



MEMO

To:	John Rush, PacifiCorp and Tina Jayaweera and Heidi Ochsner, The Cadmus Group
From:	Annie Carmichael, Manager of Interior West, Government Affairs, SunEdison
Subject:	Camdus memo on "Overview of PV Inputs and Data Sources"
Date:	8 January 2018



SunEdison appreciates the opportunity to comment on the Camdus memo prepared for PacifiCorp. The memo presents two sets of assumptions for residential and commercial distributed generation (DG) solar systems. The assumptions in this memo will inform the Camdus Groups' calculation of the current and projected levelized cost of energy (LCOE) of DG solar. The LCOE will in turn help the firm produce supply curves for DG solar projected to be installed in PacifiCorp territory over the next twenty years as part of the preparation effort for the 2011 Integrated Resource Plan (IRP). The assumptions in this memo need to be carefully vetted by all IRP stakeholders, and we look forward to participating in that process, and to participating in the Utah solar energy market as it grows. Due to the short turn around, these are preliminary comments and we hope there will be adequate time given to the stakeholders to provide further comments.

SunEdison is North America's largest solar energy services provider. We develop, finance, own and operate solar power plants across the globe. We also provide 24/7 monitoring and maintenance service, which results in high system performance and economic benefits to our customers. SunEdison manages more than 350 operational sites in ten states (with a focus on New Jersey, California, Colorado), Canada and Spain, totaling more than 125 MW under management worldwide. We have been active in Western states for several years both in helping to shape solar policies as well as business development.

SunEdison would like to call attention to a few assumptions in the Camdus memo that do not reflect the current market conditions we are experiencing in the field installing solar systems. Given that SunEdison focuses on the commercial sector, we will focus our comments on the assumptions laid out in Table 3.

The Camdus group sites multiple credible sources for solar cost data collection. However, much of the cost data is backwards looking. The current and projected cost of installing commercial solar systems in states across the West is dramatically cheaper than what the Camdus memo lays out. Part of that delta is because the price of solar panels, which account for almost half the total system cost, has fallen more than 40% in the last 24 months, and analysts project further sharp declines in prices in the next few years.¹ We believe that the Camdus memo does not take such prices drops into account.

Another factor is that the solar industry is still developing in Utah, and is still largely in the "boutique" stage. Most of the larger national companies view Utah as a "closed market," due to lack of policy drivers, such as a mandatory renewable portfolio standard, or incentives for installing solar systems. However, if Utah and PacifiCorp invest in solar, that perspective will change quickly as it has in the surrounding states. If the state chooses to prioritize solar development, Utah can expect the statewide solar industry to quickly mature, and for national companies like SunEdison to bid on projects. This increased activity will undoubtedly change the cost of installing solar in Utah. In particular, the state can expect rapid price declines on the commercial side, where the economies of scale offer a comparative price advantage. In summary, we caution against extrapolating largely from current Utah data, where very little solar activity had incurred. Again, if the market were opened with appropriate solar policies, the

¹ Solar Energy Industry Association, "US Solar Industry Year in Review 2009." Thursday, April 15, 2010. http://www.seia.org/galleries/pdf/2008_Year_in_Review-small.pdf.



experience from other states has shown that the solar industry can quickly drive down prices as competition increases.

Table 3: Commercial Assumptions & SunEdison Response

<i>Input</i>	<i>Camdus Recommended Value</i>	SunEdison Recommended Value	SunEdison Reasoning
<i>Average size</i>	<i>7.9 kW (CEC PTC AC)</i>	300 kW (average size of SunEdison commercial solar system. We have over 105 Megawatts of solar projects installed across the country. Note, we have not incorporated the CEC PTC calculations in our figures.)	A small pilot program should not be used to project future commercial solar systems. Economies of scale are achieved on larger systems, which is why utilities that offer incentives on commercial solar systems focus attention on larger system sizes. For example, in Colorado, XCEL's commercial solar program is offered on systems between 10kW to 500 kW. The average commercial system size in Colorado is 300 kW, and in California the average for commercial projects that apply for California Solar Initiative (CSI) incentives the average system is around 250kW.
<i>Installation Cost</i>	<i>\$7.80/W</i>	\$4.00-\$5.00/W	Again, Utah's small commercial pilot program is not an accurate reflection of current market prices. Across the West, cost per installed watt continues to drop. In Colorado, which has a relatively mature solar market, the price is roughly \$4/watt for small commercial systems (10- 300kW). For larger commercial projects the price will soon be around \$3.50 to \$3.00. According to Tracking the Sun, which the Camdus report cites, in 2008, the average net installed cost faced by PV system owners – that is, installed cost minus after-tax incentives – stood at \$4.2/W for commercial PV.
<i>O&M Cost</i>	<i>\$75</i>	\$21- 25/kW	According to the default input in the National Renewable Energy Lab's Solar Advisory Model (SAM), O&M costs for commercial systems hover between \$21 to 25 depending on the size of the system. The SAM O&M costs match our experience in the field installing systems. For example, for a 300 kW system average O&M cost cover around \$20/kW.
<i>Capacity Factor – UT</i>	<i>0.18</i>	0.18 - 0.24	The capacity factor will vary substantially depending on where the systems are installed and what types of systems are installed. Single axis tracking systems installed in the southern part of the state will produce a considerably higher capacity factor. For example, using PV Watts, a 1kW DC single axis tracker system in Cedar City will produce 2092 kWh/kW while a fixed tilt system will



			produce roughly 1570 kWh/kW. Thus while an 0.18 capacity factor may reflect the solar output of a fixed tilt system in Cedar City, the equivalent capacity factor for a single axis system would be closer to 23.9%. SunEdison has found single axis tracking systems to be cost effective at system sizes as small as 1 MW.
<i>Tilt</i>	37 degrees	Range: Commercial rooftops vary from 10-15 degrees; ground mount assumes single axis tracking.	Camdus assumed an “average residential system tilt” for the Utah Solar PV Incentive Pilot Program. For commercial systems this is a project dependant factor. Ground mounts or rooftop systems will have different tilts.

This concludes our preliminary comments, and again we look forward to the continuation of this dialogue. Thank you for considering our perspective, and if you have any questions I can be reached at acarmichael@sunedison.com or (720) 202-2317.