Renewable Energy Industry

1 September 2015
Comments of Renewable Northwest

1. **Currently, what are the installed costs for typical net-metered solar PV systems of 5 KW, 10 KW, 50 KW, 100 KW, 500 KW, 1,000 KW, and 5,000 KW?**

The quarterly U.S. Solar Market Insight, prepared by the Solar Energy Industries Association ("SEIA") and GTM Research, reports major trends in the U.S. solar industry. The Solar Market Insight Report for the first quarter of 2015 (Q1 2015) determines national solar PV system pricing based on tracked wholesale pricing of major solar components and data collected from major solar installers, with supplemental data collected from state and utility solar programs.[1] It should be noted that these numbers are national averages, and in-state numbers will differ depending on relative solar market maturity.

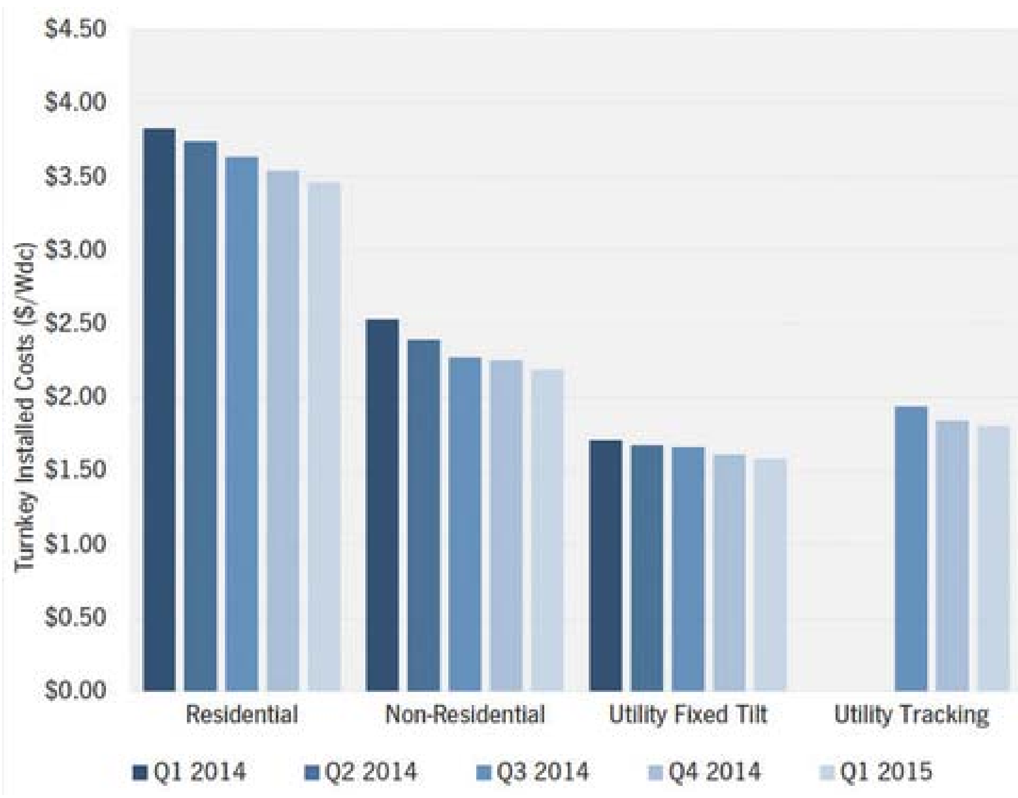

Figure 1—Modeled U.S. National Average System Costs by Market Segment, GTM Research/SEIA 2015.

Figure 1 shows that system pricing has fallen year-over-year by 9% to 14%. In relation to Question 1, residential systems are typically below 10kW, with SEIA reporting a turnkey installation cost of $3.46/W_{DC}$ in Q1 2015. Non-residential systems can cover a broad range

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[1] SEIA, Solar Market Insight Report 2015 Q1, Executive Summary, www.seia.org/research-resources/solar-market-insight-report-2015-q1

of system sizes and projects: from small systems similar to residential projects, to much larger ground-mounted systems approaching utility scale (for example, Oregon has a net-metering size limit of 2000 kW for non-residential net-metered systems)[2]. SEIA determine a medium-scale commercial solar rooftop system to be \$2.19/W_{DC} in Q1 2015. For utility sized systems, often measured in the 1000s of kW, SEIA determined the national weighted average for fixed-tilt systems to be \$1.58 /W_{DC}, and tracking projects to be \$1.80 /W_{DC} .

2. **If the net-metered systems in question 1 were required to have separate production meters, what would be the incremental installed cost for each project size?**

No specific data available at this time.

3. **Nationally, what percentage of total net metered systems fall into the size ranges in question 1 (0-5 KW, 5-10 KW, 10-50 KW, etc.)?**

It was challenging to find data specific to net-metered systems. The Solar Energy Industries Association ("SEIA") makes available information on the solar industry in general. **Figure 2** reveals that the size and type of systems installed are driven by a combination of factors, including the available solar resource, power prices, and state policy.[3] For example, Massachusetts has significant proportion of non-residential solar as the state and utilities have a variety of policies in place (such as sales tax exemptions, grants, loans, rebates) that make investing in solar an attractive option for businesses.[4]

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[2] Oregon Administrative Rules, Division 39, Net Metering Rules, 860-039-0010 (2) http://arcweb.sos.state.or.us/pages/rules/oars_800/oar_860/860_039.html

[3] SEIA, Solar Industry Data 2014, www.seia.org/research-resources/solar-industry-data

[4] Clean Energy Authority, Massachusetts Solar Rebates and Incentives, www.cleanenergyauthority.com/solar-rebates-and-incentives/massachusetts/

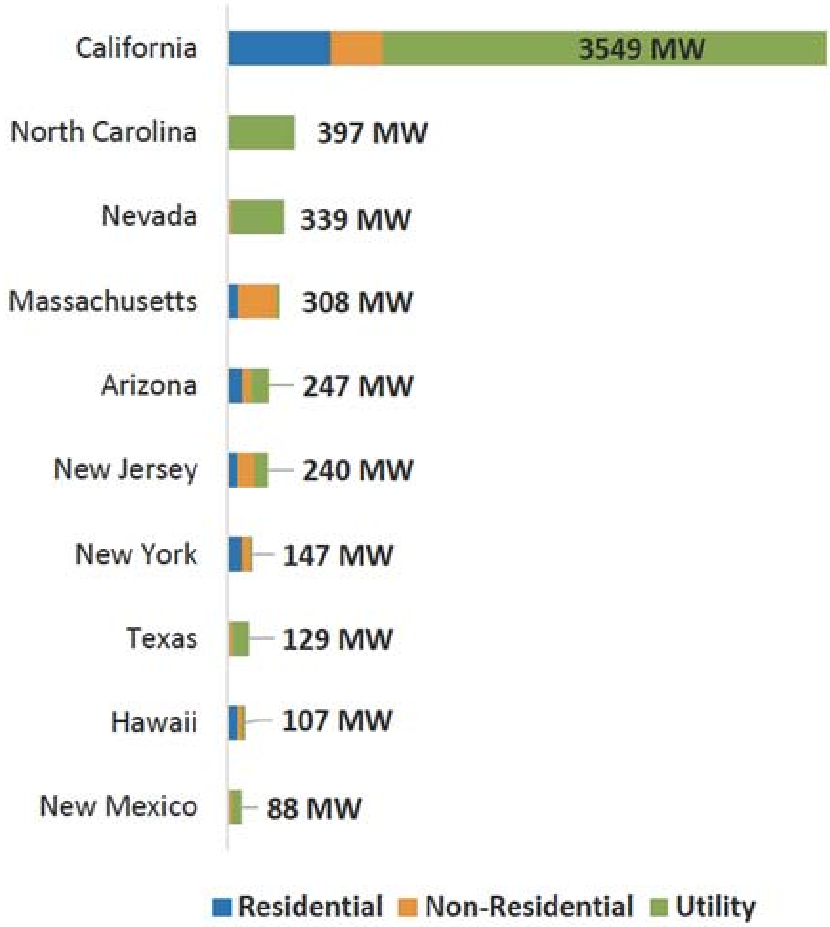

Figure 2—2014 Solar PV Installed Capacity, SEIA/GTM Research 2015

4. **Is there a reasonable generator size threshold above which production meters should be required and payments made based on utility avoided costs? If so, identify a reasonable size threshold and describe the basis for determining it.**

No; certainly not an easily identifiable, non-arbitrary, threshold. Fundamentally, net metered systems are designed to primarily offset a customer's own load, whereas PURPA (U.S. Public Utilities Regulatory Policies Act 1978) Qualifying Facilities are designed to generate bulk power and export it to the grid. Rate-making based solely on utility avoided costs should be reserved for PURPA Qualifying Facilities. The elements that compose a PURPA avoided cost rate might not include all of the components of a solar resource value, as discussed in Questions 7 and 8. Furthermore, the avoided cost (and solar resource value) is dependent upon the perspective from which the costs and benefits are being considered, as discussed in Question 9.

5. **Is there a reasonable threshold or saturation point for requiring the use of smart inverters?**

Modern power electronics and smart inverters have the potential to enable solar PV systems to respond to changes in voltage and frequency in a manner that contributes to grid reliability, and their rollout should be encouraged. However, underlying Question 5 is the topic of solar penetration and grid reliability, an issue which has been explored extensively at the state and federal level. The Small Generator Interconnection Procedures ("SGIP") were adopted by the Federal Energy Regulatory Commission ("FERC") in 2005, and apply to distributed energy resources up to 20 MW in capacity that fall under federal jurisdiction. The interconnection procedures that were developed were intended to be a model rule for consideration by state public utility commissions.

Most state interconnection procedures allow for expedited interconnection without additional technical studies if the proposed interconnection passes a series of technical screens. In 1999, before FERC set the SGIP, the California Public Utility Commission ("CPUC") established a 15% capacity threshold to identify situations where the amount of distributed generation capacity on a line section exceeds 15% of the line section's annual peak load. This 15% threshold was subsequently adopted by FERC for the SGIP. Penetrations above this threshold trigger the need for supplemental reliability studies. Montana's current administrative rules, codified in ARM 35.8.84, enable utilities to monitor and control small generating facilities once the aggregate nameplate capacity of all systems on a line is greater than 15% of the line section annual peak load (or minimum line load).[5]

Given the rapid growth and widespread deployment of solar PV system embedded in distribution grids across the country, the National Renewable Energy Laboratory ("NREL") undertook a review of the SGIP in order to ensure they were as streamlined as possible so as to avoid unnecessary studies, costs and delays.[6] NREL observed that there are many circuits across the United States and Europe with PV penetration levels well above 15% where system performance, safety, and reliability have not been materially affected, suggesting the existing 15% screen is indeed conservative.

In 2013 FERC updated the supplemental review process for interconnections that would exceed the 15% penetration level. If the aggregate generation capacity on a power line section is less than 100% of the minimum load, the small generation facility can interconnect if it passes two additional screens for voltage/power-quality and safety/reliability.[7] FERC determined that the 100% minimum load screen appropriately balanced the considerations of flexibility and reliability.

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[5] ARM 35.8.8408(8) www.mtrules.org/gateway/RuleNo.asp?RN=38.5.8408

[6] Updating Interconnection Screens for PV system Integration, U.S. Department of Energy, National Renewable Energy Agency, 2012.
energy.sandia.gov/wp/wp-content/gallery/uploads/Updating_Interconnection_PV_Systems_Integration.pdf

[7] FERC, "Small Generator Interconnection Procedures and Agreements", November 2012, p81.
www.ferc.gov/whats-new/comm-meet/2013/112113/E-1.pdf

6. **Is there a reasonable generator size threshold above which distributed generators should be subject to the same resource planning and procurement processes a regulated utility uses to procure other resources? If so, identify a reasonable size threshold and describe the basis for determining it.**

Net-metered distributed generation mainly offsets the participating customer's own on-site load, so in many ways has the same effect as energy efficiency. As with energy efficiency, net-metering should not be limited by the constraints of resource planning. However, utility integrated resource plans do take into account customer adoption of energy efficiency when determining resource need, and should do the same with net-metering.

As net-metering approaches significant penetrations (see Question 5), it is important to incorporate the systems and their anticipated growth into distributed energy resource plans (sometimes abbreviated to "DERPs"). The California Public Utility Commission required utilities to file "distribution resources plan" proposals on July 1, 2015. The Public Utilities Code requires this plans to "identify optimal locations fort the deployment of distributed resources".[8] However, it should be noted that California has a significantly larger penetration of distributed generation than Montana (see Question 10).

7. **Identify the benefits of net metering that are shared between net metering customers and customers that do not net meter.**

Avoided Energy Impacts

Net-metering studies and solar resource value investigations typically include avoided energy impacts. The net effect of distributed solar is to displace the highest variable cost generators that are on the dispatch margin and able to reduce their output. The energy related costs of that avoided marginal generation comprise the avoided energy impact.

Avoided Capacity Additions

A significant fraction of a customer's bill consists of costs associated with building power plants. The ability of solar to reduce or defer these costs is based on its capacity value, which allows it to defer investments in generation capacity. The methods used to calculate the capacity value commonly involve an Effective Load Carrying Capability calculation or an equivalent approximation.

Line Losses

Distributed solar is typically located at, or close, to the load it serves, providing value by avoiding the line losses that would otherwise have been incurred in transmitting and distributing power from a central station power plant, whether it is consumed on-site by the participating customer or by non-participating neighbors.

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[8] CPOC, Distributes Resource Plan (R.14-08-013), www.cpuc.ca.gov/PUC/energy/drp/

Avoided Transmission and Distribution
Distributed solar typically relieves the requirement to supply some of the load at a particular location through the transmission and distribution network, effectively reducing or deferring the need for additional transmission and distribution capacity.

Compliance value: reduced RPS procurement due to reduced utility sales
Solar PV that is capable of serving customer load has the effect of reducing the total energy demand that a utility has to meet. Concomitantly, this reduces the associated renewable energy that would have to be procured as mandated by the Renewable Portfolio Standard.

Security: Reliability, Resiliency, and Disaster Recovery
Generation located close to demand can lead to reduced transmission and distribution congestion, as well as minimizing the probability of outages through a dispersal of diverse generation. The increased penetration of solar and distributed generation in general could lead to a significant increase in system resiliency and stability. Looking into the near future, the colocation of electricity storage with solar PV offers up the possibility of increasing the solar resource value in various categories. As well as enabling solar PV systems to be able to better respond to demand, storage combined with solar has a future role in emergency preparedness. Solar PV could provide power to customers safely during a power outage, whether that is a private residence, hospital, school emergency shelter or other public building.

Market Price Response
In markets where the wholesale electricity price is largely based on the variable costs of the most expensive generator required to meet demand in any hour, solar lowers net demand during the hours it is generating and can suppress market clearing prices by pushing out the supply curve and reducing the need for more expensive generation assets to be dispatched in any given hour.

Ancillary Services and Grid Support
Ancillary services and grid support represent a broad array of services that can help system operators maintain a reliable grid with sufficient power quality. The impact of solar will be based on the penetration level. As solar penetration is expected to increase, it would behoove Montana to investigate the extent of this value and how it can be maximized.

Fuel Price Hedge
The fuel price hedge is driven by assumptions about natural gas price volatility, and the difficulty of accurately predicting price changes. As net-metering leads to less demand from conventional resources, this means that all customers are less exposed volatility and long term increases in fuel price.

8. **Identify additional net metering benefits (employment, taxes, societal, environmental, etc.) and explain, in the industry's opinion, how best to account for those benefits.**

Economic Development

When considering the net metering benefits from different perspectives, previous studies into distributed generation in other states—such as New Jersey, Pennsylvania and Rhode Island—have taken into account the economic development value associated with solar.[9]

Environment: Compliance Impacts

Avoided environmental compliance costs, including carbon costs (associated with the imminent regulation of emissions from existing fossil fuel plants through section 111(d) of the Clean Air Act), costs associated with existing regulation of NOx/SOx/Particulates, and other current regulation (such as Mercury Air Toxics) should be considered. The quantifiable value of avoided environmental costs and harms certainly will be of interest to many stakeholders including utilities, rate-payers, citizens and legislators.

The 2013 Rocky Mountain Institute ("RMI") survey of sixteen solar resource value studies reported that eleven out of those sixteen investigations examined environmental attributes when considering the benefits of net-metering and solar.[10]

Environment: Externalities

Increased severity and frequency of drought (and affects on agriculture and timber stands), water usage, and water pollution are all important societal considerations, and to the extent that they can be quantified, they should be investigated .The potential quantifiable value of avoided environmental and harms certainly will be of interest to many stakeholders including rate-payers, citizens and legislators.

9. **Identify one or more methods for quantifying the benefits of net metering. In your opinion, what are the advantages and disadvantages of each method?**

When attempting to quantify the benefits of net metering, it is important to recognize and acknowledge the different perspectives (and associated methods) from which they can be considered. The benefits of net-metering will contain different components when considered from different stakeholder perspectives: the utility; participating customers; non-participating customers; and society as a whole. These perspectives are those that

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[9] See Clean Power Research, "The Value of Distributed Solar Electric Generation to New Jersey and Pennsylvania", 2012 http://mseia.net/site/wp-content/uploads/2012/05/MSEIA-Final-Benefits-of-Solar-Report-2012-11-01.pdf and see Rhode Island Office of Energy Resources, "Distributed Generation Standard Contracts and Renewable Energy Fund—Jobs, Economic and Environmental Impact Study", April 2014 www.energy.ri.gov/documents/DG/RI%20Brattle%20DG-REF%20Study.pdf

[10] Rocky Mountain Institute, "A Review of Solar PV Benefit and Cost Studies", p2. www.rmi.org/cms/Download.aspx?id=10793&file=eLab_DERBenefitCostDeck_2nd_Edition&title=A+Review+of+Solar+PV+Benefit+and+Cost+Studies

would typically be examined in cost-effectiveness tests of energy efficiency programs, and are roughly equivalent to the following cost tests: Program Administrator Cost Test; Participant Cost Test; Ratepayer Impact Measure Test; and the Societal Cost Test.[11] A robust, comprehensive solar resource value investigation should consider each of these diverse perspectives. The Interstate Renewable Energy Council's "Regulator's Guidebook: Calculating the Benefits and Costs of Distributed Solar Generation" provides a detailed discussion on the differences between these methods, which have been summarized below: [12]

- **Participant Cost Test —**measures benefits and costs to program participants.
- **Ratepayer Impact Measure (aka "RIM") Test—**measures changes in rates due to changes in utility revenues and costs resulting from the assessed program.
- **Program Administrator Cost Test —**measures benefits and costs to the program administrator, without consideration of the effect on actual revenues. This test differs from the RIM test in that it considers only the revenue requirement, ignoring changes in revenue collection, typically called "lost revenues."
- **Total Resources Cost Test** —Measures the total net economic effects of the program, including both participants' and program administrator's benefits and costs, without regard to who incurs the costs or receives the benefits. For a utility-specific program, the test can be thought of as measuring the overall economic welfare over the entire utility service territory.
- **Societal Cost Test—**this method broadens consideration of costs and benefits to society as a whole, rather than just those in the program administrator territory. The test can consider non-monetized externalities, such as induced economic development effects.

10. In your opinion, is all or part of the utility or cooperative revenue impact or customer bill impact of net metering a subsidy? If so, describe the basis for determining that the impact is a subsidy.

The extent to which net-metered customers are subsidizing non-participating customers, or vice-versa, depends upon the balance between the various elements (benefits and costs) that make up the solar resource value. If the solar resource value is significantly greater than retail rate, this means that net-metered customers are providing more benefits than they are being compensated for, and are therefore subsidizing other customers.

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[11] California Public Utility Commission, "California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects", October 2001.
www.cpuc.ca.gov/nr/rdonlyres/004abf9d-027c-4be1-9ae1-ce56adf8dadc/0/cpuc_standard_practice_manual.pdf

[12] Keyes, Jason B., Rábago, Karl R., Regulator's Guidebook: Calculating the Benefits and Costs of Distributed Solar Generation, Interstate Renewable Energy Council, Inc. and Rábago Energy, LLC, October 2013. Available at http://www.irecusa.org/wp-content/uploads/2013/10/IREC_Rabago_Regulators-Guidebook-to-Assessing-Benefits-and-Costs-of-DSG.pdfp. 14.

Furthermore, a significant level of net-metering penetration is necessary before meaningful cross-subsidization (in either direction) can be perceived. For instance, the consultancy Energy and Environment Economics ("E3") performed an evaluation of the costs and benefits of California's net energy metering ("NEM") program and presented their findings to the California Public Utility Commission ("CPUC").[13] In their most extreme forecasted penetration level, E3 modeled the impact of "Full NEM Subscription", which amounts to five percent of aggregate customer peak demand (for IOUs), as defined by California Public Utility Commission (CPUC) decision D. 12-05-036.[14] In this decision, the CPUC clarified that—in California—"aggregate customer peak demand" means the sum of individual customer's non-coincident peak demand. For a given year, the total non-coincident peak demands for all customers in each IOU's service territory is defined as the sum of each customer's maximum demand in that year. For each IOU, the value represents the maximum demand for the service territory that would occur if all customers use their maximum load at the same time.[15] Table 1 shows that even with full NEM subscription in California in 2020 the cost of exports from net-metering is only 1.06% of the utilities annual revenue requirement.

Table 1—Net Cost of NEM Generation Exports in California in 2020 (Millions $2012/year)[16]

	2012 Snapshot	Full CSI Subscription	Full NEM Subscription
Residential	$61	$85	$291
Non-Residential	$18	$41	$79
Total	$79	$126	$370
% of Revenue Requirement	0.23%	0.36%	1.06%

Even so, it should be noted that E3's methodology was stymied by California Assembly Bill 2514, which both instigated the investigation and prevented it from being a comprehensive cost-benefit analysis.[17] In E3's analysis, the entire output of a net-metered system is considered to have an impact on the grid, even though such systems are designed to meet on-site load, and therefore the majority of the energy is used behind the meter. From the

13 "California Net Energy Metering-Ratepayer Impacts Evaluation", October 2013, www.cpuc.ca.gov/NR/rdonlyres/75573B69-D5C8-45D3-BE22-3074EAB16D87/0/NEMReport.pdf

14 "Legislative Subcommittee Recommendation, AB NEM", CPUC June 4, 2012 www.cpuc.ca.gov/NR/rdonlyres/F73D09CD-B4F2-4672-809B-285316B75CC9/0/582964v1AB_2514_LEG_MEMO_11239_6712_HIGHLIGHTED_CHANGES.pdf

15 "Estimation of Total Non-Coincident Peak Demands", CPUC NEM Cap Calculation Workshop, Jun3 25 2012 www.cpuc.ca.gov/NR/rdonlyres/C89C6BF8-9A37-4DF8-BF2E-2A9C8FDD1B8D/0/CPUC_NEM_Workshop_062512C.PPTX

16 "California Net Energy Metering-Ratepayer Impacts Evaluation", October 2013, p 67 www.cpuc.ca.gov/NR/rdonlyres/75573B69-D5C8-45D3-BE22-3074EAB16D87/0/NEMReport.pdf

17 California Assembly Bill 2415, Bradford, Net Energy Metering, September 2012 http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201120120AB2514

utility perspective, this behind-the-meter consumption is seen as demand reduction, just like energy efficiency. Given this, E3 acknowledged that the "all [export] generation scenario […] likely overestimates the costs that are directly associated with NEM".[18]

11. What are the pros and cons of extending Montana's net metering policy to apply to rural electric cooperatives and all regulated utilities? Is it appropriate to treat rural electric cooperatives and certain regulated utilities differently in relation to net metering requirements under specific circumstances in Montana? If yes, explain.

It is important to recall that by state law consumers cannot choose their preferred utility based on net metering policy, electric rates, or any other factor. Thus, first and foremost, net metering policy should be designed for consumers, regardless of which particular utility serves their electric needs.

Montana's net metering policy should be extended to rural electric cooperatives and all regulated utilities. Customers of any utility should have the opportunity to generate their own energy on-site. However, rural electric cooperatives and investor owned utilities are typically characterized by different distribution system geometries—with the former often having a smaller number of customers on a single line— and this should be taken into account when considering the interconnection procedures discussed in Question 5.

[18] "California Net Energy Metering—Ratepayer Impacts Evaluation", CPUC/E3, October 2013, p4