

OREGON DEPARTMENT OF ENERGY SOLAR INCOME CALCULATION INSTRUCTIONS

GENERAL INFORMATION

These instructions are to be used only in conjunction with the Business Energy Tax Credit Form (BETC). Follow appropriate instructions, print out completed form and attach it to the Application for Preliminary Certification.

This form and calculation are property of the State of Oregon and shall only be used in conjunction with application of the Business Energy Tax Credit.

All spaces in **yellow** require inputs. **Shaded** spaces are calculated by the spreadsheet.

REQUIRED INPUTS

STEP 1: List Proposed Building:

- List the building name in the proposed building cell.

The screenshot shows a Microsoft Excel spreadsheet titled "Solar and Water Budget Spreadsheet". The spreadsheet is divided into two main sections: "Building Solar Energy Budget Inputs" and "Building Energy Use Inputs".

Building Solar Energy Budget Inputs:

- Proposed Building: Ecotrust
- City (Select most applicable): Astoria
- Weather Data Used (Selected From Chart Above): Astoria
- Roof Area: Total Area, Glazing Area, sq ft
- N Wall Area: sq ft
- NW Wall Area: sq ft
- W Wall Area: sq ft
- SW Wall Area: sq ft
- S Wall Area: sq ft
- SE Wall Area: sq ft
- E Wall Area: sq ft
- NE Wall Area: sq ft
- Overall Shading Percentage
- Notes:
 - Provide percentage of blockage of surrounding obstructions calculated on the sun chart.
 - Provide Attached Solar Percentage Calculation Sheet
- Annual Incoming Solar Energy: 0 kWh, 0 therms, 0 kBtu
- PV System Efficiency: Efficiency
- Annual Converted Energy by PV System: 0 kWh
- Annual Converted Energy by PV covered Roof: 0 kWh
- Water: Annual amount of Water that falls on the roof: 0 gallons

Building Energy Use Inputs:

- Annual Solar Budget: Solar Energy MWh (Total: 0.0)
- Electricity Annual Usage: 0 kWh
- Natural Gas Energy Usage: 0 therms
- Fuel Oil Energy Usage: 0 gallons
- Other Energy Source: 0 kBtu
- Total Building Floor Area: 0 sq ft
- Building Energy Use Index (EUI): #DIV/0! kBtu/Sq.Ft./year
- Building Energy Use: #DIV/0! kWh, #DIV/0! therms, #DIV/0! kBtu/year
- Total annual incoming solar as a % of building energy usage: #DIV/0!
- Converted solar energy as a % of building energy usage: #DIV/0!
- Converted solar energy as a % of building electricity usage: #DIV/0!
- Converted roof solar energy as a % of building energy usage: #DIV/0!
- Converted roof solar energy as a % of building electricity usage: #DIV/0!

Footnotes:

- When the percentage of converted solar exceeds a hundred percent, the building is a net producer of energy and may be able to sell back excess energy.
- Building Energy Use is total building energy use converted to three forms of common energy units.

STEP 2: Select City:

1. Select one of the nine cities from the pull down menu on the spreadsheet. Select the city closest to the project location or the most similar in climate (for example a building being built in Burns would select Pendleton, a project in Bandon would select North Bend).

The screenshot shows a Microsoft Excel spreadsheet titled "Solar and Water Budget Spreadsheet". The spreadsheet is divided into two main sections: "Building Solar Energy Budget Inputs" and "Building Energy Use Inputs".

Building Solar Energy Budget Inputs:

- Proposed Building: Ecotrust
- City (Select most applicable): Astoria (dropdown menu with options: Astoria, Burns, Eugene, Medford, North Bend, Pendleton, Portland, Redmond)
- Weather Data Used (Selected From Chart Above): Portland (dropdown menu)
- Roof Area: 0 sq ft
- N Wall Area: 0 sq ft
- NW Wall Area: 0 sq ft
- W Wall Area: 0 sq ft
- SW Wall Area: 0 sq ft
- S Wall Area: 0 sq ft
- SE Wall Area: 0 sq ft
- E Wall Area: 0 sq ft
- NE Wall Area: 0 sq ft
- Overall Shading Percentage: 0%

Building Energy Use Inputs:

- Electricity Annual Usage: 0 kWh
- Natural Gas Energy Usage: 0 therms
- #2 Fuel Oil Energy Usage: 0 gallons
- Other Energy Source: 0 kBtu
- Total Building Floor Area: 0 sq ft
- Building Energy Use Index (EUI): #DIV/0! kBtu/Sq Ft./year
- Building Energy Use: #DIV/0! kWh
- Converted solar energy as a % of building energy usage: #DIV/0!
- Converted solar energy as a % of building electricity usage: #DIV/0!
- Converted roof solar energy as a % of building electricity usage: #DIV/0!

Annual Solar Budget:

- Solar Energy MWh: 0.0
- January: 0.0
- February: 0.0
- March: 0.0
- April: 0.0
- May: 0.0
- June: 0.0
- July: 0.0
- August: 0.0
- September: 0.0
- October: 0.0
- November: 0.0
- December: 0.0
- Total: 0.0

Water:

- Annual amount of Water that falls on the roof: 0 gallons

Notes:

1. Provide percentage of blockage of surrounding obstructions calculated on the sun chart.
2. Provide Attached Solar Percentage Calculation Sheet

Footnotes:

1. When the percentage of converted solar exceeds a hundred percent, the building is a net producer of energy and may be able to sell back excess energy.
2. Building Energy Use is total building energy use converted to three forms of common energy units.

STEP 3: Input Building Areas

- Input the buildings roof, gross facade (including glazing), and glazing areas. All dimensions should be given in Square Feet. For uniquely shaped buildings or roofs and walls with slopes or unique angles, average out facades and input average wall area. Roofs with a slope greater than 30 degrees shall be input as a tilt up wall. Roofs with a slope of 30 degrees or less shall be input as a flat roof.

The screenshot shows a Microsoft Excel spreadsheet titled "Solar and Water Budget Spreadsheet". The spreadsheet is divided into two main sections: "Building Solar Energy Budget Inputs" and "Building Energy Use Inputs".

Building Solar Energy Budget Inputs:

- Proposed Building: Ecotrust
- City (Select most applicable): Portland
- Weather Data Used (Selected From Chart Above): Portland
- Roof Area: 21,280 sq ft
- N Wall Area: 6,270 sq ft
- NW Wall Area: 6,270 sq ft
- W Wall Area: 11,260 sq ft
- SW Wall Area: 11,260 sq ft
- S Wall Area: 6,270 sq ft
- SE Wall Area: 6,270 sq ft
- E Wall Area: 11,260 sq ft
- NE Wall Area: 11,260 sq ft
- Overall Shading Percentage: (blank)
- Notes:
 - Provide percentage of blockage of surrounding obstructions calculated on the sun chart.
 - Provide Attached Solar Percentage Calculation Sheet
- Annual Incoming Solar Energy:
 - 4,664,261 kWh
 - 159,145 therms
 - 15,914,526 kBtu
- PV System Efficiency: (blank)
- Annual Converted Energy by PV System: 0 kWh
- Annual Converted Energy by PV covered Roof: 0 kWh
- Water:
 - Annual amount of Water that falls on the roof: 542,829 gallons

Building Energy Use Inputs:

- Annual Solar Budget: (blank)
- Solar Energy MWh: (blank)
- Electricity Annual Usage: 0 kWh
- Natural Gas Energy Usage: 0 therms
- #2 Fuel Oil Energy Usage: 0 gallons
- Other Energy Source: 0 kBtu
- Total Building Floor Area: 0 sq ft
- Building Energy Use Index (EUI): #DIV/0! kBtu/Sq.Ft./year
- Building Energy Use: #DIV/0! kWh, #DIV/0! therms, #DIV/0! kBtu/year
- Total annual incoming solar as a % of building energy usage: #DIV/0!
- Converted solar energy as a % of building energy usage: #DIV/0!
- Converted solar energy as a % of building electricity usage: #DIV/0!
- Converted roof solar energy as a % of building energy usage: #DIV/0!
- Converted roof solar energy as a % of building electricity usage: #DIV/0!
- Footnotes:
 - When the percentage of converted solar exceeds a hundred percent, the building is a net producer of energy and may be able to sell back excess energy.
 - Building Energy Use is total building energy use converted to three forms of common energy units.

The spreadsheet also includes a monthly breakdown of solar energy usage (January to December) and a total annual solar energy usage of 4664.3 MWh.

STEP 4: Input Building Shading Percentage.

1. Either of the following options can be used to calculate the amount of shading for the proposed building. Select either Option 1 or Option 2

Option 1: Use a building modeling or load software program to calculate the total amount of shading for each façade or a total overall building shading percentage. Provide sufficient backup from the software program for shading inputs.

- a. Input the shading percentage for each wall and facade into the wall's corresponding Shading Percentage Cell or input the overall shading for the entire building.
- b. If the overall shading is input make sure the individual façade inputs are blank or 0. If individual facades are input make sure the overall shading is 0.
- c. For example, a DOE2 building model can be modeled with shading from objects surrounding the building and modeled without. The shading percentage is found by comparing the solar gain difference between the two models. This can be found in the "building cooling load from wall conduction" hourly report in DOE2. This percentage difference can be input into the shading percentage cell.
- d. Skip ahead to Step 5.

Software Façade Shading Input:

The screenshot shows a Microsoft Excel spreadsheet titled "Solar and Water Budget Spreadsheet". The spreadsheet is divided into several sections for data entry:

- Building Solar Energy Budget Inputs:** Includes fields for Proposed Building (Ecotrust), City (Portland), Weather Data Used (Portland), Total Area (21,280 sq ft), Glazing Area (0 sq ft), and Shading Percentage (7.3%).
- Building Energy Use Inputs:** Includes fields for Electricity Annual Usage (0 kWh), Natural Gas Energy Usage (0 therms), #2 Fuel Oil Energy Usage (0 gallons), Other Energy Source (0 kBtu), and Total Building Floor Area (0 sq ft).
- Annual Solar Budget:** A table showing monthly solar energy (MWh) from January (151.1) to December (129.6), with a total of 4664.3 MWh.
- Building Energy Use Index (EUI):** A table showing monthly EUI values from January (207.0) to December (129.6).
- Building Energy Use:** A table showing monthly energy use in kBtu/year from January (450.0) to December (169.5).
- Annual Incoming Solar Energy:** A table showing annual incoming solar energy in kWh (4,323,709) and therms (147,526), and kBtu (14,752,766).
- PV System Efficiency:** Fields for PV System Efficiency, Annual Converted Energy by PV System (0 kWh), and Annual Converted Energy by PV covered Roof (0 kWh).
- Water:** A field for Annual amount of Water that falls on the roof (542,829 gallons).

Notes at the bottom of the spreadsheet include:

1. Provide percentage of blockage of surrounding obstructions calculated on the sun chart.
2. Provide Attached Solar Percentage Calculation Sheet

Footnotes at the bottom right include:

1. When the percentage of converted solar exceeds a hundred percent, the building is a net producer of energy and may be able to sell back excess energy.
2. Building Energy Use is total building energy use converted to three forms of common energy units.

Software Overall Shading Input:

Microsoft Excel - DOE Example - Ecotrust.xls

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Solar and Water Budget Spreadsheet

Building Solar Energy Budget Inputs					Building Energy Use Inputs					
Proposed Building	Ecotrust				Annual Solar Budget			Electricity Annual Usage	0	kWh
Weather Data Used (Selected From Chart Above)	Portland				Solar Energy MWh			Natural Gas Energy Usage	0	therms
City (Select most applicable)	Portland							#2 Fuel Oil Energy Usage	0	gallons
	Total Area	Glazing Area		Shading Percentage	January	151.1		Other Energy Source	0	kBtu
Roof Area	21,260	0	sq ft	0.0%	February	207.0		Total Building Floor Area	0	sq ft
N Wall Area	6,270	946	sq ft	0.0%	March	345.5		Building Energy Use Index (EUI)	#DIV/0!	kBtu/Sq Ft./year
NW Wall Area			sq ft		April	450.0		Building Energy Use	#DIV/0!	kWh
W Wall Area	11,260	1,300	sq ft	0.0%	May	525.9			#DIV/0!	therms
SW Wall Area			sq ft		June	612.8			#DIV/0!	kBtu/year
S Wall Area	6,270	1,016	sq ft	0.0%	July	677.2		Total annual incoming solar	#DIV/0!	
SE Wall Area			sq ft		August	592.4		as a % of building energy usage		
E Wall Area	11,260	1,930	sq ft	0.0%	September	455.7		Converted solar energy as a %	#DIV/0!	
NE Wall Area			sq ft		October	307.5		of building energy usage		
					November	169.5		Converted solar energy as a %	#DIV/0!	
					December	129.6		of building electricity usage		
	Overall Shading Percentage			7.3%	Total	4664.3		Converted roof solar energy	#DIV/0!	
Notes:										
1.	Provide percentage of blockage of surrounding obstructions calculated on the sun chart.									
2.	Provide Attached Solar Percentage Calculation Sheet									
Annual Incoming Solar Energy	4,323,788		kWh							
	147,526		therms							
	14,752,766		kBtu							
PV System Efficiency			Efficiency							
Annual Converted Energy by PV System	0		kWh							
Annual Converted Energy by PV covered Roof	0		kWh							
Water										
Annual amount of Water that falls on the roof.	542,829		gallons							
Footnotes:										
1. When the percentage of converted solar exceeds a hundred percent, the building is a net producer of energy and may be able to sell back excess energy.										
2. Building Energy Use is total building energy use converted to three forms of common energy units.										

Sheet1 / Sheet2

Ready

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- Option 2: Input the building shading percentage by using a solar graph.
- Refer to instructions for Option 2: Solar Graph Shading.

Solar and Water Budget Spreadsheet									
Building Solar Energy Budget Inputs					Building Energy Use Inputs				
Proposed Building	Ecotrust				Annual Solar Budget	Electricity Annual Usage	0	kWh	
						Natural Gas Energy Usage	0	therms	
City (Select most applicable)	Portland				Solar Energy MWh	#2 Fuel Oil Energy Usage	0	gallons	
Weather Data Used (Selected From Chart Above)	Portland					Other Energy Source	0	kBtu	
	Total Area	Glazing Area		Shading Percentage	January	Total Building Floor Area	0	sq ft	
11 Roof Area	21,280	0	sq ft	4.8%	February	Building Energy Use Index (EUI)	#DIV/0!	kBtu/Sq.Ft./year	
12 N Wall Area	6,270	946	sq ft	0.0%	March	Building Energy Use	#DIV/0!	kWh	
13 NW Wall Area			sq ft		April		#DIV/0!	therms	
14 W Wall Area	11,260	1,300	sq ft	6.0%	May		#DIV/0!	kBtu/year	
15 SW Wall Area			sq ft		June				
16 S Wall Area	6,270	1,018	sq ft	35.0%	July				
17 SE Wall Area			sq ft		August	Total annual incoming solar as a % of building energy usage	#DIV/0!		
18 E Wall Area	11,260	1,930	sq ft	1.0%	September	Converted solar energy as a % of building energy usage	#DIV/0!		
19 NE Wall Area			sq ft		October	Converted solar energy as a % of building electricity usage	#DIV/0!		
					November	Converted roof solar energy as a % of building energy usage	#DIV/0!		
					December	Converted roof solar energy as a % of building electricity usage	#DIV/0!		
					Total				
21 Overall Shading Percentage									
22 Notes:									
24 1. Provide percentage of blockage of surrounding obstructions calculated on the sun chart.									
25 2. Provide Attached Solar Percentage Calculation Sheet									
26									
27 Annual Incoming Solar Energy	4,325,000	kWh							
28	147,569	therms							
29	14,756,901	kBtu							
30									
31 PV System Efficiency		Efficiency							
32 Annual Converted Energy by PV System	0	kWh							
33 Annual Converted Energy by PV covered Roof	0	kWh							
34									
35 Water									
36									
37 Annual amount of Water that falls on the roof:	542,829	gallons							
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STEP 5: Input PV Efficiency

1. Input the overall efficiency of the building photovoltaic system. If you are unsure what this efficiency is, input 10%.

The screenshot shows a Microsoft Excel spreadsheet titled "Solar and Water Budget Spreadsheet". The spreadsheet is divided into two main sections: "Building Solar Energy Budget Inputs" and "Building Energy Use Inputs".

Building Solar Energy Budget Inputs:

- Proposed Building: Ecotrust
- City (Select most applicable): Portland
- Weather Data Used (Selected From Chart Above): Portland
- Shading Percentage: 0.0%
- Overall Shading Percentage: 0.0%
- Notes:
 1. Provide percentage of blockage of surrounding obstructions calculated on the sun chart.
 2. Provide Attached Solar Percentage Calculation Sheet
- Annual Incoming Solar Energy:
 - 4,325,000 kWh
 - 147,569 therms
 - 14,756,901 kBtu
- PV System Efficiency: 10.0% Efficiency
- Annual Converted Energy by PV System: 432,500 kWh
- Annual Converted Energy by PV covered Roof: 253,139 kWh

Building Energy Use Inputs:

- Annual Solar Budget: 4325.0 MWh
- Electricity Annual Usage: 0 kWh
- Natural Gas Energy Usage: 0 therms
- #2 Fuel Oil Energy Usage: 0 gallons
- Other Energy Source: 0 kBtu
- Total Building Floor Area: 0 sq ft
- Building Energy Use Index (EUI): #DIV/0! kBtu/Sq.Ft./year
- Building Energy Use: #DIV/0! kWh, #DIV/0! therms, #DIV/0! kBtu/year
- Total annual incoming solar as a % of building energy usage: #DIV/0!
- Converted solar energy as a % of building energy usage: #DIV/0!
- Converted solar energy as a % of building electricity usage: #DIV/0!
- Converted roof solar energy as a % of building electricity usage: #DIV/0!

Water:

- Annual amount of Water that falls on the roof: 542,829 gallons

The spreadsheet also includes a monthly breakdown of solar energy usage (January to December) and a footer with the text: "Ready" and "NUM".

BUILDING ENERGY USE INPUTS

STEP 7: Input building energy use.

1. Input the buildings annual energy usage index. To obtain this follow the steps below.
 - a. Input the total annual energy usage of the building, in kWh, therms, gallons of fuel oil, or other form of energy in kBtu. If the building is an existing building, derive energy usage from current utility bills. If the building is a proposed building and has not been built yet, the energy usage can be provided from an energy model (DOE2, etc.).

The screenshot shows a Microsoft Excel spreadsheet titled "Solar and Water Budget Spreadsheet". The spreadsheet is divided into two main sections: "Building Solar Energy Budget Inputs" and "Building Energy Use Inputs".

Building Solar Energy Budget Inputs:

- Proposed Building: Ecotrust
- City: Portland
- Weather Data Used: Portland
- Roof Area: 21,280 sq ft
- N Wall Area: 6,270 sq ft
- NW Wall Area: 11,260 sq ft
- SW Wall Area: 6,270 sq ft
- S Wall Area: 11,260 sq ft
- SE Wall Area: 6,270 sq ft
- E Wall Area: 11,260 sq ft
- NE Wall Area: 6,270 sq ft
- Overall Shading Percentage: 0.0%
- Annual Incoming Solar Energy: 4,325,000 kWh, 147,569 therms, 14,756,901 kBtu
- PV System Efficiency: 10.0%
- Annual Converted Energy by PV System: 432,500 kWh
- Annual Converted Energy by PV covered Roof: 253,139 kWh
- Annual amount of Water that falls on the roof: 542,829 gallons

Building Energy Use Inputs:

- Annual Solar Budget (MWh): 4325.0
- Electricity Annual Usage: 985,539 kWh
- Natural Gas Energy Usage: 8,674 therms
- #2 Fuel Oil Energy Usage: 0 gallons
- Other Energy Source: 0 kBtu
- Total Building Floor Area: 0 sq ft
- Building Energy Use Index (EUI): #DIV/0! kBtu/Sq.Ft./year
- Building Energy Use: #DIV/0! kWh, #DIV/0! therms, #DIV/0! kBtu/year
- Total annual incoming solar as a % of building energy usage: #DIV/0!
- Converted solar energy as a % of building energy usage: #DIV/0!
- Converted solar energy as a % of building electricity usage: 44%
- Converted roof solar energy as a % of building energy usage: #DIV/0!
- Converted roof solar energy as a % of building electricity usage: 26%

Notes:

- Provide percentage of blockage of surrounding obstructions calculated on the sun chart.
- Provide Attached Solar Percentage Calculation Sheet

Footnotes:

- When the percentage of converted solar exceeds a hundred percent, the building is a net producer of energy and may be able to sell back excess energy.
- Building Energy Use is total building energy use converted to three forms of common energy units.

STEP 8: Input Building Floor Area

1. Input the total building floor area. Dimensions should be given in Square Feet.
2. Once this has been input, the spreadsheet will calculate the buildings Energy Use Index (EUI) as well as total energy usage in kWh, therms and kBtu/year. The spreadsheet will then calculate the amount of the building's energy usage that can be provided by the sun with and without a PV system.

The screenshot shows a Microsoft Excel spreadsheet titled "Solar and Water Budget Spreadsheet". The spreadsheet is divided into two main sections: "Building Solar Energy Budget Inputs" and "Building Energy Use Inputs".

Building Solar Energy Budget Inputs:

- Proposed Building: Ecotrust
- City (Select most applicable): Portland
- Weather Data Used (Selected From Chart Above): Portland
- Total Area: 21,260 sq ft
- Glazing Area: 0 sq ft
- Shading Percentage: 0.0%
- Annual Incoming Solar Energy: 4,325,000 kWh, 147,569 therms, 14,756,901 kBtu
- PV System Efficiency: 10.0%
- Annual Converted Energy by PV System: 432,500 kWh
- Annual Converted Energy by PV covered Roof: 253,139 kWh
- Annual amount of Water that falls on the roof: 542,829 gallons

Building Energy Use Inputs:

- Annual Solar Budget: 4325.0 MWh
- Electricity Annual Usage: 985,539 kWh
- Natural Gas Energy Usage: 8,674 therms
- #2 Fuel Oil Energy Usage: 0 gallons
- Other Energy Source: 0 kBtu
- Total Building Floor Area: 64,964 sq ft
- Building Energy Use Index (EUI): 65 kBtu/Sq.Ft./year
- Building Energy Use: 1,239,759 kWh, 42,301 therms, 4,230,059 kBtu/year
- Total annual incoming solar as a % of building energy usage: 349%
- Converted solar energy as a % of building energy usage: 35%
- Converted solar energy as a % of building electricity usage: 44%
- Converted roof solar energy as a % of building energy usage: 20%
- Converted roof solar energy as a % of building electricity usage: 26%

Notes:

1. Provide percentage of blockage of surrounding obstructions calculated on the sun chart.
2. Provide Attached Solar Percentage Calculation Sheet

Footnotes:

1. When the percentage of converted solar exceeds a hundred percent, the building is a net producer of energy and may be able to sell back excess energy.
2. Building Energy Use is total building energy use converted to three forms of common energy units.

STEP 9: Attach the completed calculation to your BETC Application