

**EXHIBIT W**  
**RETIREMENT AND RESTORATION**  
OAR 345-021-0010(1)(w)

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**ATTACHMENTS**

W-1	Madras Solar Energy Facility Retirement and Restoration Cost Estimate—No Battery Storage
W-2	Madras Solar Energy Facility Retirement and Restoration Cost Estimate—Maximum Battery Storage

**OAR 345-021-0010(1)(w)** *Information about site restoration, providing evidence to support a finding by the Council as required by OAR 345-022-0050(1). The applicant shall include:*

## W.1 USEFUL LIFE

**OAR 345-021-0010(1)(w)(A)** *The estimated useful life of the proposed facility.*

**Response:** The estimated useful life of the proposed Madras Solar Energy Facility (Facility) is 40 years. However, the Facility may operate for as long as there is a market for the production of electrical energy. Facility upgrades may be implemented to prolong operation well beyond 40 years.

Madras PV1, LLC (Applicant) plans to secure a Power Purchase Agreement to sell the energy and environmental attributes from the Facility to a reputable entity. The Applicant will use the Power Purchase Agreement to secure financing for Facility construction.

## W.2 RETIREMENT AND RESTORATION ACTIONS

**OAR 345-021-0010(1)(w)(B)** *Specific actions and tasks to restore the site to a useful, non-hazardous condition.*

**Response:** The Facility will be constructed largely with recyclable, salvageable, or reusable materials consisting of steel, aluminum, concrete, solar modules, electrical cables and wires, as well as specialized pieces of electrical equipment, including large transformers and lithium-ion batteries or flow batteries. The site will feature steel fencing along its perimeter and gravel placed on access road segments and in the substation and laydown areas. When the Facility reaches the end of its operational life, the components will be disassembled, and component materials will be disposed of based on their demand as scrap, depending on the material composition and market for recyclables at that time. Retirement and restoration will be accomplished using conventional construction equipment with the objective of maximizing the recycling of materials and minimizing the amount of waste to be disposed of. Materials with known demand for scrap (solar panels, large electrical transformers, and battery units) will be staged at an onsite laydown area or loaded to the recycler's trucks, at which time the recycler takes title and is responsible for shipping costs in exchange for the salvage value of the materials. The main stages of the retirement and restoration process are as follows:

- 1) Assess existing site conditions and prepare the Facility site for retirement and restoration. Maintain internal service roads and access roads, fencing, and electrical power in place for use by the retirement and restoration workers until no longer needed. Obtain all necessary permits, and disconnect the Portland General Electric transmission line before mobilization of crews, field office, and equipment. Conduct safety, training, and project orientations with work crews.
- 2) Remove solar panels from trackers and load onto recycler's trucks. Remove steel trackers from posts, extract steel posts, and stage for recycling from site. Disconnect electrical equipment from underground cables. Maintain the underground cables in place except where they surface, then cut and remove to 3 feet below grade and transport to Jefferson County Transfer Station (JCTS). Stage large transformers, drained of oil, and stage lithium-ion battery units onsite or load onto scrap recycler trucks Free On Board (FOB).<sup>1</sup> Truck substation electrical equipment and inverters to JCTS (recycling decision by JCTS). Remove concrete equipment foundations to a minimum depth of 3 feet and truck to the county transfer station.
- 3) Remove internal gravel access road segments and gravel from substation and laydown yards. This will result in stockpiling of reusable gravel onsite for loading by recycler/reuser. Stage steel fences and gates onsite and load onto scrap recycler trucks. Stage copper cable from substation grounding grid onsite for recycler.

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<sup>1</sup> The term "Free On Board" indicates the transfer of title from seller to buyer at a specific point in time and place.

- 4) Restore the original grading minimally and revegetate with plants or plant seed mix consistent with the landowner's needs and the Facility's *Noxious Weed Control Plan* (Exhibit P, Attachment P-7).

### W.3 RETIREMENT AND RESTORATION COST ESTIMATE

**OAR 345-021-0010(1)(w)(C)** *An estimate, in current dollars, of the total and unit costs of restoring the site to a useful, non-hazardous condition.*

**Response:** Attachment W-1 provides a detailed cost estimate for retirement and restoration of the Facility without battery storage (see Exhibit C, Figure C-2A) and Attachment W-2 provides a detailed cost estimate for retirement and restoration of the Facility with maximum battery storage (see Exhibit C, Figure C-2B). The estimated costs, in fourth quarter 2019 dollars, are approximately \$3.98 million for the Facility without battery storage and \$4.1 million for the Facility with maximum battery storage. Both estimated costs include 10 percent contingency.

The Applicant notes that the description in row 4 of the "Summary" column in Attachment W-2 is "PCS – Battery Location" to make explicit that the PCS location may include battery storage. The same description is included in rows 9 through 15 of the Component/Location column in the "Calculations" Excel sheet submitted separately to the Oregon Department of Energy.

**OAR 345-021-0010(1)(w)(D)** *A discussion and justification of the methods and assumptions used to estimate site restoration costs.*

**Response:** The Applicant made the following assumptions to estimate site restoration costs:

- Each major component of the Facility is broken down to an item or operation level and estimated for hourly crew production rates for disassembly, loading onto truck or staging on site, and trucking to local transfer station, as applicable. Each crew cost is derived from fully burdened labor costs (wages, benefits, payroll taxes, insurances, and small tools) and equipment costs (derived from published hourly operating costs including rent, fuels, oil, maintenance, and wearable parts), which are also factored for additional rent based on percent of time idle. Each component breakdown is summarized for cost by the three major operational divisions: disassembly, loading, and trucking. Additional costs for disposal (also known as tipping) fees, permits, disconnects, mobilizations, site reclamation, regulations, management, site indirect costs, overhead, profit, and contingency are then added for a project total cost.
- Labor wages and benefits costs are based on prevailing wage determination in effect as of June 14, 2019, for Jefferson County, Oregon. Payroll taxes are based on 12 percent of wages.
- JCTS disposal fee is \$110 per ton delivered to JCTS, and the estimate assumes 5,050 tons will be so disposed.
- The estimate assumes no salvage value recovery for the 22,719 tons of material to be disposed of by way of recycling. This material is valued at approximately \$4 to \$10 million, depending on final battery storage configuration, using values provided by <http://www.scrapregister.com>, accessed August 9, 2019, less costs to ship and process for recycling. The solar panels are known to be of value to We Recycle Solar, 4742 N. 24th Street, Suite 300 Phoenix, AZ 85016, phone (480) 482-7050. Discussions with We Recycle Solar reveal the economics of solar panel recycling support shipping costs paid by recycler.
- All recyclable steel (equipment, structures, and fencing), copper, aluminum, large transformers, and battery units, and all reusable gravel, are disposed of by way of providing materials FOB free of charge with loading to recycler trucks.
- All concrete and substation electrical equipment (other than transformers) is trucked to JCTS for a recycling decision and disposed of by JCTS and their recycling partners.
- Miscellaneous mixed waste and operational oils, fluids, and parts are taken to JCTS for disposal, hazardous waste processing, or recycling where feasible.
- Underground material below 3 feet will be left in place. This will include underground cables, concrete foundations for the solar module posts, and a portion of the posts themselves.

- Transformer insulating oils will be removed by a subcontractor and disposed of legally.
- Bare ground portions will be seeded in accordance with the *Revegetation Plan* and *Noxious Weed Control Plan* (Exhibit P, Attachments P-6 and P-7, respectively) once retirement and restoration are complete. Site grading will not be required prior to seeding. During Facility operations, noxious weeds will be controlled to promote establishment of native vegetation. During Facility retirement and restoration, care will be taken to minimize the disturbance to existing vegetation. To be conservative, this estimate assumes that the entire area occupied by the solar modules (approximately 300 acres) will be reseeded (or likely overseeded).
- The operations and maintenance enclosure will be removed, and the surrounding graveled areas, service roads, and access road will be removed, regraded, and reseeded as part of retirement and restoration activities. During retirement and restoration of the module blocks, the internal service roads and access road will be used to minimize the disturbance to the surrounding areas.
- Total salvage value of Facility materials is referenced but is not included as an offset to the estimate total. Although the salvage value of Facility materials is not included, it should be considered if the Energy Facility Siting Council policy or rules change to allow credit for these values.
- The estimate includes a 10 percent contingency allowance.

#### W.4 MONITORING PLAN

**OAR 345-021-0010(1)(w)(E)** *For facilities that might produce site contamination by hazardous materials, a proposed monitoring plan, such as periodic environmental site assessment and reporting, or an explanation why a monitoring plan is unnecessary.*

**Response:** The Facility is not expected to cause site contamination by hazardous materials, and therefore no monitoring plan is proposed or required. Hazardous materials used for Facility maintenance will be removed to JCTS and transformer oils will be pumped for legal disposal before removing the transformers. The restoration contractor will employ environmental controls to mitigate any leakage of lubricants or fuels from trucks and heavy equipment.

**Attachment W-1**  
**Madras Solar Energy Facility Retirement**  
**and Restoration Cost Estimate—No**  
**Battery Storage**

Summary	Quantity	Unit	Disassembly	Loading	Trucking	Total Cost	Cost per Unit
Solar PV Module	177,498	panel	169,737	148,813	-	\$318,549	\$1.79 panel
Tracker	576,490	LF	962,571	181,791	62,275	\$1,206,636	\$2.09 LF
PCS location	19	location	17,260	78,983	36,398	\$132,641	\$6,981 location
UG Cable	56	tail	12,852	351	289	\$13,492	\$241 tail
POI Station	1	location	4,819	5,704	918	\$11,442	\$11,442 location
Substation	1	location	21,657	31,044	7,698	\$60,399	\$60,399 location
Sub-230kV side	1	location	1,133	4,629	-	\$5,762	\$5,762 location
Sub-35kV side	1	location	4,531	17,417	1,521	\$23,469	\$23,469 location
O&M Enclosure	1	ea	-	-	-	\$0	\$0 ea
Staging/Laydown	1	location	-	3,354	1,350	\$4,704	\$4,704 location
Perimeter Fence	28,681	LF	38,678	58,017	14,024	\$110,719	\$3.86 LF
Roads	3,564	SY	-	12,286	4,531	\$16,817	\$4.72 SY
Stored Materials	1	ls	-	201	559	\$760	\$760 ls
Tipping Fees	5,050	tons	-	-	-	\$555,930	\$110 ton
Site Reclamation	400	ac	-	-	-	\$80,000	\$200 ac
Utility disconnect	1	ea	-	-	-	\$5,000	\$5,000 ea
Surveys	1	ls	-	-	-	\$25,000	\$25,000 ls
Environmental	1	ls	-	-	-	\$50,000	\$50,000 ls
Safety	1	ls	-	-	-	\$25,000	\$25,000 ls
OSHA sanitary	1	ls	-	-	-	\$50,000	\$50,000 ls
Field Office	10	mo	-	-	-	\$12,500	\$1,250 mo
Proj Mgmt	10	mo	-	-	-	\$125,000	\$12,500 mo
Mobilization	1	ls	-	-	-	\$200,000	\$200,000 ls
Demobilization	1	ls	-	-	-	\$150,000	\$150,000 ls
Contingency	10	pct	123,324	54,259	12,956	318,382	
OH & Profit	15	pct	184,986	81,389	19,434	477,573	
<b>Total</b>			<b>1,541,546</b>	<b>678,239</b>	<b>161,954</b>	<b>\$3,979,776</b>	

Summary	Tonnage Taken to JCTS			Tonnage staged/loaded for Scrap Buyers				
	Disposal Tons	Rate	Tipping Fee	Recyclable	Salvage Tons	Scrap Value/Ton	Salvage Amt	Net
Silicon/Al	-	\$110	-	yes	4,438	100	443,758	100%
Ins Wire	0.6	\$110	65	yes	-	-	-	-
Steel	7.5	\$110	825	yes	8,370	320	2,544,455	95%
Concrete	4,935	\$110	542,850	some	-	-	-	-
Elec Equip	104	\$110	11,440	after process	-	-	-	-
XFMR	-	-	-	yes	178	1,056	187,440	100%
BTTY	-	-	-	yes	15	3,046	28,709	65%
Gravel	-	-	-	reuse	4,032	-	-	-
Copper	-	-	-	yes	10.6	6,420	61,391	90%
Aluminum	-	-	-	yes	0.5	1,136	511	90%
Mixed	3.0	\$250	750	no	-	-	-	-
	<b>5,050</b>		<b>555,930</b>		<b>17,043</b>	<b>192</b>	<b>3,266,264</b>	

**Attachment W-2**  
**Madras Solar Energy Facility Retirement**  
**and Restoration Cost Estimate—Maximum**  
**Battery Storage**

Summary	Quantity	Unit	Disassembly	Loading	Trucking	Total Cost	Cost per Unit
Solar PV Module	175,446	panel	167,774	147,092	-	\$314,867	\$1.79 panel
Tracker	569,980	LF	961,624	180,861	61,889	\$1,204,374	\$2.11 LF
PCS - Battery Location	19	location	32,362	158,459	36,398	\$227,219	\$11,959 location
UG Cable	56	tail	12,852	351	289	\$13,492	\$241 tail
POI Station	1	location	4,819	5,704	918	\$11,442	\$11,442 location
Substation	1	location	21,657	31,044	7,698	\$60,399	\$60,399 location
Sub-230kV side	1	location	1,133	4,629	-	\$5,762	\$5,762 location
Sub-35kV side	1	location	4,531	17,417	1,521	\$23,469	\$23,469 location
O&M Enclosure	1	ea	-	-	-	\$0	\$0 ea
Staging/Laydown	1	location	-	3,354	1,350	\$4,704	\$4,704 location
Perimeter Fence	28,681	LF	38,678	58,017	14,024	\$110,719	\$3.86 LF
Roads	3,564	SY	-	12,286	4,531	\$16,817	\$4.72 SY
Stored Materials	1	ls	-	201	559	\$760	\$760 ls
Tipping Fees	5,050	tons	-	-	-	\$555,930	\$110 ton
Site Reclamation	400	ac	-	-	-	\$80,000	\$200 ac
Utility disconnect	1	ea	-	-	-	\$5,000	\$5,000 ea
Surveys	1	ls	-	-	-	\$25,000	\$25,000 ls
Environmental	1	ls	-	-	-	\$50,000	\$50,000 ls
Safety	1	ls	-	-	-	\$25,000	\$25,000 ls
OSHA sanitary	1	ls	-	-	-	\$50,000	\$50,000 ls
Field Office	10	mo	-	-	-	\$12,500	\$1,250 mo
Proj Mgmt	10	mo	-	-	-	\$125,000	\$12,500 mo
Mobilization	1	ls	-	-	-	\$200,000	\$200,000 ls
Demobilization	1	ls	-	-	-	\$150,000	\$150,000 ls
Contingency	10	pct	124,543	61,942	12,918	327,245	
OH & Profit	15	pct	186,815	92,912	19,377	490,868	
<b>Total</b>			<b>1,556,788</b>	<b>774,270</b>	<b>161,472</b>	<b>\$4,090,567</b>	

Summary	Tonnage Taken to JCTS			Tonnage staged/loaded for Scrap Buyers				
	Disposal Tons	Rate	Tipping Fee	Recyclable	Salvage Tons	Scrap Value/Ton	Salvage Amt	Net
Silicon/Al	-	\$110	-	yes	4,387	100	438,669	100%
Ins Wire	0.6	\$110	65	yes	-	-	-	-
Steel	7.5	\$110	825	yes	8,305	320	2,524,665	95%
Concrete	4,935	\$110	542,850	some	-	-	-	-
Elec Equip	104	\$110	11,440	after process	-	-	-	-
XFMR	-	-	-	yes	178	1,056	187,440	100%
BTTY	-	-	-	yes	2,755	3,046	5,453,635	65%
Gravel	-	-	-	reuse	4,032	-	-	-
Copper	-	-	-	yes	10.6	6,420	61,391	90%
Aluminum	-	-	-	yes	0.5	1,136	511	90%
Mixed	3.0	\$250	750	no	-	-	-	-
	<b>5,050</b>		<b>555,930</b>		<b>19,667</b>	<b>441</b>	<b>8,666,310</b>	