SUNPOWER

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September 1, 2009
California Energy Commission Dockets Office
MS-4 Re: Docket No. # 09-IEP-1E
1516 Ninth Street Sacramento, CA 95814-5512

Re: SunPower's Comments on the Draft Staff Report Entitled "Comparative Costs of Central Station Electricity Generation."

The below summarizes SunPower's comments on the draft 2009 staff report on the comparative costs of central station electricity generation.

- Scale – Six central station PV Power plants representing more than 1 GW of capacity are now contracted with California utilities at a scale of 50 MW or more under their RPS programs. Based on the utility solar programs and the CPUC proposed FiT, more than 1 GW of capacity is expected to be deployed by 2015 through distributed PV power plants of 1 to 20 MW in scale. Thus, SunPower proposes that the CEC include both central station and distributed PV power plants as separate line items in its COGS. The two resource types have different strengths with distributed power plants being faster to interconnect and permit but achieving lower economies of scale than central station plants. We propose that the COGS consider a 20 MW distributed PV power plant and a 200 MW central station PV power plant.

- Capacity Factor – SunPower recommends increasing the assumed capacity factor for the 25MW single-axis PV system from 27% to 30% (AC). For reference, in 2008 the 12.0 MW (AC) Nellis AFB single-axis PV tracking system constructed and operated by SunPower generated 32,464 MWh[1] resulting in a 30.8% capacity factor. The available solar resource in Las Vegas in 2008 was 3.5% below normal further validating 30% as a reasonable assumption. The 30% capacity factor is similar to what we anticipate for our California PV power plants such as the 210MW California Valley Solar Ranch (CVSR). CVSR will use single-axis trackers tilted at 15 degrees and will achieve a capacity factor of approximately 30%. PV power plants located in other even higher resource locations in California such as the Mojave Desert are capable of capacity factors approaching 34%. It should be noted that almost all of the utility-scale PV plants announced in California are proposed for very high-resource locations. The 30% capacity factor is also predictable from year to year. SunPower has studied 10 years of historical annual variation in solar resource in the Mojave Desert and anticipates an annual variation in capacity factor of +-5% around the 30 year average used to estimate capacity factors.

- Equipment Life, and Depreciation – SunPower recommends increasing the 20 year equipment and depreciation life to 30 years, the same value used for wind turbines in the draft report. Unlike wind, PV power plants have very little mechanical wear and maintenance requirements and operate under relatively benign conditions. PV panels and trackers are well established technologies with over thirty years of demonstrated performance. Another data point is that the Florida Public Utility Commission unanimously ruled in December 2008[2] that a 30 year depreciation life was appropriate for the single-axis tracking PV power plants SunPower is building for Florida Power and

[1] NV Energy Portfolio Standard Annual Report, April 1, 2009 p. 42 derived from 79,539 MWh of credit given based on a 2.45 PV multiplier which equates to 32,465 MWh of real energy production on the 12.0MW AC nameplate plant rating
[2] http://www.psc.state.fl.us/dockets/cms/docketdetails.aspx?docket=080543

Light including the 25 MW Desoto PV plant.

- Debt Term – Coupled with the above, SunPower recommends a debt term of 20 years, the same as assumed for wind. Both wind and large-scale PV plants are financed using standard power project finance regimes and share similar characteristics.

- O&M Costs – In the draft report an O&M cost of $68/kW per year is assumed for both a PV and CSP power plant. SunPower's experience in operating more than 300 MW of solar power plants using a wide variety of system technology around the world is that the O&M cost for PV is dramatically lower than CSP. There are approximately 90% fewer technicians and 98% less water used for a given amount of capacity. A CSP plant operates a steam plant which is maintenance and water intensive. SunPower estimates that PV plants will have a ratio of 1 technician to 25-50MW of capacity. This would result in an O&M cost more than 50% less than CSP. We recommend using an assumed value for the study of $30/kWp/year. This number is likely going to be even lower in the future as we finalize the operational cost model for large scale PV plants.

- Capital Costs – Owing to the scaling of very large scale PV module factories, the introduction of new technologies, and the availability of sufficient silicon feedstock, the price of PV power plants is falling dramatically. We note that Nextlight Renewable Power's 230MW AV Solar Ranch I project was priced at or below the 2008 market price referent[3] of $132.90 / MWh for projects entering service in 2014 for PG&E. In addition, we would like to introduce to the record attachment A, the capital cost reduction forecast from the Department of Energy for PV power plants, which is now in formal review at DOE. We have received permission from DOE to provide this data to the CEC for the COGS from the technical lead, Robert Margolis[4]. We would also like to reference the 2008 EERE GPRA final report[5] which contains capital cost information which will be updated with the work of Robert Margolis and others at the DOE.

We look forward to working with KEMA and the CEC to further enhance our understanding and projections on of the cost of generation from PV power plants.

Sincerely,

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Attachments:

A) Draft Proposed PV application cost data from the DOE

[3] Pacific Gas and Electric Advice Letter 3469-E, June 4, 2009
http://www.pge.com/nots/rates/tariffs/tm2/pdf/ELEC_3469-E.pdf
[4] NREL, 2009, Margolis. Proposed revised PV application cost data under DOE solar program review
[5] http://www1.eere.energy.gov/ba/pba/pdfs/41347.pdf

DRAFT UNDER REVIEW - DOE PV APPLICATION COST DATA, NREL, 2009, ROBERT MARGOLIS

PV LCOE Targets (2009 Cents / kWh)	**2009**	**2015**	**2030**
Residential [1]			
Phoenix Mortgage [2]	15.44	6.47	6.52
Phoenix Home Equity Loan [3]	21.44	9.27	8.24
Kansas City Mortgage [2]	18.84	7.90	7.95
Kansas City Home Equity Loan [3]	26.15	11.31	10.05
Commercial [4]			
Phoenix 15% Tilt	10.61	4.21	4.49
Phoenix Horizontal	11.56	4.59	4.89
Kansas City 15% Tilt	13.10	5.20	5.54
Kansas City Horizontal	14.41	5.72	6.10
Utility [5]			
Phoenix Low Financing [6]	11.36	4.81	5.76
Phoenix High Financing [7]	14.48	6.09	7.52

General Assumptions	***2009***	***2015***	***2030***
Module Efficiency	13.5%	20.0%	25.0%
Inflation Rate	2.5%	2.5%	2.5%

Residential Assumptions	***2009***	***2015***	***2030***
Installed System Cost ($/Watt) [8]	$6.98	$3.50	$2.20
Inverter Replacement Cost ($/Watt, at time of replacement)	$0.228	$0.190	$0.185
Inverter Replacement Labor Cost ($, at time of replacement) [9]	$470	$370	$370
Inverter Replacement Lifetime (Years)	10	20	20
O&M Cost ($/kW/yr)	$56.3	$17.0	$10.0
Derate %	89.5%	92.0%	93.0%
Inverter Efficiency	90.0%	94.0%	95.0%
ITC	30%	30%	0%

1. Real discount rate is 5.5%, federal tax is 28% and state tax is 7%, and loan interest is tax-deductable in both financing cases. System orientation is tilted at latitude (33° for Phoenix, 39° for Kansas City)

2. Mortgage assumes that 100% of system is financed with 30-year fixed mortgage at 6.0% (nominal)

3. Home Equity Loan assumes that 100% of system is financed with 15-year loan at 7.75% (nominal)

8. 2009 installed system cost from Q1 2009 Citigroup installer survey, discounted 10% to account for installers' anticipated Q2 pricing declines

9. Based on 2009 estimate from Standard Solar of $600 for residential inverter replacement, decreasing to account for greater labor efficiency over time

Commercial Assumptions	***2009***	***2015***	***2030***
Installed System Cost ($/Watt) [10]	$6.08	$2.50	$2.00
Inverter Replacement Cost ($/Watt, at time of replacement)	$0.139	$0.130	$0.126
Inverter Replacement Labor Cost ($, at time of replacement) [11]	$2,071	$1,831	$1,831
Inverter Replacement Lifetime (Years)	15	20	20
O&M Cost ($/kW/yr)	$35.0	$16.2	$7.5
Derate %	90.0%	92.5%	93.5%
Inverter Efficiency	92.0%	95.0%	96.0%

ITC	30%	30%	10%

4. Real discount rate is 6.5%, federal tax is 35% and state tax is 8%, and system is 50% financed with a 15-year commercial loan at 7.0% (nominal)

10. 2009 installed system cost from Q1 2009 Citigroup installer survey, discounted 10% to account for installers' anticipated Q2 pricing declines

11. Based on 2009 estimate from Standard Solar of $3000 for 150kW inverter replacement, decreasing to account for greater labor efficiency over time

Utility Assumptions	***2009***	***2015***	***2030***
Installed System Cost ($/Watt) [12]	$5.00	$2.20	$1.90
Inverter Replacement Cost ($/Watt, at time of replacement)	$0.139	$0.130	$0.126
Inverter Replacement Labor Cost ($/150kW inverter, at time of replacement) [13]	$690	$610	$610
Inverter Replacement Lifetime (Years)	15	20	20
O&M Cost ($/kW/yr)	$30.0	$15.1	$6.5
Derate %	90.0%	92.5%	93.5%
Inverter Efficiency	92.0%	95.0%	96.0%
ITC	30%	30%	10%

5. Federal tax is 35% and state tax is 8%. System uses 1-axis tracking with tilt at latitude (33° for Phoenix).

6. Low Financing assumes 6.5% real discount rate, 12% required IRR and installation 50% financed with 15-year loan at 6.0%

7. High Financing assumes 8.5% real discount rate, 17% required IRR and installation 50% financed with 15-year loan at 8.0%

12. 2009 installed system cost based on expected installed cost for 30 MW Austin Energy installation and necessary installed cost to meet California's Market Price Referent

13. Based on 2009 estimate from Standard Solar of $3000 for a single 150kW inverter replacement from a commercial building, decreased to account for economies of scale and greater labor efficiency over time

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