BEFORE THE PUBLIC UTILITY COMMISSION

OF OREGON

UM 1505

In the Matter of	**)**	
	)	
Public Utility Commission of Oregon	**)**	
	)	**A cost comparison of Oregon's**
Solar Photovoltaic Draft Report	**)**	**incentive systems for residential**
Comments and Recommendations	**)**	**solar electric power**
	)	
	)	

Introduction

The pilot "feed-in tariff" solar incentive program competes with incentives offered by the Energy Trust of Oregon (ETO). The Oregon Legislature required the PUC to prepare a report that compares the cost of these two incentive systems. Since I couldn't find a cost comparison in the November 9th Draft Staff Report, I decided to create one myself. You will find it starting at the top of next page. It comes in two parts:

1. **A Cost Comparison of Incentive Systems**
2. **Appendix A: Facts and assumptions behind Tables 1 through 3**

I did my best to create and write an unbiased comparison.

Acknowledgements

- Kelcey Brown helped me collect raw data about the pilot solar incentive program.
- Kacia Brockman, Senior Solar Program Manager, Energy Trust of Oregon, provided data about ETOs activities along with top-quality advice.

Tables 1 through 4 were calculated in an Excel workbook named SolarComparison.xls that I have attached to this filing.

I hope the PUC finds this analysis useful and incorporates it into their report to the legislature.

Submitted in good cheer,

Dave Sullivan, December 7, 2010

A Cost Comparison of Incentive Systems

This comparison calculates the cost-per-kilowatt hour for Oregon's two incentive systems for residential solar electric power:

1. **VIR Incentives:** Homeowners receive a fixed volumetric incentive rate (VIR) for each kilowatt hour produced by their solar system.
2. **ETO + RETC Incentives:** Homeowners receive three types of payment. First, an up-front cash incentive is paid by the Energy Trust of Oregon (ETO) that reduces the system's purchase price. Second, homeowners can claim an Oregon Residential Energy Tax Credit (RETC) on their Oregon tax returns. Third, homeowners use net metering to reduce their electrical bills.

One way to make a complex topic understandable is to begin with a specific example. Our example uses cost and production figures taken from a solar system installed in early December 2010 in Albany, Oregon.

For clarity, this example assumes the system has a 15-year life with no residual value, and it ignores the fact that the solar panels will degrade slightly during those years. The example assumes future cash payments should be discounted by 4 percent to arrive at present values. Finally, the example assumes electrical rates will increase by 4 percent per year. Appendix A describes the example system in more detail along with the model's assumptions and methods of calculation. It also discusses the model's sensitivity to changes in the interest rate assumptions.

Table 1: The cost per kilowatt hour for an example solar system installed in Albany, Oregon

Facts about the example system:

Cost of system	$46,622
Kilowatts of DC capacity	9.40
Kilowatt hours produced/year	11,008
Feed-in tariff rate/kilowatt hour	$0.585
Oregon Residential Energy Tax Credit	$6,000
Energy Trust cash incentive per wattDC	$1.50
Net metering rate/kilowatt hour in 2010	$0.09
Annual increase in electrical rates	4%
Interest rate	4%

Results from the two incentive systems:

Line	Description	VIR Incentives	ETO + RETC Incentives
1	Energy Trust cash incentive	-	$14,100
2	Oregon Residential Energy Tax Credit	-	$5,445
3	Present value of electricity payments	$71,596	$14,860
4	Total	$71,596	$34,405
5	Kilowatt hours produced in 15 years	165,113	165,113
6	**Cost per kilowatt hour**	**$0.43**	**$0.21**

The bottom line of Table 1 shows that for this particular solar system, the VIR Incentives cost more than twice as much the ETO + RETC Incentives (43 cents versus 21 cents per kilowatt hour). That explains why the owner chose to sign up for the VIR Incentives.

Table 1 showed a specific example; Tables 2 and 3 use similar methods to compare costs for all residential solar projects undertaken at Pacific Power and PGE during 2010. Once again, Appendix A contains details about assumptions and methods of calculation.

Table 2: The cost per kilowatt hour for all small-scale solar projects funded by VIRs during 2010

Line	Description	PGE	Pacific Power	Total
1	Present value of all VIR payments	$37,892,454	$11,490,564	$49,383,018
2	Kilowatt hours produced in 15 years	87,553,485	27,196,695	114,750,180
3	**Cost per kilowatt hour**	**$0.43**	**$0.42**	**$0.43**

Table 2 calculates the average cost per kilowatt hour of using VIRs for small-scale systems; that is, systems with less than 10 kilowatts of capacity. Table 2 assumes all capacity reservations made on July 1, 2010 and October 1, 2010 will actually be installed. As a practical matter, some reservations will be abandoned and won't turn into functioning solar systems, so values in Lines 1 and 2 are both somewhat overstated, but this won't affect the cost per kilowatt hour of the systems that get installed.

To summarize, Table 2 shows the VIR Incentives will cost about 43 cents/kilowatt hour. If all 2010 capacity reservations turn into actual systems, then the resulting systems will produce over 100 million kilowatt hours over the 15-year period.

Table 3: The cost per kilowatt hour for all residential solar projects funded by ETO + RETC Incentives from January 1st through November 30th in 2010

Line	Description	PGE	Pacific Power	Total
1	Residential solar electric projects	478	388	866
2	Kilowatt hours/year	1,519,251	1,242,182	2,761,433
3	Energy Trust cash incentives	$2,776,385	$1,661,613	$4,437,998
4	Oregon Residential Energy Tax Credit	$2,602,635	$2,112,599	$4,715,234
5	Present value of electricity payments	$2,050,989	$1,676,946	$3,727,935
6	Total	$7,430,009	$5,451,158	$12,881,166
7	Kilowatt hours produced in 15 years	22,788,765	18,632,730	41,421,495
8	**Cost per kilowatt hour**	**$0.33**	**$0.29**	**$0.31**

To summarize, Table 3 shows 866 homeowners in Oregon installed solar systems during the first 11 months of 2010 with the help of ETO + RETC incentives. The average cost of the resulting electricity will be around 31 cents/kilowatt hour. Over the 15-year period, the solar systems will produce 41 million kilowatt hours of electricity.

Appendix A: Facts and assumptions behind Tables 1 through 3

Figure 1: Dave Sullivan stands next to the electronics for his new solar system.

Information about the example solar system for Table 1 came from Dave Sullivan, a retired business professor, who lives in Albany, Oregon (see Figure 1). He reserved capacity for the example system in Oregon's pilot solar incentive rate program on October 1, 2010. His 9.4 kilowatt capacity reservation locked in a 58.5 cent/kilowatt hour VIR with Pacific Power for the next 15 years. Once Sullivan had this capacity reservation, he shopped for a solar installer and signed a contract with SunWize Technologies, Inc. of Philomath, Oregon to provide and install the system for $46,622.

The solar panels were installed on a south-facing roof that is not shaded by trees or other obstructions in Albany, Oregon (see Figure 2). According to the Energy Trust of Oregon estimation methods, the system will produce 11,008 kilowatts each year.

Values in Table 1 are calculated as follows:

- Line 1: The Energy Trust of Oregon pays $1.50 per watt for residential solar systems served by Pacific Power up to a maximum $20,000 payment.
- Line 2: The Oregon Residential Energy Tax pays $3.00 per watt up to a maximum of $6,000. Because these tax credits must be spread over four years, their present value is $5,445 when discounted at 4 percent.
- Line 3, VIR column: The $.585 VIR times 11,008 kilowatts per year results in $6,039 per year for 15 years. When this stream of payments is discounted at 4 percent, their present value is $71,596.
- Line 3, Energy Trust + RETC column: The $.09 net metered rate times 11,008 kilowatts results in an initial savings of $991 for the first year. Values for later years have self-cancelling adjustments: Electricity rates are assumed to rise 4 per year, and the savings are discounted back to the present by 4 percent per year.
- Line 5: 11,008 kilowatts per year times 15 years produces 116,113 kilowatts.
- Line 6: Line 4 divided by Line 5 results in overall cost-per-kilowatt figures.

Figure 2: Sullivan's 9.4 kilowatt system almost completely covers the south-facing portion of the roof.

Lines in Table 2 are calculated as:

- Line 1 calculates the present value of all VIR payments by discounting future payments by 4 percent per year.
- Line 2 lists the total number kilowatt hours these systems will produce during the first 15 years.
- Line 3 divides Line 1 by Line 2 to determine the average cost per kilowatt hour of these projects over a 15-year life.

In Table 3, lines 1 through 3 came from the ETO. These lines show the number of residential projects, their kilowatt capacity, and ETO incentives for all solar projects funded by ETO from January 1st through November 30th in 2010. Other lines in Table 3 are calculated as:

- Line 4 assumes all projects in Line 1 will receive a $6,000 Residential Energy Tax Credit spread over the first four years at $1,500 per year. These payments have been discounted back to the present at 4 percent per year.
- Line 5 calculates the first year's electricity value by multiplying $.09 net metered rate times Line 2. Values for later years have self-cancelling adjustments: Electricity rates are assumed to rise 4 per year, and values are discounted by a 4 percent interest rate per year.
- Line 7 multiplies Line 2 by 15.
- Line 8 divides Line 6 by Line 7 to determine the average cost per kilowatt hour of these projects over a 15-year life.

Sensitivity Analysis:

Table 4 explores how the cost-per-kilowatt hour reacts to changes in assumptions about inflation for cash and electricity.

Table 4: The effect of varying the cash discount rate and electricity inflation rate assumptions on the cost-per-kilowatt hour for both of Oregon's residential solar incentive programs

"What-if" Assumptions		Results in Cost per kilowatt hour	
Cash discount rate	Electricity inflation rate	VIR Incentives	ETO + RETC Incentives
0%	0%	$0.58	$0.31
4%	0%	$0.43	$0.29
8%	0%	$0.33	$0.27
0%	4%	$0.58	$0.35
4%	4%	$0.43	$0.31
8%	4%	$0.33	$0.29
0%	8%	$0.58	$0.40
4%	8%	$0.43	$0.34
8%	8%	$0.33	$0.31