Site Location
Address:
City:
Zip Code:
County:

OREGON DEPARTMENT OF ENERGY

Oregon Business Energy Tax Credit

Solar Photovoltaic

Appendix No. 3 to Preliminary Certification Application

This appendix is for facilities using or producing renewable energy resources and is for solar photovoltaic systems only. If the facility contains additional conservation measures, they should be applied for separately using the appropriate application. For a solar photovoltaic facility to be eligible to receive a BETC, all qualifying installations must meet the minimum facility specifications described in OAR 330-090-0110(26)(e) and all other applicable rules.

1. System Description

►Attach the following additional information: □ Technical data sheet(s) for PV module(s).

a. System Type

	type modifier
□ **DC,** a pump or other direct current application, no battery storage	1.0
□ **Grid**, utility interactive system without battery backup	1.0
□ **Grid with Battery Backup**, utility interactive system that includes battery backup	0.9
□ **Off-Grid**, Remote or non-utility connected application with battery storage	0.8

b. PV Array(s)

Total array rated power: $Watts_{Total}$_____ Watts DC at Standard Test Conditions (STC)
where, $Watts_{Total} = Watts_1 + Watts_2 + Watts_3 + Watts_4 + \ldots$

Sub Array 1
Rated power ($Watts_1$): _____ Watts DC at STC
Number of modules: _____ Module output: _____ Watts DC at STC
Module warranty tolerance: _____ % (enter the +/- rating of the module @ STC)
Module manufacturer: _____ Module model: _____
Inverter manufacturer: _____ Inverter model: _____

Sub Array 2
Rated power ($Watts_2$): _____ Watts DC at STC
Number of modules: _____ Module output: _____ Watts DC at STC
Module warranty tolerance:_____ % (enter the +/- rating of the module @ STC)
Module manufacturer: _____ Module model: _____
Inverter manufacturer: _____ Inverter model: _____

Sub Array 3
Rated power ($Watts_3$): _____ Watts DC at STC
Number of modules: _____ Module output: _____ Watts DC at STC
Module warranty tolerance: _____ % (enter the +/- rating of the module @ STC)
Module manufacturer: _____ Module model: _____
Inverter manufacturer: _____ Inverter model: _____

c. Mounting

	annual output modifier
□ **1-Axis**, single axis tracking system	1.20
□ **2-Axis**, dual axis tracking system	1.25
□ **BIPV**, building integrated system, fixed axis	1.00
□ **Ground**, ground mount, fixed axis	1.00
□ **Roof**, rack mounted	1.00
□ **Other**, _____ Specify System Type	0.90

2. Site Assessment Conduct Site Survey

►Attach the following additional information:

- Sun charts used to determine Total Solar Resource Fraction (TSRF) of array(s) sub arrays or the report from site assessment tool. (i.e. solar pathfinder, solmetric suneye or other industry accepted tools)

Use one or more sun charts for each sub-array. Sun charts must be taken from a location on the array which best characterizes the annual shading impact. Shading of PV modules is very sensitive to shading so evaluate the worst case location on each sub array. Facilities must have a TSRF greater than 75% to be eligible for a tax credit.

a. Site Diagram

Draw or attach simple plan view of site/buildings/trees that shows where the array will be located.

b. Total Solar Resource Fraction (TSRF)

Tilt is the collector tilt from horizontal. Orientation is the direction the sub array faces where 180 equals true south. The Tilt and Orientation Factor (TOF) is taken from the Oregon Department of Energy or Energy Trust of Oregon PV sun charts. The Shading Fraction lost annual due to external shading. The system TSRF is the power weighted average TSRF of each sub array as calculated below.

$TSRF = (Watts_1 \times TSRF_1 + Watts_2 \times TSRF_2 + Watts_3 \times TSRF_3 + Watts_4 \times TSRF_4) \div Watts_{Total}$

= _____

Sub Array 1

Tilt: _____° Orientation: _____° TOF: _____° Shading: _____

$TSRF_1$ = TOF x (1 – Shading Fraction) = _____

Sub Array 2

Tilt: _____° Orientation: _____° TOF: _____° Shading: _____

$TSRF_1$ = TOF x (1 – Shading Fraction) = _____

Sub Array 3

Tilt: _____° Orientation: _____° TOF: _____° Shading: _____

$TSRF_1$ = TOF x (1 – Shading Fraction) = _____

Sub Array 4

Tilt: _____° Orientation: _____° TOF: _____° Shading: _____

$TSRF_1$ = TOF x (1 – Shading Fraction) = _____

3. Estimated Annual Energy Production

a. Solar Resource

Choose the city with the most similar solar resource (kWh/yr-W)

		Solar Resource
□	**Astoria**, Seaside, Cannon Beach, Warrenton	1.03
□	**Burns**, John Day, Canyon City, Hines	1.39
□	**Eugene**, Roseburg, Springfield, Sweet Home	1.14
□	**Medford**, Klamath Falls, Grant's Pass, Ashland	1.32
□	**North Bend**, Coos Bay, Coquille, Bandon	1.26
□	**Pendleton**, Enterprise, La Grande	1.31
□	**Portland**, Hood River, Hillsboro, Oregon City	1.08
□	**Redmond**, Bend, Prineville, Madras, Lakeview	1.43
□	**Salem**, Lincoln City, Corvallis, Silverton	1.14

b. Estimated annual energy produced by entire array:

Total rated output ($Watt_{Total}$, from 1b) = _____

Total Solar Resource Fraction (TSRF, from 2b) = x _____[1]

System Type Modifier (from 1a) = x _____

Mounting Type Modifier (from 1c) = x _____

Solar Resource (from 3a) = x _____

3b. Annual useful energy produced = _____ kWh/yr

4. Energy use without Facility (for building or entire facility)

Gather this information from historical energy bills. If the facility is new construction, then estimate the energy use that would have been present without the PV array.

a. Energy use for the past 12 months:

Electricity = _____ kWh/yr

Other (enter units) _____ x _____ = _____ kWh/yr

4a. Total Energy Use = _____ kWh/yr

b. Total Energy use for the past 12 months (4a) x 0.003413 = _____ MMBtu/yr

c. Utilities (Electric, Gas, Oil, Other):

d. Fraction of electrical energy supplied by PV system (3b ÷ 4a) = _____ %

[1] Express TSRF as a fraction (e.g. 88% = 0.88)

5. Onsite Energy Savings
Complete this section if you are using the energy created onsite; calculate the savings per **year** using the table.

Fuel type	5a. Conventional energy use displaced	5b. Fuel cost per unit	5c. Cost savings (5a x 5b)
Electricity	kWh	$	$
Other:		$	$
		5d. Total	$

6. Energy sales
Complete this section if you are selling the energy created; calculate the revenue per year using the table.

6a. Is a energy sales contract: Under negotiation? ☐ Yes ☐ No

Completed? ☐ Yes ☐ No

6b. Name of utility or energy service supplier you will sell energy to?

6c. List expected sales revenue for power generation sold to the utility or energy service provider below or attach a copy of your Energy Purchase Agreement.

Year	Annual kwh	$ per kwh rate	= Sales revenue
1		X	=
2		X	=
3		X	=
4		X	=
5		X	=
6		X	=
7		X	=
8		X	=
9		X	=
10		X	=
11		X	=
12		X	=
13		X	=
14		X	=
15		X	=
16		X	=
17		X	=
18		X	=
19		X	=
20		X	=
Total energy revenue for 20 years:			$

7. Estimated Facility Cost	
Materials:	**Estimated cost:**
Labor:	**Estimated cost:**
Engineering:	**Estimated cost:**
Other: (Do not include Business Energy Tax Credit review costs.)	**Estimated cost:**
a. Total of Estimated Costs from above:	**7a. $**
b. Deduct any federal grants: **Note: OAR 330-090-0110(20)(l)** The sum of any rebates or cash payments under ORS 469.631 to 469.645, 469.649 to 469.659, 469.673 to 469.683, or 757.612(5)(a), or from a public purpose organization and the Business Energy Tax Credit may not exceed eligible costs.	**7b. $**
c. Facility Owner's Estimated Facility Cost Take 7a and subtract 7b to get the Estimated Facility Cost	**7c. $**

8. Estimated Facility Cost The Estimated Facility Cost is the lesser of the Maximum Eligible Cost and the Owner's Estimated Facility Cost. The Maximum Eligible Cost is calculated using a spreadsheet that can be downloaded from the Oregon Department of Energy Web site. The Maximum Eligible Cost will decline as more systems are granted preliminary certifications. Applicants should use the spreadsheet on line to ensure they are using the most recent version.

8a. Is this going to be placed on/serve a publicly owned facility (Yes/No)?

8b. Maximum Eligible Cost (calculated from MEC spreadsheet): $ .00

8c. Estimated Facility Cost (lesser of 7c and 8b): $ .00

9. Facility Incentives			
	Amount	Secured: Yes or No	
Federal Business Energy Investment Tax Credit (ITC) Indicate how you are taking this incentive, if not checked ODOE will assume you are taking it as a grant and deduct it from your costs	$		☐ Taking as a Tax Credit (do not deduct from estimated cost) ☐ Taking as a Grant (deduct from estimated costs 7b) ☐ Not Applicable
Other Federal Grants _____	$		Deduct all federal grants from estimated costs 7b
Other Federal Tax Credits _____	$		Do not deduct from estimated costs 7b
Energy Trust of Oregon	$		Do not deduct from estimated costs 7b
Utility Incentives _____	$		Do not deduct from estimated costs 7b
Other Incentives _____	$		Do not deduct from estimated costs 7b
a. Sub-total Incentives	9a. $	The sum of any rebates or cash payments under ORS 469.631 to 469.645, 469.649 to 469.659, 469.673 to 469.683, or 757.612(5)(a), or from a public purpose organization or federal grants or credits and the business energy tax credit may not exceed eligible project costs OAR 330-090-0110(20(l).	
b. Business Energy Tax Credit (BETC) Calculated (8c x 50%)	9b. $		
c. Total Incentives (9a+ 9b)	9c. $		

10. Oregon Business Energy Tax Credit Requested	
a. Do your Total Incentives (9c) exceed your Estimated Facility Cost (7a)?	☐ Yes, go to 10b ☐ No, go to 10d
If YES, you need to reduce your Business Energy Tax Credit, calculate:	
b. Amount Exceeded: Total Incentives – Estimated Facility Cost (9c – 7a)	10b $
c. Reduce your BETC by the Amount Exceeded (9b – 10b)	10c $
d. Maximum Eligible Business Energy Tax Credit (9b or if reduced 10c)	10d $
e. **Oregon Business Energy Tax Credit Requested** 10d or a lower amount chosen by applicant. An applicant may request less than their maximum eligible tax credit. If reduced, the lowered tax credit amount will be used when calculating other program priority scores and the applicant will receive points based on the lowered tax credit amount. The applicant shall not receive more than their requested amount. Please note that OAR 330-090-0350(3)(e) allows applicants to apply for less than the maximum eligible tax credit for their project, but this does not change the tier within which the application is reviewed.	10e $

11. Facility Leveraging

Leveraged = the facility owner will be responsible for the initial or later payment of these funds
Non-Leveraged = the facility owner will not be responsible for paying these funds back

	Amount	Secured: Yes or No	Type of Funds
Owner's funds	$		Leveraged
Loans (including SELP Loan)	$		Leveraged
Other funds (Leveraged) _____	$		Leveraged
Sub-Total Incentives (9a) Includes grants, tax credits, incentives	$		Non-Leveraged
Business Energy Tax Credit (10e)	$		Non-Leveraged
Other funds (Non-Leveraged) _____	$		Non-Leveraged
a. Total project cost	$	**The total should equal Section 7a**	

12. Simple payback period—Calculate how long the facility will take to pay for itself.

a. Total estimated facility cost (7a)	12a. $
b. Facility value. (Enter zero for any item below that does not apply to your facility.) 1. Cost savings per year (5d) $ 2. Total first **full** year fuel savings revenue, no escalation (6c) $	12b. $
c. Simple payback: total eligible facility cost(12a) ÷ total facility cost savings (12b)	years

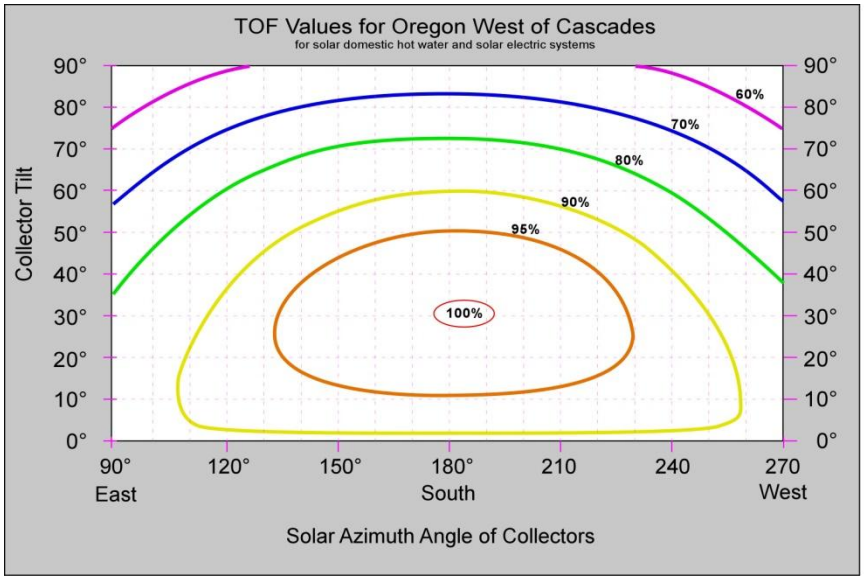
Solar Site Assessment

A tool for estimating the impact of collector tilt, orientation and shading

To estimate the performance of a solar energy system we need to know how much solar energy is available for your collector. This worksheet is used to estimate the impact of tilt, orientation and external shading on how much solar energy your solar collectors can collect. The Total Solar Resource Fraction (TSRF) represents the fraction of energy a particular collector would receive when compared to one in the same city, but that has optimal tilt, orientation and no external shading. For example, a collector with a TSRF of 80 percent indicates that 80 percent of the solar energy at your location over a year will be available to the solar collector.

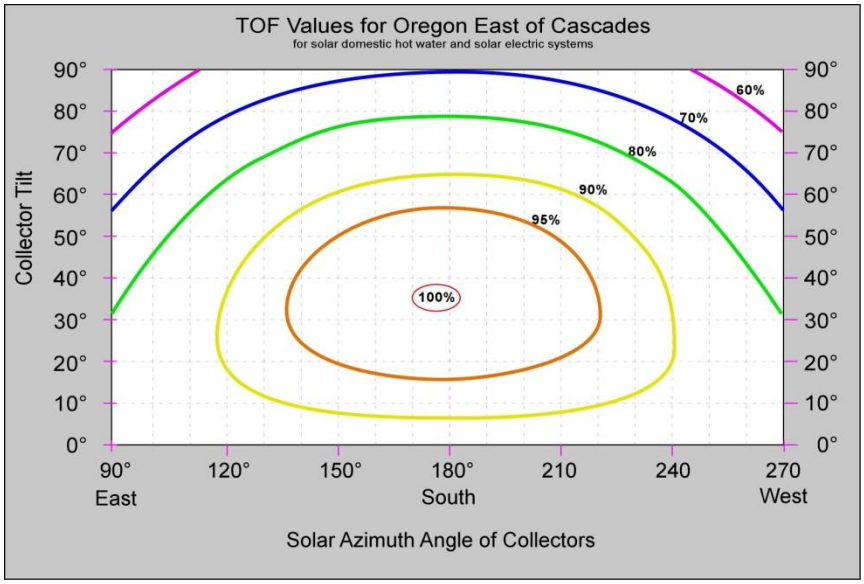
For simplicity we have separated calculating the TSRF into two parts. The first part is to determine the impact of collector tilt and orientation. This Tilt and Orientation Factor (TOF) is estimated using one of the following plots. The second part is to uses a sun chart to estimate how much energy is lost on an annual basis from external shading from plants, buildings or other obstructions. The combination of these two effects will provide your collector's TSRF.

TOF graphs (right) show the impact of tilt, and orientation on annual performance of a solar collector. TOF values range from 100% (no loss) at the center of the inner circle to less than 60% (40% or more loss) in the upper left and right corners.



Azimuth angles are based on true polar orientation, adjusted for magnetic declination (16-20 degrees for most of Oregon)

Use the upper graph if your system is installed West of the Cascades. Use the lower graph if your system is installed East of the Cascades.



Draw a dark X mark the graph for your collector's tilt and azimuth angle. Interpolate between the nearest two lines to estimate the TOF value to the nearest 1%.

Collector Tilt = _____ °
(angle from horizontal)

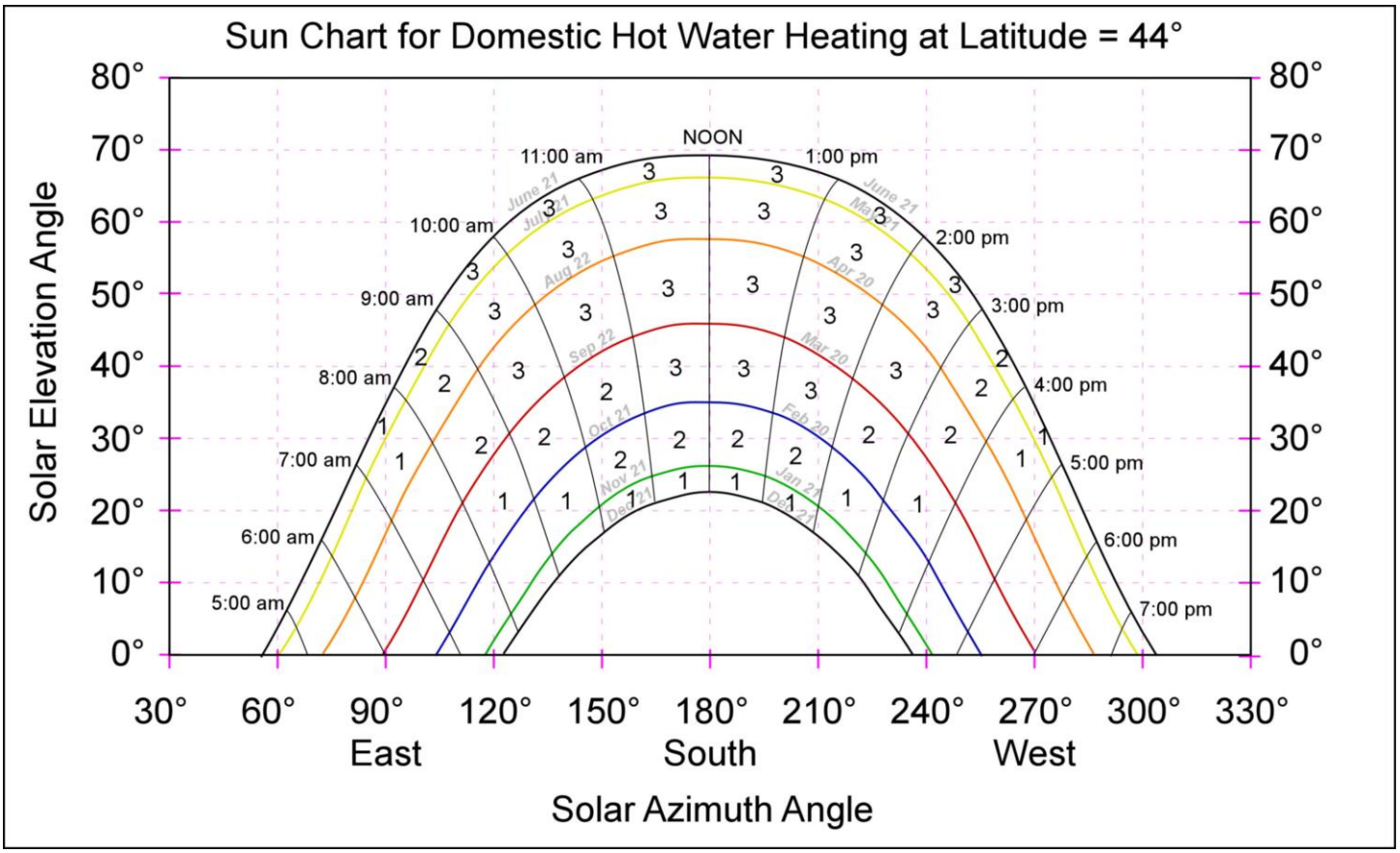
Solar Azimuth =_____ °
(collector orientation)

TOF = _____ %
(estimated from graph)

Sun Chart

For solar water heating and solar electric systems

Step 1 – From the midpoint of the solar array, draw the skyline on the graph below. Use the elevation angles and solar azimuth angles to determine the location of the obstructions. A solar site assessment tool such as the Pathfinder™ or Solmetric Suneye is recommended for increased accuracy. Energy Trust of Oregon sun charts can be used in lieu of the sun chart below. Draw deciduous trees with a dotted outline and fill with light shading. Year-round obstructions like buildings, or evergreen trees should be drawn with solid outlines and filled with heavy shading.



Step 2 – Add up the solar fraction numbers in the sections that have shading. For solar electric systems, partial shading in one section must be counted fully (no fractional amounts). Any deciduous tree shading below the Sept 22/March 20 line can be counted at half value to account for the fact that some light will get through these obstructions when the trees lose their leaves. This sum of all these values divided by 100 is the "Shading Fraction". It represents the percent of energy lost to external shading.

Shading Fraction = sum of obstructed areas ÷ 100 = _____

Step 3 – Calculate the Total Solar Resource Fraction using the following equation:

Total Solar Resource Fraction = TOF x (1 – Shading Fraction) = _____