extent practical.

Debris and Residual Waste: Any remaining debris or residual waste will be collected, and all recyclable materials will be sorted. All sorted materials will be removed and sent to either an approved recycling or disposal facility.

Ferrous metal scrap has been included in the estimate and is assumed to be generated primarily from steel piles, fence, and racking structure. Additional steel sources include conduit, substation components, and storage containers. It is assumed storage containers will be reused on other projects. Steel will be accumulated in the staging area and salvaged for market value or recycled.

Approximately 1,844 cubic yards of concrete will be generated from building and equipment foundations. Concrete will be broken into manageably sized pieces and staged for offsite recycling or disposal.
Used equipment, including inverters and transformers, will be sold for market value or recycled. Prior to offsite recycling of transformers, oil will be removed from units, collected in appropriate containers, and transported to an approved recycling facility.

Gravel generated by the removal of project access roads will be stockpiled and loaded for recycling or reuse elsewhere. It is assumed gravel will be used on another project and transportation will be managed by others locally.

General construction and demolition debris are anticipated to be generated as part of decommissioning. Construction and demolition debris will be disposed at an approved offsite disposal facility.

5 SIGNATURE OF ENGINEERING PROFESSIONAL

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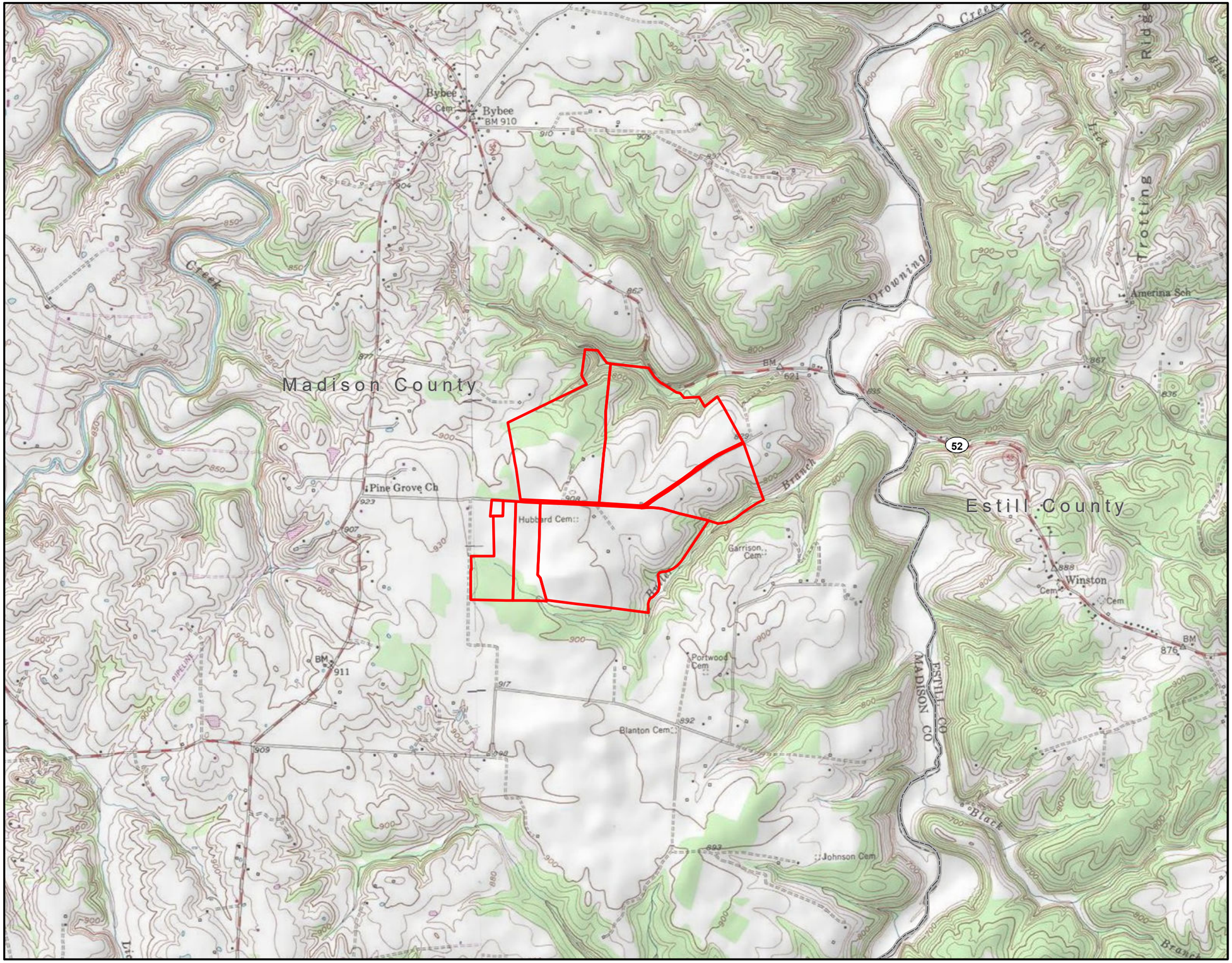
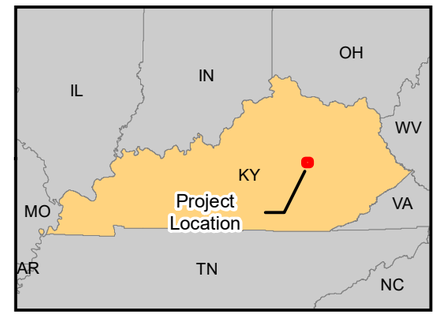
Kim Pinkston, P.E.
Project Engineer

APPENDIX A
FIGURE 1



Legend

- Subject Property
- County



N

0 1,000 2,000 4,000 Feet

Figure 1. Project Vicinity Map

Prepared For: Pine Grove Solar

Prepared By: TETRA TECH

Date: 01/2022

Source: Esri, et. al., 2021

Coordinate System: NAD 1983 StatePlane Kentucky South FIPS 1602 Feet, Foot US
Datum: North American 1983

Not for Construction

APPENDIX B
DECOMMISSIONING COST ESTIMATE

DECOMMISSIONING COST ESTIMATE

This decommissioning cost estimate was developed based on 2022 Quarter 4 cost data. Actual costs and revenues will be dependent on salvage values and labor, equipment, and material cost at the time of decommissioning. Limited project design details were available during the preparation of this cost estimate due to the preliminary nature of the design as it advances through permitting and approval. Therefore, assumptions based on similarly sized solar projects have been included in this effort. The cost and salvage estimates and associated assumptions are summarized below in Tables A-1 and A-2.

Decommissioning Costs

Decommissioning costs include labor, equipment, and materials associated with decommissioning, as well as transportation and disposal costs for system components that are not sold for salvage. The major decommissioning activities include site preparation, equipment removal, site restoration, waste management, and overhead and management of these activities. Overhead and management costs include supervision and coordination, operating expenses for necessary equipment and facilities, and costs associated with obtaining preconstruction permits. These major activities are outlined in the table below and described further in the following subsections.

Costs for damages to public roads are not included in the decommissioning estimate. Transportation services requiring use of public roads would be performed by subcontractors. If the subcontractor causes damage to public roads as a result of their work on this project, they would be responsible for repair of any damages.

Table A-1. Estimated Decommissioning Costs[1]

Item	Extended Cost
Equipment & Facilities Mobilization / Demobilization	
Equipment Mobilization	$ 61,200
Site Facilities	$ 2,200
Crew Mobilization & Site Setup	$ 36,200
Project Site Support	$ 254,900
Crew Demobilization & Site Cleanup	$ 24,100
Subtotal	*$ 378,600*
Substation & Transmission Line Retirement	
Substation Disassembly	$ 175,700
Transmission Line Disassembly	$ 8,000
Subtotal	*$ 183,700*
Solar Array Retirement	
Fence Removal	$ 44,000
Inverter / Transformer Removal	$ 71,300
Remove Foundations to Subgrade	$ 36,300
Solar Panel Removal & Disposal	$ 689,700
Solar Rack (Trackers) & Post Removal	$ 545,400
Above Grade Cable Removal - Rack Mounted	$ 76,900
Subtotal	*$ 1,463,600*
Site Restoration - Partial Site Seeding	
Strip & Decompact Roads	$ 43,900
Spot Grade Disturbed Areas	$ 18,000
Re-Seed With Native Vegetation - Roads & Areas Disturbed By Construction	$ 33,500
Subtotal	*$ 95,400*
Contractor Markups	
Home Office, Project Management (5% Of Cost)	$ 106,100
Contractor OH & Fee (13% Of Cost)	$ 289,600
Subtotal	*$ 395,700*
Total Decommissioning Cost	**$ 2,517,000**

[1] Costs reflect values as of the fourth quarter 2022 and do not include assumptions with respect to escalation or discount rates.

Decommissioning Salvage Value

Upon decommissioning, many of the materials and components of the solar facility may be able to be sold for salvage/reuse. The total salvage value is estimated to be $423,000 as outlined below.

Table A-2. Estimated Decommissioning Salvage Value

Item	Extended Salvage
Equipment Salvage	
Steel Salvage	$ 378,000
Copper Salvage	$ 45,000
Total Salvage Value	**$ 423,000**

Decommissioning Cost Summary and Financial Assurance

The total decommissioning cost, including labor, materials, equipment, and disposal, is estimated to be $2,517,000 while the total salvage value is estimated to be $423,000. Therefore, the net decommissioning cost is $2,094,000.