To: Kelly Knutsen and Sarah Wright, Utah Clean Energy Date: November 4, 2008
From: Gwen Rose, The Vote Solar Initiative

RE: Solar PV assumptions in the Quantec DSM report

This memo reviews several assumptions made in the "Assessment of Long Term Potential for Demand Side and other Supplemental Resources" report as well as comments by NREL and Pacificorp.

In summary, The Vote Solar Initiative finds:

- Federal tax credits elements have changed since the last LCOE calculations were done
- The assumption for system cost declines over time are overly conservative based on current market analysis
- The assumption for average system costs are on the higher than U.S. and global average
- Administrative costs are much higher compared to the administrative costs of other PV rebate programs

We would recommend the calculations for LCOE be updated to reflect the new federal tax credit parameters and include a sensitivity to a range of system prices and cost reductions and that the administrative costs not be set as a percentage of system costs.

Levelized Costs and Installed System Costs

Federal tax credits

Pacificorp notes in its June 18, 2008 memo to NREL:

> *In addition, the federal tax credits are scheduled to sunset on December 31st, 2008 and may not get extended…The federal tax incentive for residential customers is 30% of installed costs with a cap of $2,000. The federal tax incentive for commercial customers is 30% of installed costs with no cap.* (page 2)

As of October 3, 2008, the federal investment tax credits for solar have been extended and include the following relevant changes:

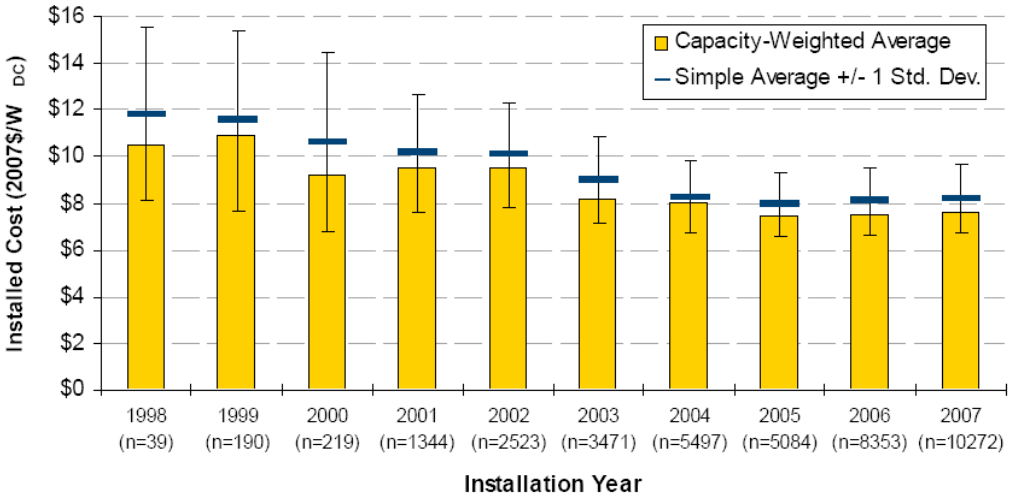
- 8-year extension; tax credits are available through 2017
- Commercial and residential systems will receive a 30% tax credit
- The $2,000 cap for residential systems has been removed

These changes, particularly the security of the tax credits and removal of the residential cap, would lower the LCOE.

Historic Declines in Module and Non-Module Costs:

The report "Assessment of Long Term Potential for Demand Side and other Supplemental Resources" states that the capital costs are kept "nominally constant (therefore decreasing in real terms), based on historical trends." (page 117)

However, historic and recent market data indicates that cost declines for PV systems are greater than the assumed 1.9% inflation rate. Recent analysis from Lawrence Berkeley National Laboratory (LBNL)[1] of project-level data for 37,000 completed, grid-tied systems in 12 states totaling 363 MW_{dc} found that PV costs have declined an average of $0.32/kWdc in 2007$ dollars – equivalent to 3.1% per year (real)/4.8% per year (nominal) from 1998 – 2007.



Source: LBNL

This is supported by additional analysis from Photon Consulting which indicates that from 2006 – 2007, the factory price and wholesale price of modules dropped 6%. From 2008 – 2010, module prices are expected to drop by 8% per year. For entire systems, prices are expected to drop 7% – 8%.

Global Price Outlook to 2010

Global price outlook to 2010					
	2006	2007	2008	2009	2010
Module Price (Factory Gate)	$4.01	$3.78	$3.60	$3.30	$3.03
Module Price (Wholesale)	$4.21	$3.97	$3.78	$3.47	$3.19
Non-Module	$3.46	$3.45	$3.09	$2.85	$2.67
System	$7.67	$7.42	$6.87	$6.31	$5.86

Source: "Detailing Demand", 2008. Photon Consulting

[1] Wiser, Ryan, Lawrence Berkeley National Laboratory. "An Empirical Investigation of PV Cost Trends, and Implications for Incentive Program Design". Solar Power International, October 2008.

Initial Installed Cost

The DSM report uses the assumption that the cost per kilowatt for PV is $9000/watt. This appears to be in the higher range.

The global average price for a PV system is $7.42/watt. Most system prices have declined from 2006 levels. The table below indicates that the system price for "Rest of North American" (sans California) is $8.45/watt. The analysis from LBNL puts the average system cost for other nearby markets slightly lower: Arizona is $7.75/watt and Oregon is $8.30/watt.

Prices by Market and Market Segment in 2007

Prices by market/market segment, 2007

Market	2007 weighted average price ($/watt)				Year on year change (%)			
	Module (FG)	Module (WS)	Non-mod	Sys. price	Module (FG)	Module (WS)	Non-mod	Sys. Price
Japan	$2.90	$3.05	$2.75	$5.80	(11%)	(10%)	12%	(1%)
Germany field (non c-Si)	$2.30	$2.40	$2.60	$5.00	(4%)	(4%)	(1%)	(3%)
Germany field (c-Si)	$3.60	$3.80	$1.55	$5.35	(10%)	(10%)	3%	(6%)
Germany rooftop	$3.80	$4.05	$2.30	$6.35	(10%)	(8%)	5%	(4%)
Spain field	$4.05	$4.25	$2.90	$7.15	(6%)	(6%)	(6%)	(6%)
Italy rooftop	$4.10	$4.30	$4.20	$8.50	(5%)	(4%)	0%	(2%)
Italy field	$4.10	$4.30	$2.90	$7.20	n/a	n/a	n/a	n/a
California non-residential	$3.60	$3.80	$2.90	$6.70	(5%)	(6%)	(9%)	(7%)
California residential	$3.70	$3.90	$3.70	$7.60	(8%)	(7%)	12%	1%
Rest of North America	$3.80	$4.00	$4.45	$8.45	(10%)	(9%)	(9%)	(9%)
South Korea	$4.00	$4.20	$4.00	$8.20	(2%)	(2%)	(4%)	(3%)
France rooftop	$4.30	$4.50	$5.00	$9.50	2%	2%	3%	3%
France field	$4.00	$4.20	$3.70	$7.90	0%	0%	1%	1%
Greece	$4.10	$4.30	$4.60	$8.90	(5%)	(5%)	2%	(1%)
China	$3.60	$3.80	$2.95	$6.75	(3%)	(3%)	(3%)	(3%)
Integrated products	$4.75	$5.00	$7.00	$12.00	0%	0%	0%	0%
Unallocated	$4.05	$4.20	$4.65	$8.85	(5%)	(5%)	1%	(2%)
Global Average	$3.78	$3.97	$3.45	$7.42	(6%)	(6%)	0%	(3%)

Source: "Detailing Demand", 2008. Photon Consulting

Administrative Costs

To determine potential administrative costs, 15% is added to the total capital costs, adding an equivalent of $1,350 per system. This is likely to be much higher than the actual costs necessary to run a rebate program, and is higher than the administrative costs of other rebate programs around the country.

By way of example, the California Solar Initiative has established an administrative budget of $216,000,000 over 10 years (10% of the total program cost). Under this program, utilities are providing incentives to build 1,970 Megawatts of solar PV on homes and businesses. On a capacity basis, that is around $110 per kW in administrative costs. Assuming an installed cost from $7500/kW - $9000/kW, the administrative costs are equivalent to 1.2% - 1.5% of total capital cost.