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October 5, 2011

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California Energy Commission
Docket Office, MS-4
1516 Ninth Street
Sacramento, CA 95814-5512
docket@energy.state.ca.us

Re: California Energy Commission ("Energy Commission") Docket No. 11-IEP-1G: Committee Workshop on Renewable Power in California: Status and Issues

To Whom It May Concern:

Southern California Edison ("SCE") participated in the September 14th Committee Workshop ("Workshop") on Draft "Renewable Power in California" [1] ("Draft Report"). We appreciate the opportunity to collaborate with the Energy Commission and respectfully submit these comments to the Draft Report on this important issue. SCE is hopeful that the Energy Commission, in concert with key stakeholders, can identify and prioritize the issues surrounding renewable issues in California in order to develop and support strategies for implementation that are in the best interest of California's electricity customers. Along with this letter, SCE includes three attachments: Attachment I includes comments on the Draft Report and addresses several issues we consider important. Attachment II includes responses to the questions of interest to the Commissioners on the dais at the Workshop, and Attachment III is the joint investor-owned utilities' ("IOU's") position paper on Localized Energy Resources ("LER").

The Draft Report correctly identifies some important concerns regarding the status and progress of renewable energy development in California. These concerns relate to safety (of the public and utility employees), system reliability and customer affordability. Specifically, SCE has concerns with the following issues:

- Considerations for Governor Brown's Clean Energy Jobs Plan;
- Specific Issues in the Draft Report;
- Cost Consequences of Increasing the Penetration of Intermittent Renewable Energy Resources;
    - Costs of existing requirements
    - Costs of net energy metering and other subsidies
    - Costs of renewable integration
    - Levelized cost and the market price referent
- Difficulties of Licensing and Land Use;
    - Licensing and permitting
    - Interconnection

[1] California Energy Commission Staff Report, "Renewable Power in California: Status and Issues," CEC-150-2011-002 August 2011. Available at: http://www.energy.ca.gov/2011publications/CEC-150-2011-002/CEC-150-2011-002.pdf.

- Changes Required to Mitigate the Reliability Impacts of High Penetration of Intermittent Resources.
    - Regional operation changes
    - Local operation changes

In the best interest of its customers, SCE is actively working to meet the existing state energy goals in a cost effective manner. These goals include achieving a 20% Renewables Portfolio Standard ("RPS") goal in 2013 and continuing to increase procurement incrementally to 33%. Key to SCE's attempts to achieve these goals in a cost-effective manner is the use of competitive market process results. This kind of market-oriented approach is also being used by SCE in its Renewable Auction Mechanism ("RAM") and in purchasing combined heat and power ("CHP") resources in accordance with the Qualifying Facilities ("QF") settlement agreement.[2] SCE also continues to actively pursue cost-effective energy efficiency and demand response resources first per the loading order. As a leader in electric vehicle readiness arena, SCE is laying the foundation for the deployment of electric vehicles that encourages customer adoption.

In closing, SCE would like to extend our appreciation for your consideration of our comments to contribute to developing a strategic plan that is in the best interest of California's customers.

Sincerely,

/s/ Manuel Alvarez

Manuel Alvarez, Manager,
Regulatory Policy & Affairs

[2] D.10-12-035, dated December 16, 2011, adopting Combined Heat and Power ("CHP") Settlement Agreement.

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Attachment I

Considerations for Governor Brown's Clean Energy Jobs Plan

An element of Governor Brown's Clean Energy Jobs Plan (the "Governor's Plan") is the integration of 20,000 megawatts ("MW") of renewable energy – 12,000 MW of localized energy resources ("LER") and 8,000 MW of utility-scale energy resources to reduce greenhouse gas ("GHG") emissions.[3] Southern California Edison ("SCE") supports careful consideration of the Governor's Plan to evaluate what is best for the state and its electricity customers, mitigating technical complications that threaten reliability and power quality. Policy tradeoffs may provide regulators opportunities to alleviate some of the negative consequences of policy implementation. The ability to make tradeoffs requires studies before policy adoption to provide a full understanding of the impacts to safety, reliability, and affordability.

The stated goal of the Governor's Plan is job creation. Although it is generally agreed that "clean energy" will create new jobs, the specific amount and timing of these jobs is uncertain. The "California Workforce Education & Training Needs Assessment for Energy Efficiency, Distributed Generation, and Demand Response"[4] estimates that an investment of $11.2 billion from various sources will create approximately 211,000 clean energy jobs by 2020.[5] In contrast, the Governor's plan estimates it will create "close to half a million" clean energy jobs by 2020 with no estimate of the associated costs. It is true that in the U.S., California attracts the largest share of clean-tech venture capital (more than all the other states combined)[6]. However, it is important for policy makers to assess if policy intervention is necessary in excess of existing market mechanisms to achieve the plan's stated objectives. Then, studies should be conducted to understand the ramifications of the intervention. For example, policymakers need to ensure that further upward pressure on rates does not undermine employment in other economic sectors. A cautionary example is provided by the study performed by TIAX LLC, for the 2008 IEPR Update, which identified a loss of service sector jobs (driven by the cost of California Solar Initiative ("CSI") incentives) as a collateral impact of solar incentives.[7]

SCE believes the addition of LER and renewables goes a long way towards meeting 33% Renewable Portfolio Standard ("RPS"). However, this expansion is expected to significantly increase the renewable generation intermittency challenge. Unless resolved, this could jeopardize grid reliability and the ability to achieve California's 33% RPS goal. The 2010

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[3] http://www.jerrybrown.org/Clean_Energy.
[4] Donald Vial Center on Employment in the Green Economy, University of California, Berkeley; March 4, 2011 – Executive Summary.
[5] The referenced jobs are not permanent but account for the number of person-years. The jobs are from direct energy efficiency activities; indirect jobs from inputs needed for direct activities and induced jobs from increased income.
[6] Clean Edge – The Clean-Tech Market Authority May 2011. Available at http://www.cleanedge.com/e-letter/2011.05.18_CE_Alert.html.
[7] Cost Benefit Analysis of the Self-Generation Incentive Program, TIAX LLC, CEC-300-2008-010-F, October 2008.

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Long-Term Procurement Plan ("LTPP") proceeding has made important progress towards developing an understanding how system operation changes required by 33% RPS will impact costs, but many uncertainties remain. For instance, the exact levels of penetration that will trigger delivery system upgrades, as well as the types and costs of upgrades required, are still being studied.

Moreover, the need for additional ancillary services for renewable integration as penetration increases is also undetermined. Historically, ancillary service needs are partially supplied by fossil power plants with once-through cooling ("OTC") technology. The State Water Resource Control Board ("SWRCB") policy requires the elimination of OTC.[8] Whether these plants will be needed to support the increased need for integration services is uncertain. As plant owners choose their mechanism for compliance with the policy (re-power, retrofit or retire) construction timelines and other considerations for reduced ancillary service resources and their associated costs must be accounted for as the renewable penetration increases.

Specific Issues in the Draft Report

The Draft Report includes quantitative assessments of resource potential, resource assumptions and the set of regional targets that should count toward accomplishing the Governor's Plan. Table 6 of the Draft Report shows 17,000,000 MW of technical potential for solar photovoltaic ("PV") in California without any explanation of the methodology and assumptions used to derive this number.[9] SCE estimates that this would require roughly 50,000 square miles of PV panels or more than one-third (1/3) of the land area in California.[10] SCE would like to see further explanation of the methodology and assumptions used to calculate the 17,000,000 MW number. In addition, SCE suggests that an estimate of the economic potential, which is an indication of the amount of PV that would likely be developed cost-effectively, would be a more useful metric.

The assumptions in Table ES-3 under Executive Summary of the Draft Report seem to presume that each identified new transmission line can be loaded up to 100% of its capacity[11]. Since the loading capability of a transmission line is highly dependent on the grid network as a whole, the resulting calculations of "Additional Project Capacity for 8,000 MW of New Large-Scale Renewables (MW)" in the last column of the Table, based on individual transmission lines' capacity, are flawed. These renewable projects may not materialize without additional transmission upgrades and /or new additions.

SCE supports the inclusion of all existing programs and "in the pipeline" resources toward achieving the Governor's Plan and in setting regional targets for the 12,000 MW (see Table 1).

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[8] State Water Board Policy on the Use of Coastal and Estuarine Waters for Power Plant Cooling Appendix A dated 7/19/11.

[9] California Energy Commission Staff Report, "Renewable Power in California: Status and Issues," CEC-150-2011-002 August 2011; p. 40.

[10] Assumes 180W per panel and 52" by 35" panels.

[11] California Energy Commission Staff Report, "Renewable Power in California: Status and Issues," CEC-150-2011-002 August 2011; p. 4.

Table 1 – Existing Programs for Inclusion in Governor's Plan Targets

Existing Programs
Renewable Auction Mechanism ("RAM")
IOU Solar PV Programs
Qualifying Facilities ("QF") Settlement Agreement[12]
California Solar Initiative ("CSI")
Self-Generation Incentive Program ("SGIP"
CHP Competitive Procurement
CHP As-Available Facilities
Feed-In Tariff ("FIT") – Renewable & CHP

As the process evolves, the Energy Commission should engage stakeholders in determining what resources are included, what regional targets will exist and what will count going forward. For instance, the regional targets provided currently do not inform the utilities of their respective obligations. There is no way to identify how Los Angeles County would be apportioned between SCE and the various Publicly Owned Utilities ("POUs") located in the county. SCE would like to ensure that all load serving entities contribute equitably to achieving the goals laid out in the Governor's Plan.

When it comes to California's ancillary service resources, although historically correct, the term "load following" is now inappropriate. With little or no variable energy resources ("VERs") in resource portfolios, historical "Load-Following" was required due to variability in Load. This ceases to be the case as the number of VERs added to a generation portfolio increases. As such, the term "Load-Following" should be transitioned to simply "Following", as both Load and Generation contribute to system variability and uncertainty. The requirement for responses to VERs creates a need for Following services as demonstrated by below:

- As Puget Sound Energy demonstrated, two wind plants alone require more hourly Regulation (49.72 MW/hr) than all of Puget Sound Energy Load (45.34 MW/hr).[13]
- The Bonneville Power Administration ("BPA") has VER balancing reserves that are 3 times higher than its Following Reserves[14].
- Westar showed that the Regulation requirements of its wind resources were 6 times higher than that for its Load – even with variability offsetting benefits enjoyed by VERs[15].

Balancing authorities across the country are recognizing the generation-driven need for Following and Regulation services. Additionally, they account for the integration costs of VERs by following cost-causation principles, where the costs associate with higher integration charges are flowed back to those entities creating/causing the costs.

[12] D.10-12-035, dated December 16, 2011, adopting Combined Heat and Power (CHP) Settlement Agreement.
[13] FERC Docket# ER11-3735.
[14] http://www.bpa.gov/corporate/ratecase/2012/docs/bp-12-E-BPA-05a.pdf.
[15] FERC Docket# ER09-1273.

Cost Consequences of Increasing the Penetration of Intermittent Renewable Energy Resources

In general, SCE believes that the Draft Report lacks sufficient analysis of the cost and customer impacts of the various renewable energy policies currently being pursued by California. As stated at the Workshop, SCE is concerned that the costs (including potential subsidies) associated with these programs will impede the State's overall environmental goals. Therefore, it is essential for policymakers to understand the cost implications of various environmentally-driven policies. The following section describes some of the issues that warrant consideration in the draft report.

Costs of Existing Requirements

The economic impacts of requiring 20,000 MW of LER and renewable resources must be considered in the context of other factors such as costs of meeting environmental goals, initiatives such as the California Air Resources Board's ("CARB") pending cap and trade program and customer rate impacts. Based on testimony in the 2010 LTPP,[16] it is uncertain whether the IOU resource portfolios could accommodate 20,000 MW of LER and renewable resources. Additionally, the levelized costs of carbon abatement for the LTPP Joint IOU cases are approximately \$200/metric ton CO_{2e}, leading to levelized system average rates of almost 18 ¢/kWh. With California electric rates already in the top 20 percent of the United States,[17] understanding the additional costs for the Governor's Plan should be paramount. If California wants to be a leader in environmental policies and have those policies accepted by the public, policymakers need to ensure that they are at the lowest cost practicable. SCE urges the Energy Commission to consider the imposition of these costs on customers in developing the timeline and strategy for implementing the Governor's proposal.

Costs of Net Energy Metering and Other Subsidies

SCE believes that the Draft Report does not adequately document the impact of subsidies on cost allocation among customer groups. Under the net energy metering ("NEM") program, customers that install LER behind-the-meter are not required to pay certain charges that are then spread to all other customers, including a fee for ensuring that electricity is available to them when needed. As a result, these costs are shifted to customers who are not participating in the NEM program. Likewise, per Public Utilities Code § 2827, customers installing solar panels on their homes are exempt from paying distribution upgrade costs, which include interconnection studies, distribution system modifications, and/or application review fees. Furthermore, NEM requires that energy delivered to the grid at times when the solar panels' output is greater than site load directly offset the energy delivered to the site when the solar panels' output is less than site load. As a result, it is possible for participating customers to avoid the costs (e.g., distribution and transmission infrastructure) for services they are still receiving associated with delivering power to their sites as well as the distribution upgrades caused by their installation. These costs, estimated at \$52 million accumulated from 2001

[16] Rulemaking 10-05-006 Exhibit IOU I - 2010 LTPP Joint IOU SCE, SDGE and PG&E Track I Testimony, July 1, 2011.
[17] U.S. Dept. of Energy Electric Power Monthly, May 2011 pg. 110.

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through mid-2011, must then be borne by non-participating customers. This policy is unsustainable. Until utilities are allowed to charge NEM customers for the grid services they receive, customers without LER will continue to carry the burden of these costs. SCE is concerned that this program will have an even greater negative impact on non-participating customers if NEM is expanded.

In addition to NEM, other subsidies that are currently granted to LER customers must be re-evaluated as the State moves to higher levels of LER penetration and as prices for certain LER technologies continue to decline. For example, program incentives like the CSI also result in cost shifts to non-participating customers.

Costs of Renewable Integration

The cost incurred to manage the VERs (i.e., renewable integration costs) is difficult to anticipate and quantify. The California Independent System Operator ("CAISO") and the California Public Utilities Commission ("CPUC") are performing major modeling efforts to determine the quantity and types of resources needed to integrate renewables. Based on this analysis, some quantification of the cost will be available in the near future.

Additionally, market design changes are establishing market structures to enable system operators to deal with the uncertainty and variability associated with renewable energy. These balancing services will also increase costs.

SCE has strongly advocated for the costs of these services to be allocated to the market participants creating/causing these costs. This form of cost allocation will create price signals for corrective action and yield a more efficient dispatch, and use of generation resources. When not following cost allocation based on cause, market or price signals do not provide clear incentives for change, resulting in uneconomic behavior through misdirected short-term and long-term investments or dispatch decisions. In such situations, subsidization of certain market participants by others is more likely to occur, such as when load pays for following services for its needs *as well as* the need incurred by VERs.

This "cost-causation" principle is being considered and/or adopted by Balancing Authorities across the country. Recently, the CAISO adopted this principle to guide its "renewable integration" market redesign.[18] The Bonneville Power Authority, Westar, and Puget Sound Energy, have fully implemented systems in line with this principle. Specifically, these transmission operators all flow the costs for balancing products and services back to the sources of variability. At any scale – Balancing Authority, regional, or national – cost allocation based on cause is a key element in the creation of efficient market solutions.

The role of regional solutions in market-based renewables integration efforts are an important aspect of the fundamental system changes necessary due to the addition of high penetrations of intermittent renewables. The "cost-causation" principle should underwrite any potential regional solution.

[18] Page 1, Renewables Integration Market and Product Review Phase 2 (RIMPR2), Revised Straw Proposal: http://www.caiso.com/Documents/RevisedStrawProposal-RenewablesIntegrationMarketandProductReviewPhase2.pdf.

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Regional solutions essentially involve using resources of one balancing area to address renewables driven operational challenges from another. For instance, when a Balancing Area lacks sufficient flexible capacity to effectively and reliably manage high amounts of uncertainty and variability from VERs, the ability to electrically transfer the intermittency to another Balancing Area may be desired. Various forms of this "regional collaboration" can be devised. In the end, expanding or combining Balancing Areas is a theoretical way to achieve the goals of regional collaboration.

These potential regional solutions will be best promoted through the broad application of cost-causation principles. Using the above example, even though the duties of integrating uncertain and variable energy have been transferred to a new Balancing Area, the costs for that solution should flow back to the source of the intermittency. Thus, those who create the need for integrating services experience price signals to reduce their intermittency.

There are many accumulating issues that must be considered to implement least cost solutions to ensure system reliability as higher penetrations of intermittent resources are integrated into the system. Regulators must allow adequate time to allow cost-effective solutions to evolve.

Levelized Cost and the Market Price Referent

In the Draft Report, the discussion of the costs of renewables relies on a conceptually faulty levelized cost comparison of dispatchable conventional and non-dispatchable renewable resources. The Draft Report cites a 2009 levelized cost study conducted by Lazard Ltd that concludes that some renewable technologies are cost-competitive with conventional generation at this time.[19] SCE has reviewed this study and found that its conclusions are the result of misinterpreting the relative levelized cost ranking for the various technologies studied. The levelized cost comparisons do not capture differences in capacity factor, time of delivery, capacity reliability, useful asset (economic) life, and integration costs. SCE's comments from the May 16th, 2011, workshop on Localized Renewable Generation discuss this issue in more detail.

SCE also notes that the Draft Report incorrectly states that the Market Price Referent ("MPR") is a measure of avoided cost. The MPR is an administratively developed benchmark that purports to be the levelized cost of a new-build Combined Cycle Gas Turbine ("CCGT") and relies on particular assumptions, such as future gas prices, which are overestimated. Therefore, it cannot be inferred that project costs below the MPR are below avoided costs or are even economical.

The Difficulties of Licensing and Land Use

Licensing and Permitting

SCE generally supports local, state, and federal government agency efforts to significantly reduce the permitting time for new renewable generation infrastructure projects, including the transmission infrastructure necessary to interconnect and support such generation. SCE

[19] Levelized Cost of Energy Analysis – Version 3.0, February 2009.

also generally supports efforts to establish and implement a fully coordinated and effective statewide transmission planning process that includes both transmission and land use planning. However, the issues associated with land use planning are complex, primarily because land use planning associated with specific projects frequently involves multiple local, state, and federal government agencies having very different jurisdictional authority and regulatory process timelines. To truly reduce permitting time for LER, the following are needed:

1) a sense of urgency among agencies to reach and implement sound land use outcomes (including permitting) in a timely fashion;
2) significantly less agency regulation in aggregate;
3) clear lead agency authority and prescriptive timelines for agency actions (e.g., statutes, memoranda of understanding) that empower agency leadership and decision-making and cut through inter-agency stalemates;
4) process collaboration among agencies that eliminates redundancies, integrates/automates processes, and facilitates early communication/resolution of inter-agency issues; and,
5) expeditious, streamlined dispute resolution that minimizes litigation.

Inter-agency application of these principles could help the state to more effectively meet the Governor's Plan goal of reducing permitting time to no more than three years.[20]

Additionally, state public policy should support increasing the capacity of existing transmission assets and rights-of-way ("ROWs") through "up-sizing" to meet service demands and/or public policy requirements (e.g., RPS). Projects that increase transmission capacity generally have less siting and permitting challenges, especially where mitigation measures are already in place. Policymakers should also support giving IOUs the ability to carry land costs in rate base for ten rather than five years to facilitate corridor designation and longer-term planning for additional renewable generation.

<u>Interconnection</u>

The staff report identifies a number of major challenges regarding the integration of high levels of LER into the state's distribution system. Among other things, transforming the historic design of the distribution system in conjunction with accommodating ongoing higher penetration levels of interconnecting LER have and will continue to necessitate changes in the generator interconnection process. However, the Energy Commission should note that California has been a leader on these issues. California's Rule 21 was created through a stakeholder process and has been a good first step for California in standardizing interconnection procedures. Additionally, California stakeholders recognized early the depth and breadth of interconnection challenges and have actively implemented significant interconnection process reforms. These significant reforms were necessary, in part, because of the extraordinarily heavy volume of LER project applicants and the corresponding system changes currently required to accommodate these and other renewables (discussed further below). Most recently, the CPUC established a settlement process to address matters related

[20] California Energy Commission Staff Report, "Renewable Power in California: Status and Issues," CEC-150-2011-002 August 2011; p. 77.

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to Rule 21 and issued R.11-09-011 on September 27, 2011 to improve distribution level interconnection rules and regulations for certain classes of electric generators and electric storage resources. These reforms and collaborative processes should be given the opportunity to proceed to allow appropriate stakeholder assessment of their benefits.

There are other factors beyond SCE's control that negatively impact the interconnection study process, including that a large number of generation projects are located far from load centers. Interconnection can be accomplished relatively quickly when project applicants seek interconnection in areas where there are no transmission constraints. Generally, the complexity, expense, and length of time associated with interconnection processes could be reduced, at current infill levels, if the public policy requirement was for generators to locate in areas on the system that can accommodate increased generation (typically circuits near load with low LER penetration levels). In support of this consideration, SCE notes that its experience with SCE's California Renewable Energy Small Tariff ("CREST") program has been that the vast majority of 1.5 MW project applicants have attempted to locate in remote, transmission constrained areas—making it difficult for SCE to study/interconnect them. The finding in the Draft Report[21] that the second type of distributed generation ("DG") (1 MW – 5 MW) is usually within or close to load centers is not consistent with SCE's experience.

SCE also notes several technical points of clarification. The Draft Report incorrectly defines the technical screens used within the interconnection process. These screens are a group of questions or thresholds that determine if the proposed interconnection *requires an interconnection study* (instead of "affects local circuits or substation").[22] Furthermore, each utility does not post and regularly update queues detailing the amount of LER that could be interconnected on a circuit with minimal studies.[23] Rather, SCE maps do take interconnections and queued LER into account in the values SCE prescribes for customer interconnection opportunities. Third, regarding Table 18[24], Rule 21 timing varies by location and is not constrained by a "90 – 180 business day requirement."[25]

<u>**The Changes Required to Mitigate the Reliability Impacts of High Penetration of Intermittent Resources**</u>

<u>Regional Operation Changes</u>

California's environmental goals will cause fundamental changes to the operations of the electric grid. The bulk power grid that serves the Western United States is an interconnected system that ties the Western states, two provinces in Canada and Northern Baja California, Mexico. There are ten states in the West that have RPS which will also impact the operations of the grid in California. Studies at the Western Electric Coordinating Council ("WECC") level will be necessary to ascertain the effects of these wide area variable resources. Balancing Authorities will have to evaluate their operating procedures to insure they can cope with the variability and can insure that adjacent Balancing Authorities are not

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[21] California Energy Commission Staff Report, "Renewable Power in California: Status and Issues," CEC-150-2011-002 August 2011; p. 137.
[22] Ibid, p. 138.
[23] Ibid, p. 153.
[24] Ibid, p.154.
[25] Ibid, p. 184.

unintentionally affected and vice versa. Wide area situational awareness systems will be necessary to insure that operators across the WECC have a common understanding of the status of these wide spread variable resources. The WECC states with existing RPS goals are listed below.

WECC States with RPS	Goal in %	Year
Washington	15	2020
Montana	15	2015
Colorado*	30	2020
Oregon	25	2025
Nevada	25	2025
Arizona	15	2025
Utah	20	2025
South Dakota**	10	2015
California	33	2020
New Mexico*	20	2020

* Electric cooperatives and municipal utilities with more than 40k customer: 10% by 2020
** Non-mandatory

Local Operation Changes

Intermittency of renewable generation resources will require significant technology upgrades to maintain a reliable transmission and distribution system. These changes will be dictated by the level of penetration of the resources, the types of resources, and will be a sustained phenomenon throughout the WECC interconnection grid. The extent of these factors and the technology solutions to manage and mitigate the intermittency they cause are still under development.

Some examples of the numerous studies and approaches to managing and mitigating intermittency currently under evaluation are:

- Western Interconnection Synchrophasor Program ("WISP")
- Distribution Management Systems ("DMS") for inverters
- Revised Inverter Standards

The WISP effort is intended to improve the stability monitoring capabilities throughout the western states. This initiative is an example of the type of sophisticated monitoring and control systems that are likely to be required to manage the dynamics introduced by high penetration of renewable generation. WISP could become a critical tool for evaluating the real-time status of the system and providing the intelligent alarming to provide system operators warning to enable mitigation strategies.

A Distribution Management System (DMS) monitors load flows on the distribution system, manages voltage and voltage devices (e.g., capacitors), and indicates abnormal conditions on the distribution system. The DMS has historically been a system that monitors the one way flow from the substation out to the distribution circuit and generally has control over capacitors, regulators, and/or tap changing banks to maintain voltage. The next generation DMS will need to account for generation resources on the distribution network, manage demand response, and possibly control storage devices or inverters to optimize system voltage.

The standards for the control concepts on devices like inverters are still evolving. At higher renewable penetration levels, more accurate voltage control of inverters used on solar installations is required. As an example, solar inverters are set to isolate the solar PV generation from the distribution system in case of a de-energized circuit (anti-islanding). This equipment serves as a safety measure to protect utility workers and the public from the dangers of possible back feeds, but it also has the potential to cause a loss of generation in the event of a large voltage drop. The voltage dynamics of high penetration renewable energy still requires additional study to identify appropriate solutions. SCE's inverter testing provides the information to support efforts to establish standards (i.e., IEEE[26] 1547-8) and the most cost-effective solutions for our customers. The length of the standards revision process may require the adoption of interim standards.

[26] Institute of Electrical and Electronics Engineers

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Attachment II - Commissioner Questions

1. **<u>Can you speak now or in your comments to what modeling efforts you have going on to look these issues (the system implications of large amounts of LER), in addition to observing and seeing how things play out?</u>**

SCE is engaged in numerous modeling efforts to assess a variety of technical challenges related to renewable and localized energy resources. These efforts address both the planning challenges of meeting the 33% RPS goal as well as the operational challenges of integrating renewables and LER into the existing grid. Some modeling efforts related to meeting the 33% RPS include transmission and generation interconnection planning studies and improving screening models to efficiently manage the increasing numbers of renewable energy proposals that SCE receives. Examples of modeling efforts that address operational challenges of renewable resources include studies that examine the impacts of variable energy resources (VERs) on ancillary service requirements and system reliability as well as efforts to improve models used to simulate the effects of wind and solar resources on SCE's grid.

2. **<u>What is the appropriate timing to meet the Governor's goals?</u>**

As indicated by the Staff Report, California is on track to achieving a 33% RPS by 2020. Therefore, SCE does not believe that pursuing a significant amount of additional utility-scale renewable generation and LER within a compressed timeframe is prudent at this time. Providing sufficient time for research and development will reduce the cost and reliability impacts of the Governor's plan by allowing utilities and state policymakers an opportunity to better understand the impact that renewable generation and LER will have on the electricity grid.

3. **<u>What are the types of things we have to resolve in the near term, so that we can move forward in the longer term to a much greater or much faster rollout?</u>**

Before any additional programs or policies can be designed, the state agencies must work with utilities to comprehensively study the following areas:

- Safety:
  - Assess impact of LER on safety conditions (such as islanding)
  - Determine how LER equipment can be standardized to ensure safety for customers and workers
- Service quality:
  - Impacts of having a significantly larger number of small generators interconnecting to the electric grid
  - Impacts on power quality and system reliability due to intermittency, voltage, and operability issues associated with renewables and LER
  - Changes to the distribution and transmission system needed to accommodate expanded LER
- Cost:
  - Cost to customers
  - Rate impacts

- Program Design Considerations:
    - Planning for higher levels of generators under 20 megawatts in size including California's achievements to date;
    - Impacts on system operations including technology mix, eligibility of project sizes (including projects larger than 20 megawatts) and pace for advancing LER,
    - Participation by all distribution service providers
    - System need and demand for LER generation
    - Processes for small generators to locate in areas that minimize interconnection and transmission and distribution modification costs
- Economic impact:
    - Impact to energy and capacity markets and other existing mechanisms that are central to energy planning and system operations
    - Issues for local governments on resources
    - Impact to economy and jobs

4. **"…in the near term that we try to design the programs to really drive the costs down by looking at what we can do on sort of permitting, what we can do on interconnection, what we can do on financing. Basically, ways to make it possible for these things to be more cookie cutter."**

    a. **What are the issues related to permitting and land use?**

In the short-term, SCE continues to work with the public and consider relevant environmental issues early in the planning stages. In addition, SCE supports approving larger projects by "upsizing" beyond the current need demonstrated by individual interconnection requests when longer-term needs are clearly apparent.

In the long-term, the Energy Commission should facilitate corridor designation, which will give utilities the opportunity to begin building public support, initiate programmatic, broad environmental studies, and utilize cooperative planning methods for siting corridors in advance of initiating significant investment. Such activities will expedite licensing, permitting, and construction when it is determined that a project is needed.

SCE addressed this topic in detail in its comments on the May 17, 2011, IEPR Committee Workshop on Transmission Needed to Meet State Renewable Policy Mandates and Goals

    b. **How can permitting and interconnection be accelerated?**

Interconnection can be accomplished relatively quickly when generators interconnect in areas where there are no transmission constraints or interdependencies. However, as penetration levels increase, the number of interconnections that can be fast tracked diminishes. In SCE's experience, land use issues (cost and availability) appear to be the primary drivers of interconnection siting. In the future, programs should be constructed such that interconnection costs are appropriately considered by developers.

As required by the CAISO, SCE publishes and updates annually unit cost guides for estimating commonly-used or otherwise standardized equipment. SCE plans to expand the unit cost guides to include distribution level equipment in the near future. SCE has also published two interconnection maps in Google Earth/Maps to assist developers in the siting of future LER as part of the Solar Photovoltaic Program and Renewable Auction Mechanism.

SCE also reminds the Energy Commission that modifications to CAISO and Wholesale Distribution Access Tariff ("WDAT") interconnection procedures to implement cluster studies were only recently approved by FERC in December 2010 (for the CAISO) and April 2011 (for SCE's WDAT). SCE believes that these reforms will expedite the interconnection process under both procedures. The Energy Commission should allow a reasonable interval of time for the implementation of these reforms and appropriate stakeholder analysis before additional improvements are proposed.

CPUC established a settlement process to address matters related to Rule 21 and issued R.11-09-011 on September 27, 2011 to improve distribution level interconnection rules and regulations for certain classes of electric generators and electric storage resources

c. <u>Can we try to make things more "cookie cutter"?</u>

As of mid-May 2011, SCE had 785 renewable generation interconnection requests in the interconnection queue, excluding Net Energy Metering interconnection requests. This queue contains a wide variance of system sizes, generation technology types, and geographic location throughout SCE's 50,000 square mile service territory. In light of this, SCE firmly believes that the best way to assure system reliability and safety is to evaluate the collective impact of each interconnection request within the current procedures. SCE does not believe that additional simplifications will be an improvement over the cluster study process. There are many "moving parts" to an interconnection study, including: 1) unique project factors; 2) key assumptions that are reflected in the analysis; and, 3) leveraging the skills, experience, and informed analysis/judgment of a transmission engineer or planner, that would be lost in reliance on a formulaic approach.

5. <u>What have you learned from the first rollout of projects that [the IOUs] have done of a PV nature?</u>

In March 2011, SCE published an article in InterPV describing lessons learned from our utility-owned rooftop solar projects to date.[1] The article catalogues some of the design improvements SCE has implemented at our roof-top PV sites. For example, we specified a DC disconnect in each home that is run on the grounding equipment to allow operation and maintenance flexibility due to limited and inconvenient roof access. The article also describes some of the inherent challenges of installing solar stations on commercial rooftops from design, permitting, and regulatory perspectives

[1] Breig, D. P. (2011, March). Lessons Learned and Improvements Made. InterPV, 94-96. Retrieved September 26, 2011, from http://www.interpv.net/

6. **[The Energy Commission] would welcome any suggestion you have for speeding up the standard-setting process?**

It may take a significant amount of time to adequately develop standards for two major reasons. First, standards require the consensus of many parties with varying perspectives. Second, those involved in the standards process also have full time commitments elsewhere. Dedicating an individual to manage the process can reduce the time required, but a significant amount of development time (2 to 3 years) will still be required.

7. **What is the ratio between the total number of bids [received] versus the one selected, 10 to 1, 20 to 1?**

The ratio of bids that received offers for a position on SCE's short-list to total project options considered in SCE's large renewable solicitations decreased substantially in the last five years. This change occurred for two reasons. First, the number of bids received each year approximately doubled, and second, SCE's forecast need for additional renewable energy decreased.

8. **[Regarding the diversity of the bids into the RPS solicitations,] are these all PV or do [the IOUs] have a good mixture of renewable technologies?**

In SCE’s most recent solicitations, the majority of bids SCE received use solar PV technology. However, this has not always been the case. In prior years, wind, solar thermal, and geothermal bids were the most common. Many other technologies also participate in SCE’s solicitations, including biogas used for co-generation, hydroelectric, and municipal solid waste.

9. **What is an appropriate renewables contract failure rate to use?**

Based on SCE’s experience with executed renewable contracts, SCE currently suggests using a renewables contract failure rate of 40%. SCE used a 40% renewables contract failure rate to determine procurement need in SCE’s most recent renewable solicitation, as announced publicly at SCE’s 2011 Request for Proposals Bidders Conference held May 26, 2011. This is equivalent to a renewables contract success rate of 60%.

10. **What are the root causes of renewable contract failure? How much is due to water use, land use, permitting, financing, etc.?**

In general order of importance, issues related to a) the timing of transmission/interconnection, b) siting, permitting, and developer performance, c) financing, and d) a lack of regulatory approval can all contribute to the termination of renewables contracts.

These issues are often interrelated. For example, if transmission and interconnection becomes a problem, project costs can increase because capital costs may rise while projects are waiting to interconnect. Given a fixed contract price, financing can then become an issue.

11. There are lots of other reasons (besides renewables) why rates are going up, and so it will be good for us to understand the relative impact of renewables versus all the other system improvements and cost investments [the IOUs] have?

The five major areas contributing to increasing rates in the future are

1. above-market energy costs from renewable generation to meet the State's RPS targets,
2. transmission investment needed to interconnect renewable generators,
3. system upgrades to accommodate increasing amounts of intermittent, renewable power,
4. administration & general (e.g. pension contribution) and information technology costs associated the State's energy procurement market plus NERC/CIP requirements, and
5. aging infrastructure replacement and system modernization. Note that SCE has been investing in this initiative for a decade, bust must step-up its capital program.

12. What are some cost cutting measures?

In each GRC, SCE identifies and quantifies specific productivity savings and subtracts these savings from the GRC revenue requirement. Attrition or Post-Test year O&M expense cost recovery also have no allowance for customer growth, which is an implied productivity saving.

Additionally, SCE notes that nearly 90% of the 2012 GRC forecast is the continuing cost recovery of capital invested over the last several decades and previously found reasonable for inclusion in rates by the CPUC, plus the 2010 level of operating & maintenance expenses (mostly SCE and contingent workforce) funded. Only about 5% to 8% of the total GRC revenue requirement is generally at issue in a GRC.

As filed on June 3rd, 2011 with the Energy Commission[2], increased generation costs account for 68% of the total forecasted change in SCE's revenue requirements from 2012 to 2015. This increase is primarily the result of higher gas prices projected for 2015 (~35% of net increase) and QF and RPS contracts (~60% of net increase). Over the same period, transmission and distribution costs account for the bulk of the remaining change. These increases are almost entirely the result of capital expenditures related to interconnecting renewable generators on the transmission side and infrastructure replacement plus simultaneously building out to serve additional regional load. These capital programs do cause additional O&M, but this is a small piece compared to the overall capital expenditure.

Outside of the GRC, other IOU costs are allocated toward administering demand-side management programs, a priority for meeting state environmental goals, and FERC jurisdiction transmission projects. The transmission rates proposed to be in effect as of January 1, 2012 are $722 million, an increase of 102% over 2008. 54 %, of this increase was due to construction of transmission projects to interconnect renewable generation. Reducing costs significantly will not be possible without sacrificing reliability, safety, and environmental goals.

While continuing to pursue cross cutting measures and productivity improvement initiatives are important, the potential opportunities are small in relation to the additional cost of infrastructure improvements needed to implement state energy policies.

[2] Electricity Demand Forecast Form 8 – Docket #11-IEP-1C dated June 3,2011;

13. <u>It would be good to get feedback from [the IOUs] all about what the cost differential would be between the upgrades [that the IOUs would] have to do, anyway, versus upgrading to a more optimal system (to accommodate 12,000 MW of LER).</u>

At this time, SCE cannot reasonably estimate the additional cost needed to upgrade the electricity system to meet the 12,000 MW goal versus the system modernization costs needed regardless of the 12,000 MW goal. However, SCE expects that the costs to integrate the 12,000 MW goal will significantly exceed the costs associated with modernization alone. This is because SCE's electric system was not designed to accommodate significant amounts of LER but was designed for power to flow from the generation source, through the transmission system, the distribution system and then to the customer.

Depending on the size and placement of LER, significant amounts of energy could flow backward from the distribution system onto the transmission system. At the very least, distribution system and substation protection strategies would need to be modified (potentially to the same intelligence and cost levels presently required for transmission system operations). Such upgrades would not be incorporated into existing modernization efforts.

Additionally, the presence of increasing amounts of localized and variable energy resources feeding into the system will impact SCE's ability to control distribution voltages, which will likely require the deployment of costly mitigation technologies. SCE generally controls distribution voltage using capacitor banks, which are effective for existing system requirements but cannot react fast enough nor often enough to be effective in high LER penetration scenarios, even when automated. While modifications to interconnection requirements and equipment standards may mitigate some of the impacts, utility system upgrades will be needed. Both distribution static VAR compensators (DSVC) and fast acting energy storage systems have the potential to support LER integration, but are very costly. For instance, a standard capacitor bank typically costs between $18,000 and $60,000 (overhead/underground), and a DSVC (prototype) costs between $400,000 and $600,000.

14. <u>It would certainly be good to get, from the utilities, an update on the net metering numbers.</u>

As of August, 31 2011, SCE estimates that we have 1.1% of SCE's all-time system peak currently subscribed to the NEM program. The specified program cap is 5% of system peak. This represents 23,597 SCE customers and 260.9 MWs of installed capacity.

Position Paper: Localized Energy Resources

1. Executive Summary

California is proud of its national and international leadership in advancing clean energy. California's investor-owned utilities (IOUs) have helped the state achieve its goals to date. We are keenly interested in helping the state reach its aggressive energy and environmental targets in the future, while protecting customers from unreasonable rate increases.

Governor Brown's energy policies are ambitious and wide-ranging and will help California continue its clean energy leadership. California's IOUs are committed to supporting the state's efforts to study what is needed to meet the Governor's goal of achieving 12,000 megawatts of Localized Energy Resources (LER) in a way that makes the most economic sense for the state and our customers, protects against unintended consequences, and addresses unforeseen effects that are already occurring.

Four key principles should guide California's implementation of the 12,000 megawatts of LER goal:

- safe and reliable electric service with consistent power quality;
- broad resource eligibility;
- reasonable costs to customers, without cost shifting;
- California-wide participation.

These key principles will result in a sustainable long-term program that provides flexibility while ensuring no one set of customers bears an undue burden for achieving the goal.

Additional studies are needed to determine the factors that govern feasibility, examine how to achieve the goal in the most cost-effective way for customers, to better understand the significant engineering and infrastructure issues associated with integrating 12,000 megawatts into the transmission and distribution grids, and to identify the appropriate solutions to those issues and their limitations. We also need to better understand how this goal interacts with existing mandates and must manage its implementation in a way that results in investments that benefit the economy. Investment in generation that sits idle or degrades system reliability, or imposes burdensome integration costs relative to larger projects of the same technology type, represents a poor policy choice in support of California's clean energy future.

2. Key Themes/Issues

A. Key Principles to Implementation

A fundamental first step in understanding the goal of 12,000 megawatts of LER is to define more specifically what kinds of energy resources should count towards the goal. We support a broad definition that recognizes both the breadth of localized energy resources and the progress made to date with LER in California.

As the major utilities in California, we must, along with the CAISO, maintain power quality and system reliability within necessarily strict limits, while at the same time managing the cost of electricity service. A focused understanding of the effect of increased levels of LER on these two fundamental areas of consumer impact must be at the heart of any policy discussion in this area to avoid negatively impacting reliability, the cost of the transmission and distribution of electricity to consumers, or both.

An important challenge is to avoid defining LER too narrowly. This should not be just a solar, wind, or even just a renewable initiative. In addition, we agree with the Governor that projects up to 20 megawatts in size should be counted toward the goal. We support considering a wide range of project types and sizes to be included, such as projects that are greater than 20 megawatts. The broader the opportunity for diverse resources, the better the chance we'll meet reliability and cost containment goals.

While abiding by these key principles, we also must study and understand how to achieve this goal in the most economically meaningful way for the state and our customers.

This assessment should consider:

- power quality;
- system reliability;
- cost to customers;
- rate impacts;
- changes to the distribution and transmission system needed to accommodate expanded LER;
- California's achievements to date in installing and planning for higher levels of generators under 20 megawatts in size;
- the technology mix, eligibility of project sizes (including projects larger than 20 megawatts), pace for advancing LER, and impact on system operations;
- participation by all load-serving entities;
- the impact of having a significantly larger number of small generators interconnecting to the electric grid;
- processes for small generators to locate in areas that minimize interconnection and transmission and distribution modification costs;

- system need and demand for LER generation;
- resource issues for local governments;
- net economic impact and job creation.

Ultimately, California will be best served by achieving the goal in a way that optimally balances environmental, system reliability, and customer cost impacts. These are fundamental tenets of our energy future, and careful study is needed to understand the impact of significantly increased amounts of LER, such as the 12,000 megawatts goal, on each of these issues and to inform policymakers on how these choices affect the everyday lives of Californians.

B. Additional Study Needed to Address and Understand Service Quality Issues

Reliability, safety, and affordability of electric service are key parameters to successfully achieving the 12,000 megawatts goal. To assess the impact on reliability, we need to better understand how many projects are necessary, over what time period, and where they should be located, taking into account the impacts of different generator sizes and operating parameters on the local distribution and transmission system, as well as the overall area operating impacts. From a cost perspective, we will require additional information on the magnitude of infrastructure modifications that will be required to accommodate the impact of variable LER on our electric distribution system.

Critical issues for grid operations and planning include voltage, intermittency, operability, and interconnection and system integration.

- Voltage: Voltage is analogous to water pressure in a municipal water system. Just as sufficient pressure is required to keep water flowing through pipes, electric systems need steady and sufficient voltage pressure to keep electrons moving smoothly across wires. LER will have the ability to affect service voltage. A significant amount of new LER will require system modifications to keep voltages within standards, which may require that new LER facilities interact with utility voltage regulation equipment (something that does not occur today). On some circuits, especially those with relatively light loads, even small amounts of LER can have significant operating impacts. In addition, transient voltages and power line distortions can interfere with and even damage sensitive customer equipment.

- Intermittency: The output of renewable generation varies with the energy source. For example, solar panels don't produce electricity when the sun doesn't shine, and wind turbines don't spin when the wind doesn't blow. But it's not just an on-or-off proposition. The output from solar and wind can vary over relatively short periods depending on cloud cover and shifting wind speeds. This intermittency produces challenges in managing demand on specific parts of the grid and ensuring adequate capacity. The intermittent nature of some renewables also makes it more challenging to regulate system voltage.

- Operability: There is a lack of both generation visibility and control systems in place to integrate high volumes of LER. First, LER projects must include telemetry (which allows system operators to monitor generator output) so that system operators can see if the resource is available to generate. Additionally, system operators should have the ability to interrupt generation in case of system instability or other issues. If these visibility and control systems are not put in place, high penetration of LER could lead to significant impacts to system operations including large outages, instability, and extended restoration time.

- Interconnections and System Integration: Connecting generation in areas of the grid where there is little local need for power or insufficient delivery capacity may result in the need for significant and redundant upstream distribution and transmission system modifications. Interconnecting LER at locations on the distribution system where there is high load demand and/or where there is significant distribution capacity available could help California electricity customers avoid significant system upgrade costs. California's IOUs agree with the Governor's assessment that some changes are required in order to increase the amount of LER across the state and facilitate the interconnection. For example, the IOUs have been working with the CPUC to reform California's Rule 21 distribution interconnection process, which lacks a detailed method to study exporting generators or a group of generators, does not have a methodology for cost allocation particularly between a group of electrically dependent generators, and does not integrate with the IOU's WDAT queues and the CAISO's queue, and has no option to seek resource adequacy. Making Rule 21 more compatible with other interconnection procedures will allow generators to connect to the distribution system in an effective, streamlined process. Also, we agree with the Governor that the permitting process for building and connecting LER needs to be greatly streamlined and are ready to work with stakeholders to improve the interconnection application and study process. However, we also believe that LER needs to be optimally located to minimize system impacts and integration costs.

There are technical solutions to mitigate these concerns and ensure service quality. For example, elements typically associated with the concept of a smart-grid may facilitate the interconnection of more LER (e.g., volt-var management systems and smart inverters). However smart-grid investments will involve billions in investment, require common standards, and take years to implement.

We need to understand the best combination of solutions, the appropriate allocation of cost responsibility that ensures that development is in the optimal location, and the optimal timeline for deployment and development of these interconnections. We must ensure that all LER meet consistent, equitable, and meaningful performance standards so that they meet our energy needs safely and reliably. We should also have a fuller understanding of the cost implications of resolving the integration concerns that a large introduction of intermittent LER will create.

C. Early Action Should Count Toward the Goal of 12,000 Megawatts of LER

The IOUs collectively have vast experience with LER. Together, SCE, PG&E and SDG&E have had significant success deploying new LER on the grid, and have additional resources already in the pipeline. This experience by IOUs has taught valuable lessons that should be part of any planning for future LER and how it should play into the state's ambitious 33% renewable energy goal. Such insight will be invaluable in determining the right mix and pace of LER projects and avoiding significant negative impacts on system modification cost and reliability. As a starting point, the significant number of existing and in-pipeline LER must be counted toward this goal. This will ensure that customers don't pay twice to achieve the goal or pay for energy that isn't needed to meet California's energy needs.

D. Cost Containment

An equally important challenge is cost containment, which includes 1) managing the interconnection costs; 2) controlling transmission and distribution impacts and modification costs required to integrate the LER generation into the system; 3) determining optimal technologies and locations to maximize benefits and minimize costs, and 4) choosing appropriate wholesale pricing mechanisms for how generation output is procured. We also need to evaluate how existing pricing mechanisms and subsidies for LER may need to be modified, so that electric rates will not increase too much or too quickly. Further, we need to understand what level of rate impact is considered "acceptable" so that policy changes can be considered before the impacts become unacceptable.

No matter what model is used to recover the cost of these interconnections, in the end, customers will pay higher costs if we do not carefully manage the implementation of the goal. From a utility perspective, it is important to keep the costs as low as possible and that the people who benefit from the generation pay their fair share of costs.

A 12,000 megawatt LER program has the potential to impose significant upward pressure on rates, including generation rates and distribution and transmission rates. The total cost of the program can be reduced by including existing LER programs and installed capacity, as well as a broad range of technology types toward the 12,000 megawatts goal. This will result in lower interconnection costs and reduce the transmission and distribution upgrade costs borne by the utilities and their customers.

E. Cost Responsibility

Cost responsibility is just as important as the total cost of the program, because it can result in some customers paying more to subsidize services provided to customers that install LER. While it is important to keep the costs as low as possible, it is also important that the people who benefit from the generation pay their fair share of those costs.

The current Net Energy Metering system is an example of how subsidies harm non-participating customers. Under this program, customers that install LER behind the meter are able to avoid paying the cost of ensuring that electricity is available to them when they need it as well as to avoid paying the cost of important public purpose programs (such as our low income programs).[i] Instead, customers without LER are required to pay the cost of services used by those who do install LER. As long as the utility is not allowed to charge the NEM customer for the grid services they receive, customers without LER will continue to carry these costs. Because those with solar panels tend to be more affluent, this ends up as a subsidy for the affluent from lower-income customers.

Numerous other subsidies are currently granted to LER customers that must be re-evaluated as we move to higher levels of LER penetration and as prices for LER continue to decline. Program incentives like the California Solar Initiative result in cost shifts to non-participating customers. This wealth transfer is not sustainable as we work toward the 12,000 megawatts goal.

We believe that a fair system for LER would be based on a market-based mechanism that reflects the true cost of generation. Administratively set prices and hidden subsidies lead to higher customer costs than we would see under a market-based, competitive framework.

F. Sustainable Job Creation Needed

Creating sustainable green jobs in the state is a high priority for the Governor and the IOUs support that priority. In fact, the three major IOUs helped create thousands of new permanent jobs in California in recent years, during the worst recession in decades, as we invest prudently in upgrading the state's electricity grid and in renewable energy procurement. This work has also created thousands of temporary construction jobs. Many of these jobs are "green," including constructing industrial rooftop solar generators and building/upgrading transmission and distribution circuits to connect new utility-scale renewable energy projects. This work typically employs high-paying, union labor.

What is not clear, though, is whether small-scale LER projects will create sustainable jobs in California. Most of the sustained, higher-paying jobs connected to deployment of LER are in the manufacturing of the components used in LER installations and likely would be located in other states or even off-shore unless the State can develop policies that encourage growth of renewable manufacturing within California. Generally, the jobs that would be created in California are one-time sales and installation jobs, with minimal on-going maintenance jobs, which may not be as highly paid. California needs to assess what resources will foster the creation of the most long-term opportunities, which will require considering workforce sectors beyond LER. Additionally, California must assess the impact of increased electricity rates on job creation and investment outside of the electric sector and the broader state economy.

3. Conclusion

In closing, clean energy is a significant part of California's past – and future – energy supply. To best foster continued efforts in this arena, we must have a careful examination and balancing of public policy issues to find the best path forward for California. Careful assessment of the concerns mentioned above is necessary. We believe certain issues can be mitigated through a coordinated policy design that takes into account the realities of the electricity grid and cost impacts. Policymakers should consider all of these impacts and all of the challenges presented by high penetrations of LER and understand what is required to successfully integrate them into the electric system. This consideration will allow for the necessary planning of resources toward the goal.

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[i] *(Illustrative Example)* Let's compare two hypothetical customers: One owns a 10,000-square-foot home with a pool that uses about 2,000 kilowatt-hours per month in the summer and pays an average monthly electric bill of $500. The other rents a 1,200-square-foot home that uses 800 kilowatt-hours and pays $140 per month. The higher-income owner of the larger home spends $65,000 to install a 10-kilowatt solar system that produces 1400 kilowatt hours per month. His net energy use falls to about 600 kilowatt-hours and his bill declines to just $90. Because the costs incurred to provide reliability and grid integration services to the NEM customer are paid for by other ratepayers, the renter of the small home actually sees his electric bill go up a few dollars, to $145 a month, despite experiencing no change in his electricity consumption. This cost shift occurs because the affluent homeowner is no longer fully paying for the distribution system that he continues to use, thus the renter has to make up the difference. This cost shift would be mitigated if the NEM customer was required to pay for their use of the electricity grad and the reliability and grid integration services that the utility provides.