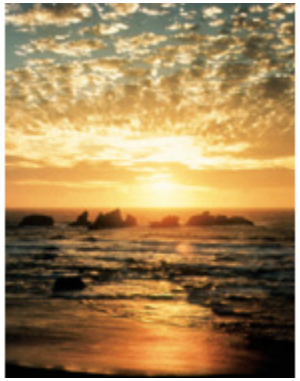




Solar Tax Credit Update

December 13, 2007

Christopher Dymond, Senior Energy Analyst

Oregon Department of Energy

Disclaimer

This presentation only covers program changes from 2007-2008

BETC

Business Energy Tax Credit

Key Challenges

- Support diversity of sizes and location
- Achieve declining system cost
- Tracking of jobs and system details
- Continuous improvement of quality and performance

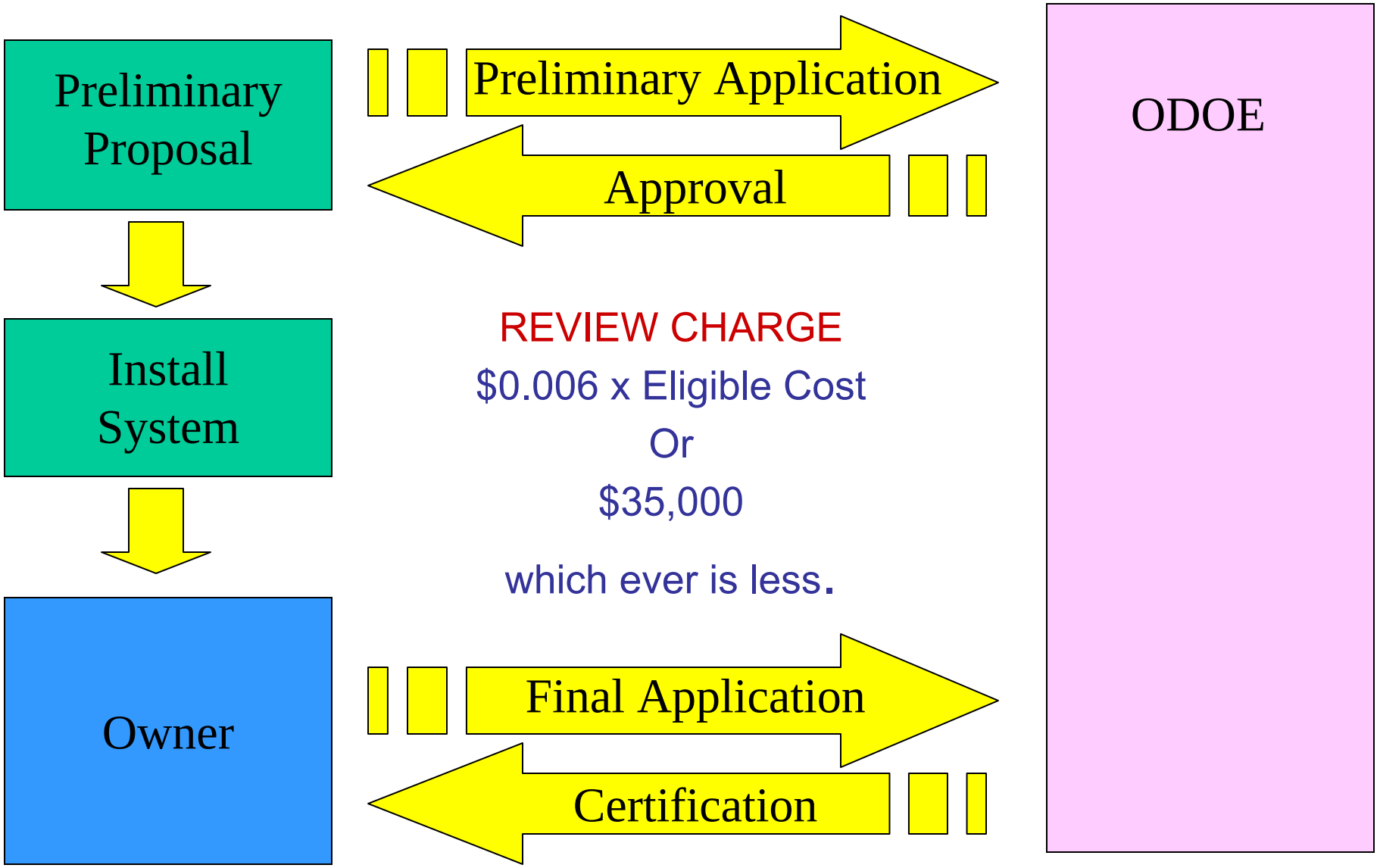
Key Changes

- Maximum eligible cost changed from from simple payback to size based
- Increased scrutiny of system before issuing final certification
- Reduced application charge
- Precertification valid for only 12 months
- TSRF must be >75 % for BETC projects

50% BETC for Solar Technologies

- Photovoltics
- Solar Thermal
  - Solar Water Heating
  - Solar Space Heating
  - Pool Heating
- Passive Solar
- Manufacturing Facilities
- Builder Incentives

BETC Process



BETC Rates (percent of eligible cost)

Renewables

Eligible Cost	Year 1	Year 2	Year 3	Year 4	Year 5
≤ $20k	50%				
> $20k	10%	10%	10%	10%	10%

Conservation Measures

Eligible Cost	Year 1	Year 2	Year 3	Year 4	Year 5
≤ $20k	35%				
> $20k	10%	10%	5%	5%	5%

BETC Pass Through Option

- Owner releases right to tax credit in exchange for third party payment
- Payment depends on type
  - Conservation (35% Tax Credit)
    - 1 year 30.5% of project cost
    - 5 year 25.5% of project cost
  - Renewables (50% Tax Credit)
    - 1 year 43.5% of eligible cost
    - 4 year 33.5% of eligible cost
  - ODOE does **not** guarantee partners for projects

Time Constraints

- Application must be received before project commences
- Maximum eligible cost will decrease
- Projects must be completed and final certification applied for within 12 months of certification.
- Credit must be claimed within 8 years of tax credit date.

PV Eligible Cost

- Eligible Cost is the lesser of
  - Estimated Project Cost
  - Maximum Eligible Cost
- Download spreadsheet to calculate

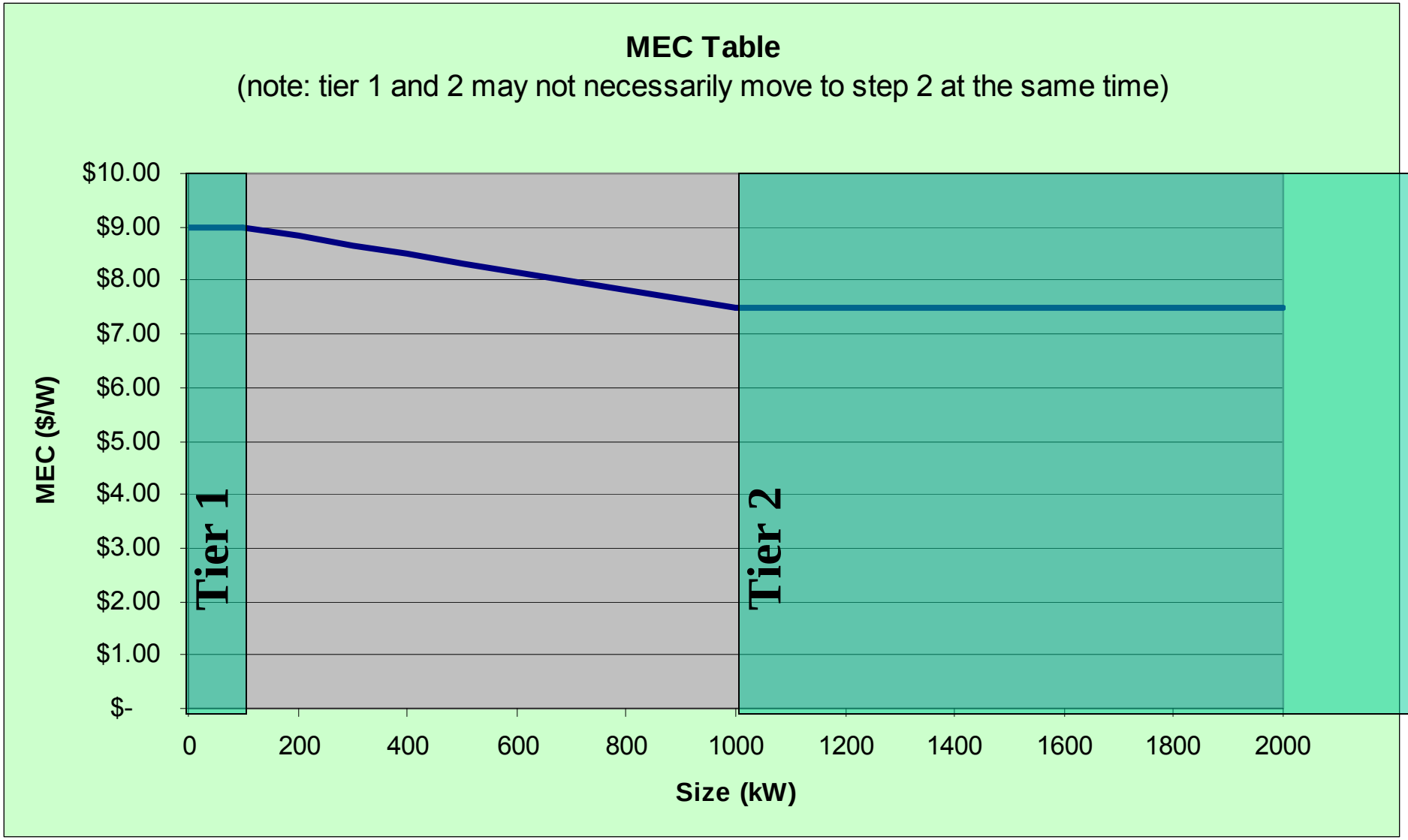
Oregon PV Incentive Calculator

System Size	22	kW DC @ STC
TSRF	78%	System may be inpected to ensure TSRF > 75%
Module Tolerance	5%	percent deration on modules chosen
Public Building?	FALSE	True or False

Estimated Project Cost	$ 255,000	$ 11.59	per Watt @ STC
Max Eligible Cost	$ 188,100	$ 8.55	per Watt @ STC

Eligible Cost	**$ 188,100**	(valid for 12 months from pre-cert date)

PV Maximum Eligible Cost



Incentive Steps

Each Tier has it's own threshold of installed kW. Once that threshold is met The MEC will automatically drop.

ODOE PV Step Tracker **12/13/2007**

	To Date	Step	Next Step
Tier 1	**1,393 kW**	**1**	**4,000 kW**
Tier 2	**427 kW**	**1**	**4,000 kW**

Note : Online value is not most current. Date of completed application review set's incentive rate.

PV System - Type and Size

8. 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 w/Bat**, utility interactive system that includes batter 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 STC

Sub Array 1

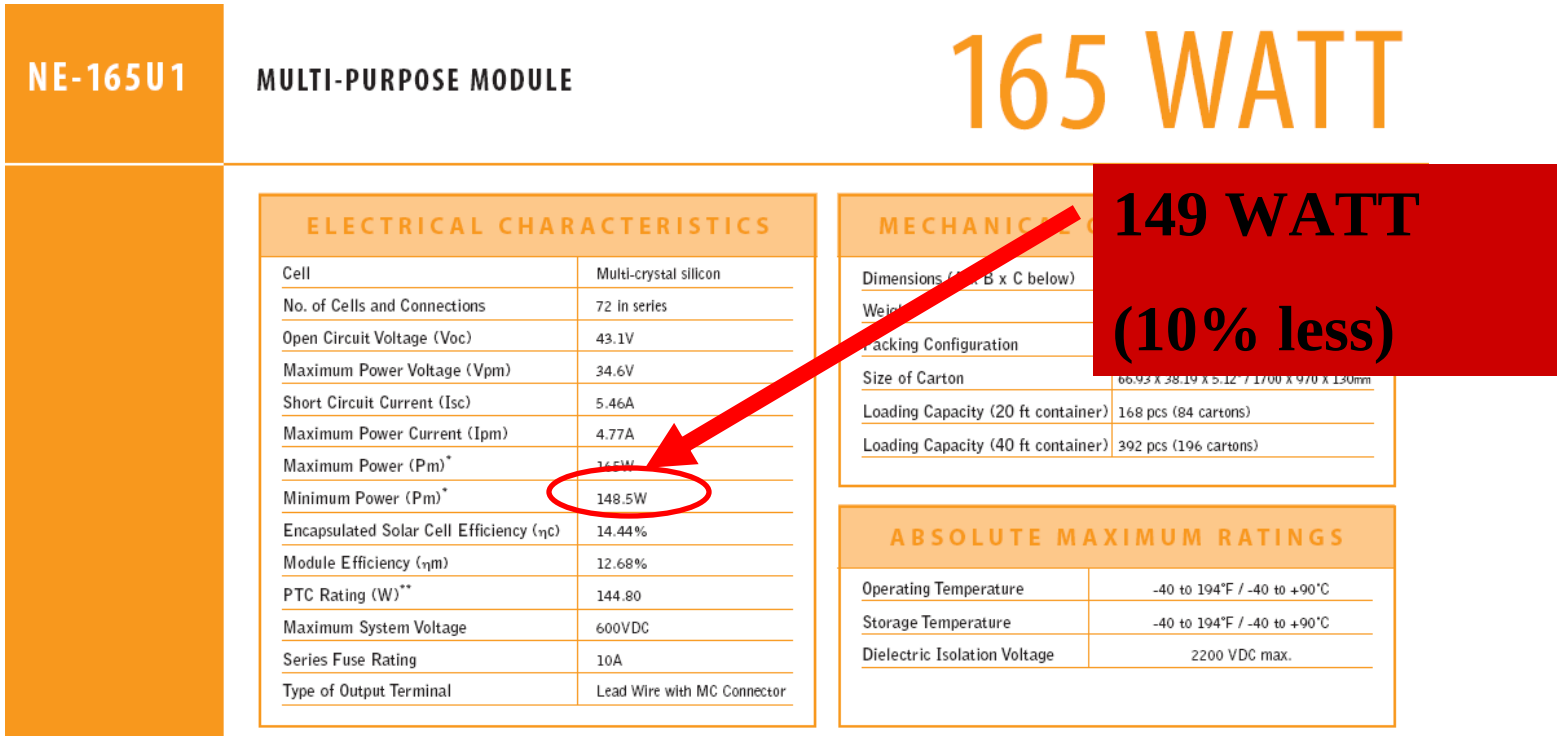
Rated power ($Watts_1$): _____ Watts DC at STC
Number of modules: _____ Module output: _____ Watts DC at STC
Module power tolerance: _____ % (enter the +/- rating of the module @ STC)
Module manufacturer: _____ Module model: _____
Inverter manufacturer: _____ Inverter model: _____

Sub Array 2

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

PV Module Tolerance

- Maximum Eligible Cost will be based on module warranty not “STC” watts



NE-165U1

MULTI-PURPOSE MODULE

165 WATT

149 WATT

(10% less)

ELECTRICAL CHARACTERISTICS

Cell	Multi-crystal silicon
No. of Cells and Connections	72 in series
Open Circuit Voltage (Voc)	43.1V
Maximum Power Voltage (Vpm)	34.6V
Short Circuit Current (Isc)	5.46A
Maximum Power Current (Ipm)	4.77A
Maximum Power (Pm)*	165W
Minimum Power (Pm)*	148.5W
Encapsulated Solar Cell Efficiency (ηc)	14.44%
Module Efficiency (ηm)	12.68%
PTC Rating (W)**	144.80
Maximum System Voltage	600VDC
Series Fuse Rating	10A
Type of Output Terminal	Lead Wire with MC Connector

MECHANICAL

Dimensions (A x B x C below)	
Weight	
Packing Configuration	
Size of Carton	66.93 x 38.19 x 5.12" / 1700 x 970 x 130mm
Loading Capacity (20 ft container)	168 pcs (84 cartons)
Loading Capacity (40 ft container)	392 pcs (196 cartons)

ABSOLUTE MAXIMUM RATINGS

Operating Temperature	-40 to 194°F / -40 to +90°C
Storage Temperature	-40 to 194°F / -40 to +90°C
Dielectric Isolation Voltage	2200 VDC max.

PV Total Solar Resource Fraction

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. TOF is the tilt and orientation factor 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: _____

$TSRF_1 = TOF \times (1 - \text{Shading Fraction}) = \_\_\_\_\_$

Sub Array 2

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

$TSRF_1 = TOF \times (1 - \text{Shading Fraction}) = \_\_\_\_\_$

Sub Array 3

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

$TSRF_1 = TOF \times (1 - \text{Shading Fraction}) = \_\_\_\_\_$

Sub Array 4

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

$TSRF_1 = TOF \times (1 - \text{Shading Fraction}) = \_\_\_\_\_$

System TSRF ≥ 75%

Estimated Performance

11. 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 8b) =		_____
Total Solar Resource Fraction (TSRF, from 10b) =	x	_____[1]
System Type Modifier (from 8a) =	x	_____
Mounting Type Modifier (from 8c) =	x	_____
Solar Resource (from 11a) =	x	_____
Annual useful energy produced	=	_____ kWh/yr

Estimated Cost

13. Estimated Project Cost	
Materials:	**Estimated cost:**
Labor:	**Estimated cost:**
Engineering:	**Estimated cost:**
Other: (Do not include Business Energy Tax Credit review costs.)	**Estimated cost:**

Signature Page

16. Read the statement below, sign and date.

- The Oregon Department of Energy is required by law to disclose information in this application to the public on request. Proprietary information may be exempt from disclosure. Mark on each page any information that you want kept confidential. The Director of the Oregon Department of Energy will make any decisions regarding public disclosure of information in this application.
- I understand that Oregon Department of Energy approval and certification of my project is for tax credit purposes only. The Oregon Department of Energy does not guarantee or in any way ensure the performance of any equipment, the quality of any system or the reliability of any dealer.
- The project will comply with all local, state and federal requirements. I will obtain all necessary permits.
- I will permit the Oregon Department of Energy or its agents to inspect the project at its discretion to make sure the project qualifies for the tax credit. I understand that if I give false information about the project, or if I refuse to permit the Oregon Department of Energy to inspect the project, I will not get the tax credit.
- I hereby release the State of Oregon and its commissions, agencies, officers, employees, contractors, and agents, and agree to defend and indemnify the foregoing from and against any claims, demands, or costs (including attorney and expert witness fees at trial and on appeal) arising from or in any way related to the Oregon Department of Energy's issuance or failure to issue any pre-certification or final certification for a Business Energy Tax Credit, or any party's inability to obtain a Business Energy Tax Credit.
- I understand that the sum of all financial incentives and the tax credit can not exceed the total eligible project cost.
- I have completed this form to the best of my knowledge.
- I have included an energy audit (or analysis) or energy use records, if applicable.
- I have enclosed a check to the Oregon Department of Energy or will pay by Visa or MasterCard for the review charge.
- I verify that the business/organization as project owner does not discriminate in providing access to its programs, services and activities on the basis of race, color, religion, ancestry, national origin, political affiliation, sex, age, marital status, sexual orientation, physical or mental disability, or any other inappropriate reason prohibited by law or policy of the state or federal government.
- I certify that I am the owner or the authorized agent.

Signature: _____Title: _____

Print Name:_____ Date: _____

Send completed application with payment to:

Oregon Department of Energy
625 Marion St. NE
Salem, OR 97301-3737

If you have questions, call: **1-800-221-8035 (toll-free in Oregon) or (503) 378-4040**

or visit our Web site: www.oregon.gov/energy **FAX: (503) 373-7806**

OREGON DEPARTMENT OF ENERGY

PV Technical Requirements (a sampling – read full document)

- Designed to last at least 25 years
- Performance w/o sacrificing aesthetics
- Mounting must not reduce expected life/durability of roof
- Built to code w/proper signage
- System Manual
  - System documentation (design, plan view, sun chart)
  - 2-year full warranty
  - Component datasheets
- Class 0.5 Performance Meter
- Voltages inside operating windows
- Voltage drop < 2% on AC and DC lines

Solar Thermal (ST)

- Three tier, declines over time

	Size (kBtu/day)	STEP 1	STEP 2	STEP 3
TIER 1	≤100	220	TBD	TBD
TIER 2	>100 and ≤250	220	TBD	TBD
TIER 3	>250	220	TBD	TBD

Solar Thermal Eligible Cost

Oregon ST Incentive Calculator

Solar Collector Mfg.		
Collector Model		
Certification #		
Gross Collector Area		ft^2
Public Building?	FALSE	True or False
Number of Collectors	2	
TSRF	100%	TSRF must be ≥ 75%
Total System Area	0	ft^2
Rated Output of System	36.8	kBtu/day
Estimated Project Cost	$ 8,000	
Max Eligible Cost	$ 8,096	
Eligible Cost	**$ 8,000**	

“Standard Oregon Conditions” SOC

Collector Thermal Performance Rating (www.solar-rating.org)

Thousands of Btu Per Panel Per Day				
Category (Ti - Ta)	CLEAR DAY 2000 Btu/ft^2-day	MILDLY CLOUDY 1500 Btu/ft^2-day	CLOUDY DAY 1000 Btu/ft^2-day	
A -9 ºF	n/a	26	n/a	10%
B 9 ºF	n/a	23	n/a	20%
C 36 ºF	n/a	20	n/a	30%
D 90 ºF	n/a	13	n/a	40%
E -144 ºF	n/a	1	n/a	0%

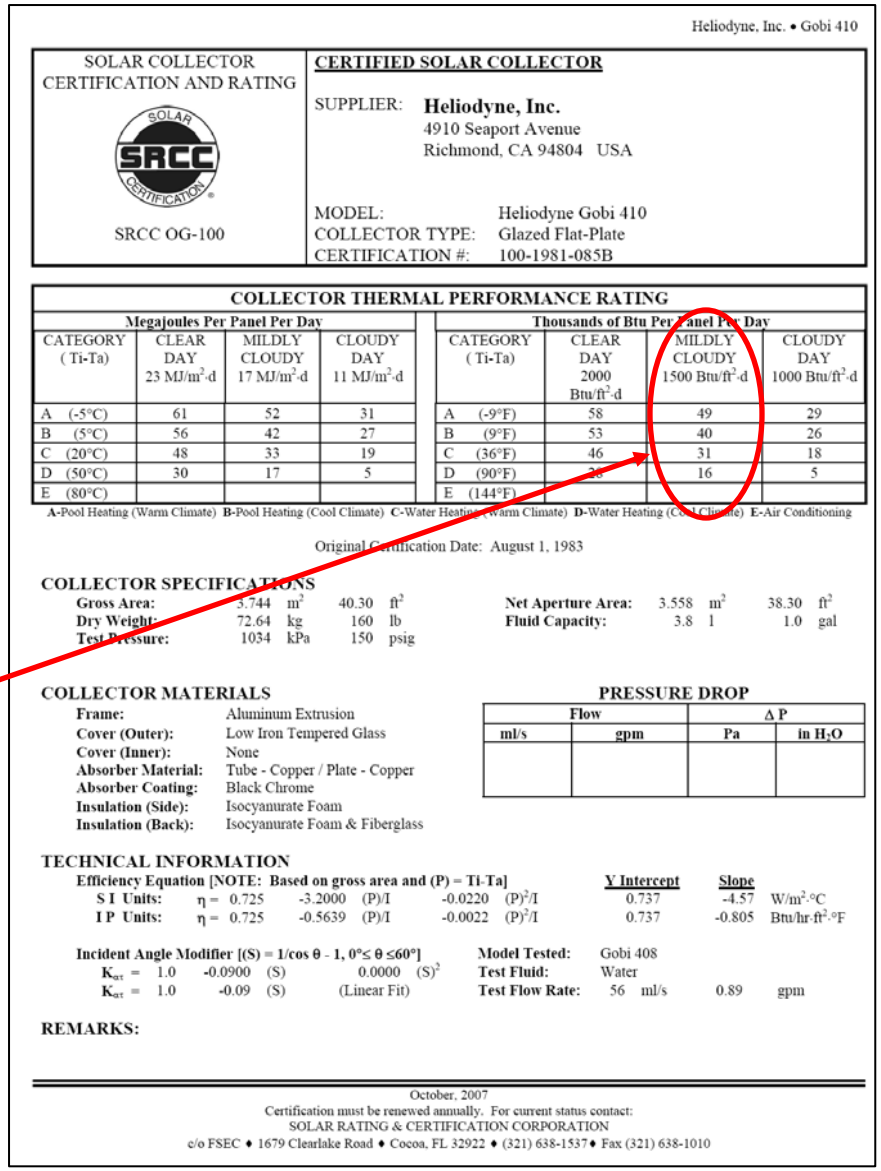
Collector SOC 18.4 kBtu/day per panel (**enter data above**)

SRCC OG-100 Data Sheet

The SRCC is an independent third party rater of solar thermal collectors (OG-100) and solar water heating systems (OG-300)

www.solar-rating.org

The "Standard Oregon Conditions" rating of a collector are based on a weighted average of the mildly cloudy test results



Heliodyne, Inc. • Gobi 410

SOLAR COLLECTOR CERTIFICATION AND RATING

SRCC OG-100

CERTIFIED SOLAR COLLECTOR

SUPPLIER: **Heliodyne, Inc.**
4910 Seaport Avenue
Richmond, CA 94804 USA

MODEL: Heliodyne Gobi 410
COLLECTOR TYPE: Glazed Flat-Plate
CERTIFICATION #: 100-1981-085B

COLLECTOR THERMAL PERFORMANCE RATING

Megajoules Per Panel Per Day				Thousands of Btu Per Panel Per Day			
CATEGORY (Ti-Ta)	CLEAR DAY 23 MJ/m²·d	MILDLY CLOUDY 17 MJ/m²·d	CLOUDY DAY 11 MJ/m²·d	CATEGORY (Ti-Ta)	CLEAR DAY 2000 Btu/ft²·d	MILDLY CLOUDY 1500 Btu/ft²·d	CLOUDY DAY 1000 Btu/ft²·d
A (-5°C)	61	52	31	A (-9°F)	58	49	29
B (5°C)	56	42	27	B (9°F)	53	40	26
C (20°C)	48	33	19	C (36°F)	46	31	18
D (50°C)	30	17	5	D (90°F)	30	16	5
E (80°C)				E (144°F)			

A-Pool Heating (Warm Climate) **B**-Pool Heating (Cool Climate) **C**-Water Heating (Warm Climate) **D**-Water Heating (Cool Climate) **E**-Air Conditioning

Original Certification Date: August 1, 1983

COLLECTOR SPECIFICATIONS

Gross Area:	3.744	m²	40.30	ft²	**Net Aperture Area:**	3.558	m²	38.30	ft²
Dry Weight:	72.64	kg	160	lb	**Fluid Capacity:**	3.8	l	1.0	gal
Test Pressure:	1034	kPa	150	psig					

COLLECTOR MATERIALS

Frame:	Aluminum Extrusion
Cover (Outer):	Low Iron Tempered Glass
Cover (Inner):	None
Absorber Material:	Tube - Copper / Plate - Copper
Absorber Coating:	Black Chrome
Insulation (Side):	Isocyanurate Foam
Insulation (Back):	Isocyanurate Foam & Fiberglass

PRESSURE DROP

Flow		ΔP	
ml/s	gpm	Pa	in H_2O

TECHNICAL INFORMATION

Efficiency Equation [NOTE: Based on gross area and (P) = Ti-Ta]

						Y Intercept	Slope	
S I Units:	η =	0.725	-3.2000	(P)/I	-0.0220 (P)²/I	0.737	-4.57	W/m²·°C
I P Units:	η =	0.725	-0.5639	(P)/I	-0.0022 (P)²/I	0.737	-0.805	Btu/hr·ft²·°F

Incident Angle Modifier [(S) = 1/cos θ - 1, 0°≤ θ ≤60°]

$K_{\alpha\tau}$ =	1.0	-0.0900 (S)	0.0000 (S)²	
$K_{\alpha\tau}$ =	1.0	-0.09 (S)	(Linear Fit)	

Model Tested: Gobi 408
Test Fluid: Water
Test Flow Rate: 56 ml/s 0.89 gpm

REMARKS:

October, 2007
Certification must be renewed annually. For current status contact:
SOLAR RATING & CERTIFICATION CORPORATION
c/o FSEC ♦ 1679 Clearlake Road ♦ Cocoa, FL 32922 ♦ (321) 638-1537 ♦ Fax (321) 638-1010

ST Technical Requirements (a sampling – read full document)

- Designed to last at least 2+ years
- Performance w/o sacrificing aesthetics
- Mounting must not reduce expected life/durability of roof
- Built to code w/proper signage
- System Manual
  - System documentation (design, plan view, sun chart)
  - 2-year full warranty
  - Component datasheets
- Solar savings fraction ≤ 70%
- Adequate storage (1.25 gallons/ft2 for DHW)
- Insulation - tank ≥ R15, pipes ≥ R2.5, potable ≥ R12
- BTU meter on systems with SOC ≥ 250 kBtu/day

RETC

Residential Energy Tax Credit

Residential Energy Tax Credit

Make Sale & Sign Contract with Homeowner

Install System

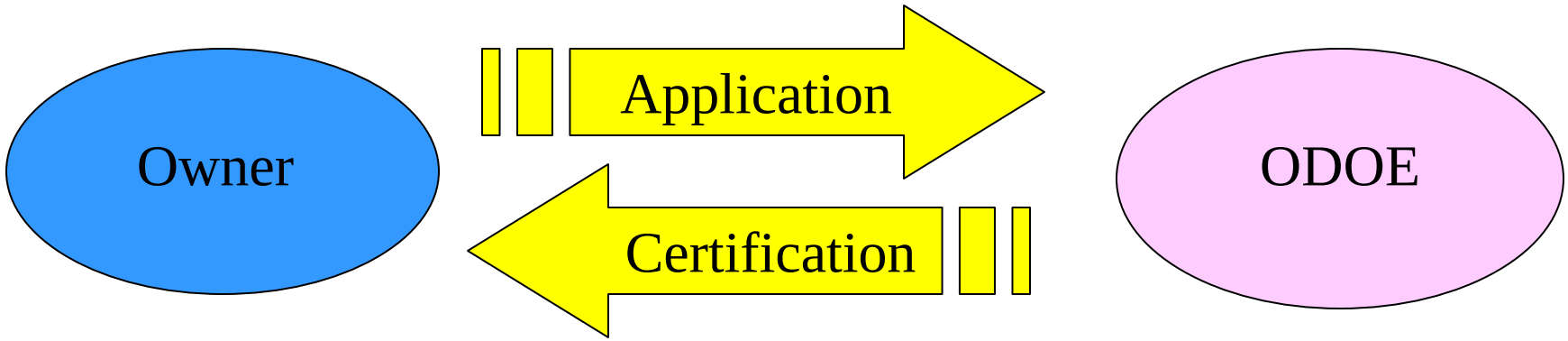
Give Owner:

Training

Application

Manual

Warrantee



RETC Groups and Maximums

1. Alternative Energy Devices $1,500
2. Pools $1,500
3. Solar Electric $6,000
   - Maximum of $1,500 per year
4. Alternative Fuel Vehicles $1,500
5. Appliances $1,000

System and installation requirements vary by technology.

Other RETC Changes

- Tank insulation bonus no longer available to SDHW Yield tables
- 2 year warranty requirement
- Different system types allowed in same year

HB 2620

1.5% for Solar on Public Buildings

Solar on Public Buildings

- Public Comment is OVER!
- Rules go into effect on January 1st
- Key Elements of 2nd Draft
  - Applies to $1M+ projects
  - Must be on building and have TSRF > 75%
  - Passive & day lighting if savings > 20%
  - Public body must request ODOE advisory body review if it believes solar inappropriate.
  - Alternative financing allowed if affixed and >10 yrs
  - State funded projects must role funds to next project

BETC for Builders

High Performance Homes and Solar Equipment

Oregon High Performance Home

- Energy Efficiency
  - Exceed Fed Tax Credit Requirements (w/gas)
  - Improved Shell Insulation
  - Energy Star Certified
  - Ducts Inside, or no Ducts
- Renewable Energy (1kWh/yr/ft^2)
  - Passive Solar and Daylighting
  - Solar Water Heating
  - Solar Electric
  - Geothermal
  - Wind

Oregon HPH Builder Tax Credits

- Shell and HVAC $3,000
- Up to $9,000 for renewables

TCCT

Tax Credit Certified Technician

Purpose of TCCT

- Provide verification of tax credit applications that system meets ODOE requirements
- Establish an entry level of expertise for participation with tax credit programs
- Serve as a third party certification while industry develops its own certification.

Who can be a TCCT?

- Anyone that provides sales, installation or service of solar equipment
- Anyone is knowledgeable about solar equipment design, selection, site evaluation and the state tax credit program rules (OAR 330-070)
- Must take responsibility for verifying system will perform according to ODOE requirements and is designed to last

Technologies

- Photovoltaics (PV)
- Solar Thermal Systems (ST)
- Ground Source Heat Pumps
- Premium Efficient Duct Systems
- Heat Pumps

2008 Changes

- 24 month warranty
- 2008
  - testing ODOE, NABCEP, BCD, or approved
  - Last year for ODOE test
- 2009
  - ODOE test, NABCEP, BCD or approved
- 2010 everyone must have either:
  - NABCEP “Light”
  - LRT/STL
  - Approved alternate

Getting Certified

1. Attend a initial program training
2. Sign and annual agreement with the Oregon Office of Energy
3. Pass technical test
   - ODOE Exam
   - NABCEP Certification
   - Solar Specialty License (LRT, STL)

Staying Certified – Each Year

1. Renew annual agreement with the Oregon Office of Energy
2. Attend conference call
3. Attend 2 hours/year of related technical continuing education
4. Verify/Commission 2 systems

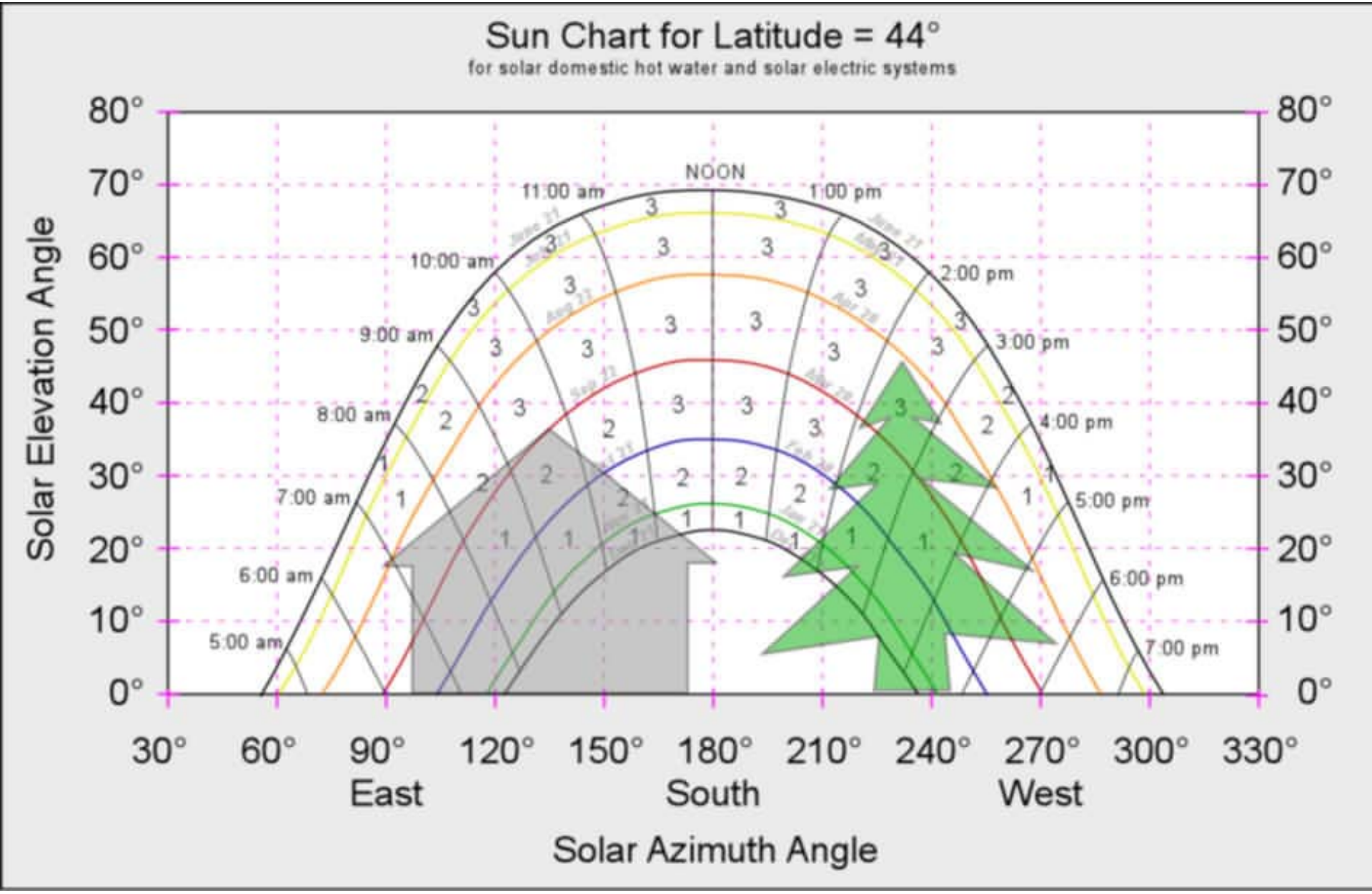
Sun Charts

Estimating losses from tilt, orientation and external shading

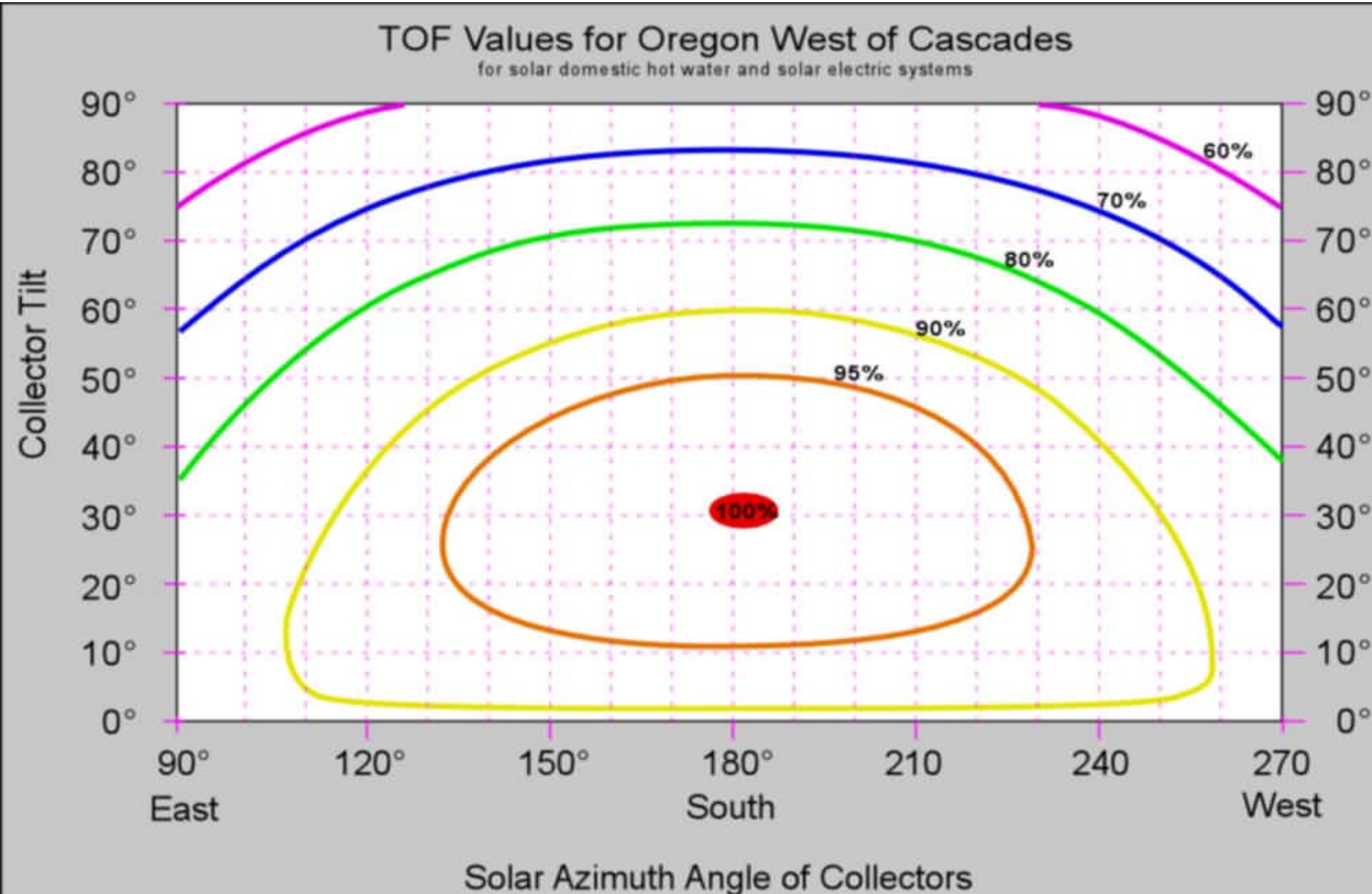
Total Solar Resource Fraction

- Acceptable Methods and Tools
  - ODOE Sun Chart
  - ETO approved Sun Chart tools
- BETC
  - TSRF ≥ 75% - Full Credit
  - TSRF < 75% - Not Eligible for Tax Credit
- RETC
  - TSRF ≥ 75% - Full Credit
  - TSRF ≥ 50% - 75% of Full Credit
  - TSRF < 50% - Not Eligible for Tax Credit

SunChart – Shading Losses



TOF Graph


TOF Values for Oregon West of Cascades
for solar domestic hot water and solar electric systems
Collector Tilt
90°
80°
70°
60°
50°
40°
30°
20°
10°
0°
60%
70%
80%
90%
95%
100%
90°
East
120°
150°
180°
South
210
240
270
West
Solar Azimuth Angle of Collectors

Resources

Staff and Website

Web site & Contacts

- **www.oregon.gov/energy**
- Tax credit administrative specialists

Angie Whitehorn (RETC)	(503) 378-2697
Lisa Hull (BETC)	(503) 378-6330
Linda Kutnar (BETC)	(503) 373-7803

- Conservation Services Manager

Suzanne Dillard	(503) 373-7565

- Technical support

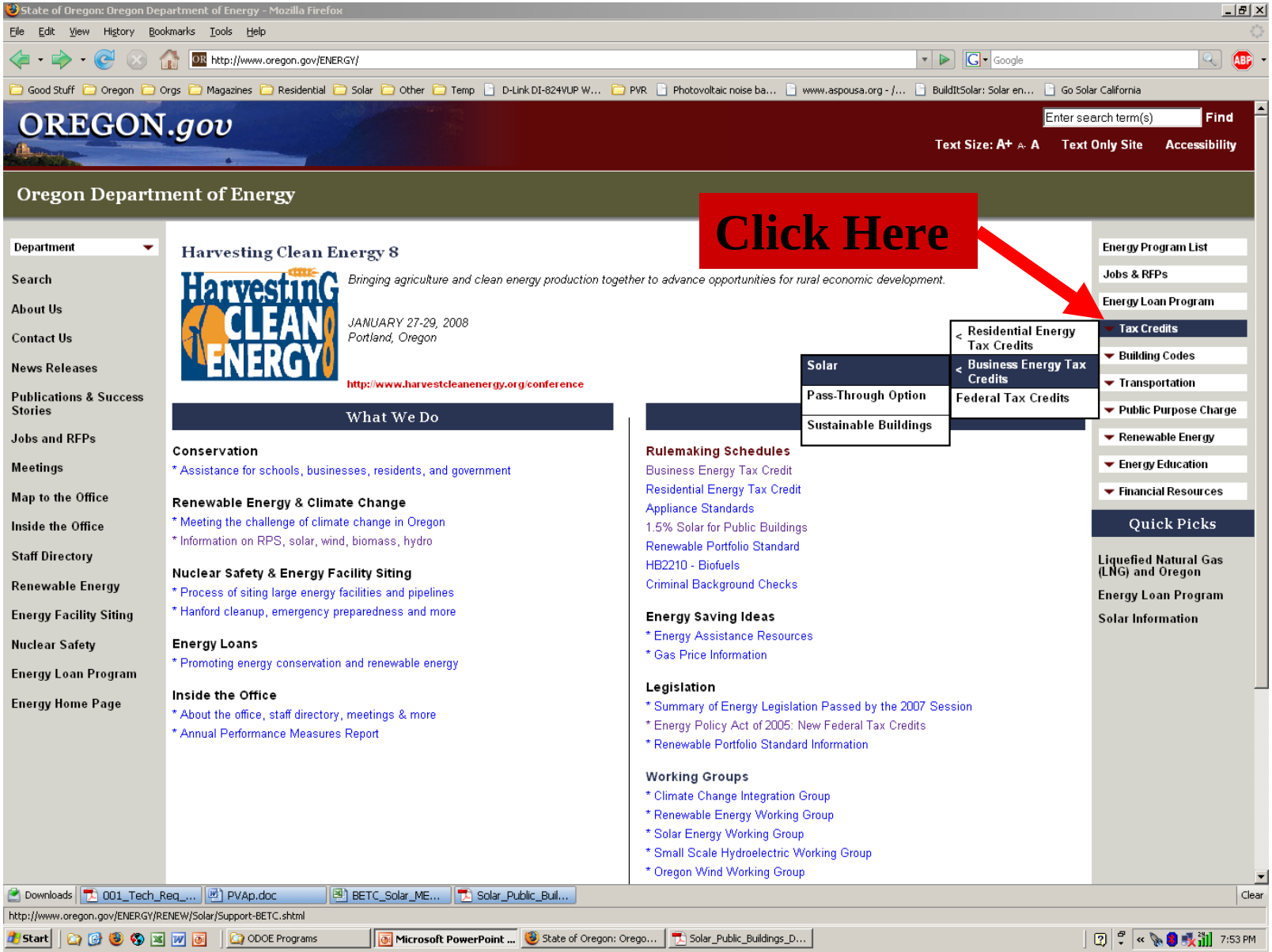
Christopher Dymond	(503) 378-8325
Rob Delmar	(503) 378-

ODOE Handouts

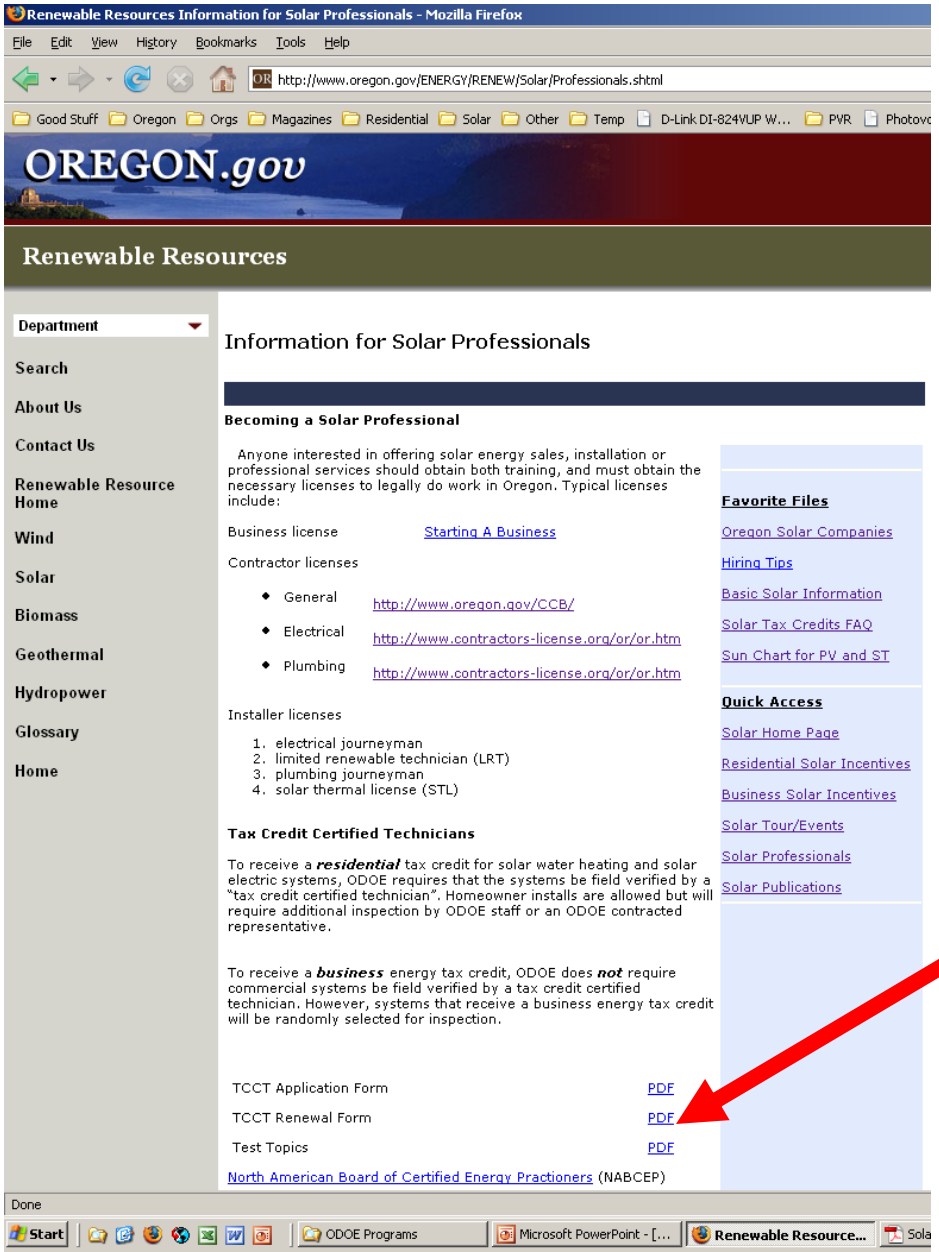
- Program Brochures
  - BETC, RETC, SELP
- Consumer Guides
  - Solar Electric
  - *Solar Water Heating*
  - *High Performance Homes*
- Solar & Green Magazine

- Call ODOE if you need more (800) 221-8035

ODOE Web Site

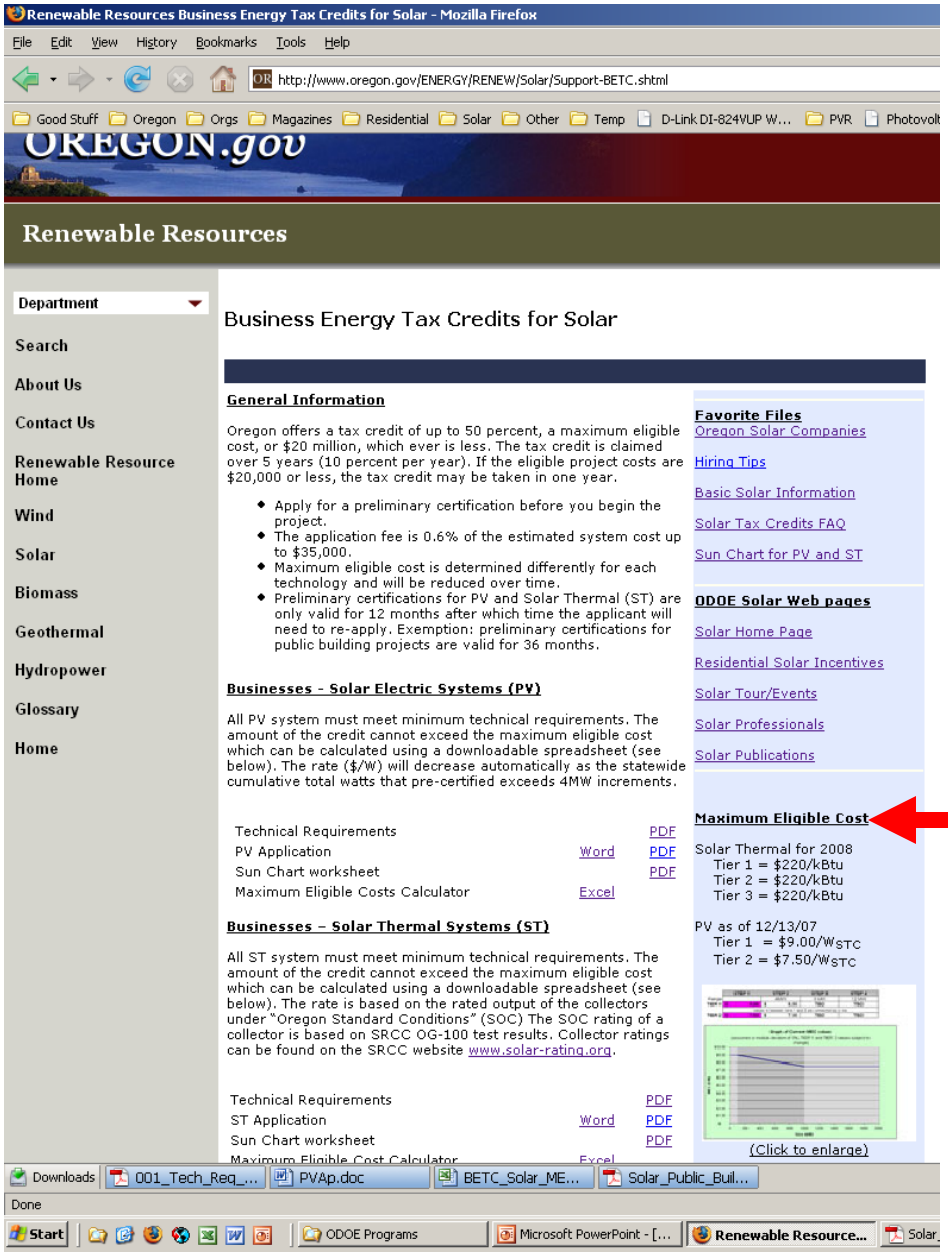


BETC for Solar Web Page



TCCT Applications

Solar Professionals Web Page



Maximum Eligible Cost Rate