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Chairman Robert Weisenmiller
Commissioner Karen Douglas
Commissioner Carla Peterman
California Energy Commission
Dockets Office, MS-4
Re: Docket No. 11-IEP-1D
1516 Ninth Street
Sacramento, CA 95814-5512

Re: "Docket #11-IEP-1G Renewables" Implementation of 12000 MW DG Goal

Dear Chair Weisenmiller and Commissioners Douglas and Peterman:

Thank you for the opportunity to submit these comments regarding policies to implement the Governor's proposed goal of 12,000 MW of clean local distributed generation (DG). The Sacramento Municipal Utility District (SMUD), the second largest publicly owned utility in the State, appreciates the work of the staff at the California Energy Commission (CEC), their colleagues in the Governor's office and other energy agencies, and their consultants in developing the initial analyses and discussion questions related to the feasibility and potential policies for implementing the Governor's proposed goal.

SMUD participated in the May 9 workshop, and below provides general comments on the proposed goal as well as answers to the specific questions posed in the workshop agenda.

SMUD's General Comments

SMUD has actively supported renewable energy development and distributed generation development to serve our customers as part of our long-term sustainability goal – reducing our GHG emissions for serving retail load to 10% of our 1990 level by 2050. Policies contributing to this goal include SMUD's recently-accomplished 20% by 2010 renewable portfolio standard target (RPS) and our 33% RPS target for 2020, adopted prior to this year's passage of California's mandatory 33% by 2020 RPS. In addition, SMUD has for some time supported the development of clean local distributed generation in our service area. SMUD developed distributed solar programs in the 1990s with great success, and currently is participating in the California Solar Initiative (CSI), striving to add 125 MW of distributed solar power by 2016 as partof the State's 3,000 MW CSI goal. SMUD has recently developed and implemented a 100 MW Feed-In Tariff structure (these projects are currently in active development) that provides tariff prices based on the value of the power to SMUD, rather than based on estimates of the production cost of the eligible technologies. SMUD has significant local combined heat and power (CHP) resources as part of its power mix, and opened its Feed-In Tariff to CHP applicants as well as renewable technologies. Finally, SMUD has an active research and development program that has many significant projects related to clean local distributed generation, renewable generation, distributed and central storage options, understanding the impacts of these resources on the grid, and examining ways to better integrate them into the grid.

SMUD is committed to achieving our renewable and distributed generation goals, and our programs are on tract to meet those goals. This leaves SMUD with little to no need for additional renewable or distributed generation resources in the near-term – we have projects in place to meet our goals through at least 2016.

SMUD strongly supports clean local generation, as these resources fit well with our Board's sustainability and local focus goals. SMUD is committed to working with state policymakers and other stakeholders to achieve additional clean local generation. In pursuit of this goal, SMUD believes that the following factors must be considered:

- **Grid Reliability** – It is paramount when considering adding additional distributed generation to the grid that reliability be maintained. Californians enjoy reliable electrical service today, and the benefits of clean local generation would be substantially reduced if grid reliability were lowered as a result of adding these resources to the grid. SMUD appreciates the attention that the CEC is paying to the grid and reliability experiences in other countries with dramatic increases in distributed generation – lessons learned in those circumstances can be adapted to California's grid structure to prevent loss of reliability. However, we must adequately understand the potential reliability impacts and the costs of possible solutions in California's context before moving forward with any large scale mandates.

- **Cost-effectiveness** – While there are clear benefits to clean local generation, it is also critical to consider the costs involved in developing these resources, including any cost of maintaining reliability, in order to avoid significant rate impacts for utility customers. California's economy, though recovering, is still weak, and additional costs without commensurate benefits could harm the recovery.

- **Timing** – When considering the above two factors, the timing of developing additional distributed resources becomes critical. Adding substantial amounts of these resources when their costs are relatively high and when they may not be needed due to flat or declining load growth, and given current system resources and contracts under development, will lead to unnecessary costs and possibly **strand**ed resources. The full costs of these resources must still be recovered from our ratepayers even as their use is decreased when distributed generation resources are increased. In addition, time is needed to fully understand the effects of ever-increasing quantities of distributed generation, particularly intermittent distributed generation, on the reliable operation of the grid, and to implement those grid changes necessary to preserve reliability. SMUD is concerned that a date of 2020 for a goal of 12,000 MW of clean local generation will not allow adequate consideration of resource needs and reliability issues, and urges consideration of a more gradual phase-in and a later date for such a goal.

- **Eligibility** – SMUD believes that a variety of resources should be considered eligible for the proposed clean local generation goal, including combined heat and power and biomethane and biogas resources. A variety of resources with different characteristics can be easier to integrate into the grid and help reduce costs and avoid reliability issues. The proposed goal should also count the amounts of existing and committed clean local generation from current programs and resource plans. SMUD is pleased to see the State begin with a solid accounting of these existing programs and resources – there is no need to duplicate or complicate what the State's existing program commitments.

- **Interaction with other policy goals** – The State has many different policy goals that are acting jointly to change the electrical system in California. The new 33% RPS, the development of the smart grid, the State's strong energy efficiency programs and targets, and similar policies all are acting to change grid and resource development over this decade. Layered onto these policies is the launching of the cap-and-trade program in 2012, which will further complicate the landscape. A new target of 12,000 MW of DG must be coordinated with these policies, allowing stakeholders flexibility to meet the goals in a manner that best meets the needs of the utility at lowest cost for each service area. For example, SMUD previously commented (see our Renewable Net Short (RNS) comments last month) that the enactment of the 33% RPS allowing use of tradable renewable energy certificates (TREC) implies that DG resources can and will contribute to the RPS goal, and that recognizing this is most important when considering the Governor's proposed DG goal. Table 1 below illustrates one effect of recognizing this nexus among the State's goals, both adopted and proposed. A second example is the interaction between smart grid development and the capability to reliably integrate large amounts of distributed generation. Development of significant distributed generation prior to putting this capability in place will be inherently more complicated and costly.

- **Flexibility** – California should look at each specific policy goal, such as the 33% RPS and the proposed 12,000 MW of clean local generation, in light of the ultimate goals for these policies – reducing the carbon footprint of the electricity system, decreasing ratepayers' exposure to volatile electricity prices, and providing for a reliable, stable, and clean electricity system. When these reasons are kept in mind, allowing each entity flexibility in meeting the overall goals based upon local conditions – such as load needs, resource potentials, local costs, and transmission constraints – will help to meet the ultimate goals most cost-effectively. For example, to the extent that DG is customer-owned customers would participate in part because they see the value of DG to them. In SMUD's case, we have few customers that have the desired thermal load to make CHP cost effective, and SMUD's lower retail rates make PV and other DG options appear relatively less valuable to our customers.

Table 1 below is provided as an illustration of the effect of reasonable coordination of state policies. Column 2 reflects State treatment of renewable DG for customer-owned, net-metered renewable installations in the past, as basically independent of the RPS. Columns 3 and 4 illustrate two different methods that would coordinate and explicitly consider renewable DG as part of RPS compliance. In both cases, the additional renewable generation considered acts to lower the amount of additional renewables needed for the RPS, but in Column 4, where the renewable generation is not added back into retail sales, 'double counting' of distributed renewable generation exists. SMUD believes that the 'Column 4'structure in effect exists today, with the opening up of the RPS to TRECs by the California Public Utilities Commission and the 33% RPS legislation this year. SMUD suggests that proper coordination here requires the State to use the 'Column 3' structure as a method of coordinating DG and RPS policies.

Table 1: Illustrative Effect on RNS and Renewable Needs of Net-Metered Distributed Generation (1000 GWh)

	(1) With No DG	(2) Current Standard Calculation	(3) Renewable DG Counts, And In "Retail Sales"	(4) Renewable DG Counts, But Not In "Retail Sales"
Example Gross Retail Sales	300	300	300	300
Example Renewable DG		20	20	20
Net Retail Sales	300	280	300 (DG sales added back in)	280
33% RNS Amt.	99	92	79 (99-20)	72 (92-20)
Result ---		DG lowers RNS by 7 K GWh (33% of DG energy)	RNS lowered by additional 13 K GWh (100% of DG energy counts)	RNS lowered by 27 K GWh (100% of DG energy counts, but sales not added back in)

Another need for coordination is with the State's strong energy efficiency policies and goals. California pursues energy efficiency first in the loading order for new resources. Because of success there and unfortunate economic conditions, load growth is now flat and/or declining in many areas across the State. This reflects on the timing of pursuing other resources, such as the Governor's proposed goal for distributed generation. With little immediate need for new resources and with planned resources to meet the RPS in the pipeline, there is no rush. The State has time to understand the impacts of adding additional DG resources in large quantities and will benefit as their costs come down.

SMUD also believes that much can be learned from the experience in Germany, Spain, Italy, the Czech Republic, and other areas that have had to integrate in their electricity systems dramatic growth in distributed renewable generation. While there are some differences in the underlying electrical grids, and in grid management policies and policies for incentivizing and interconnecting clean local generation, it is clear that many of the issues and questions in those markets are relevant in California. SMUD believes that more research should be done about the experiences in Europe, and notes that the KEMA study did not cover Italy or the Czech Republic, nor Japan, which also has a significant amount of installed distributed photovoltaics. Before moving forward with policies that may incentivize development of DG at the scale considered by the proposed goal, or penalize lack of achievement toward that goal, the State must have a better understanding of how these developments have worked in other jurisdictions, and what problems and costs have arisen.

In this regard, SMUD emphasizes that research and development is needed in other areas as well, to help reduce the direct costs of clean local generation and to address and mitigate the costs of integration of these resources into the grid. Research is needed to help make these resources more dispatchable where applicable, and to help make their generation amounts and variation predictable and observable to system operators. Additional experience with the smart grid is necessary, and more research and experience is needed with distributed storage as a grid resource. In addition, research is needed to continue reducing the emissions of those clean distributed technologies that combust biogas or natural gas.

Answers to CEC Questions

I. Developing Interim and Regional Targets for 12,000 MW by 2020

1) Please suggest a methodology for setting interim and regional targets building to the 12,000 MW goal by 2020. Considerations to address include: state and local policies, the capability of the distribution system, economics, and resource availability. To aid discussion, staff has identified the following options for parsing out the goal:

- **Set targets for each load serving entity or county.**
- **Set targets per sector, for example, residential, commercial, public, or other.**
- **Set separate targets for installations that serve on-site load and for projects that produce energy for wholesale.**
- **Set targets by utilities' portion of coincident peak.**
- **Set targets based on resource potential and/or best use of the distribution system.**

Response: As mentioned above, SMUD has been a leader in developing and implementing policies, goals and programs that are well aligned with State policies. SMUD has met the 20% renewable generation by 2010 set by our Board, and is on target to achieve the Board's 33% renewable generation by 2020 goal (now a state mandate) as well as the longer-term goal of reducing the carbon emissions associated with serving our customers to 10% of our 1990 emissions level.

However, SMUD also puts high priority on ensuring reliable power at reasonable cost. Our success on our sustainability goals, our continued high rankings on reliability metrics nationwide, and our continuing trend of lower prices than neighboring utilities, are testament to SMUD's success in effectively balancing our goals of increasing renewable energy, lowering GHG emissions and providing low cost, highly reliable electricity. Our ability to balance these objectives is made significantly easier because SMUD has enjoyed the flexibility to consider the conditions and requirements in our service area, pursuing renewable resources and other resources as we need them to meet our combined policy, cost, and reliability goals.

SMUD believes that the methodology that should be considered for the Governor's proposed DG goals should:

1. *recognize the amount of DG already built and established in program pipelines;*
2. *be based on a thorough understanding of the potential and differential costs of DG resources in various service areas (including costs of variable generation integration and distribution system upgrades needed), rather than based on a simple percentage of peak load per utility or some other arbitrary factor; and*
3. *recognize when new resources are needed, and allow flexibility so that local conditions can be reflected on an ongoing basis as the proposed goal is pursued without stranding already procured assets.*

At present, because of our diligent planning and procurement, SMUD has met our 20% RPS goal for 2010 and is on target to meet the State's upcoming goals for renewables and GHG reductions. As a result, we do not have a clear need for any more new renewable projects (i.e., other than what's in our procurement pipeline), or really any new generation of any kind, until at least 2016. Our position on the 12,000 MW DG goal is shaped by our track record on successful renewable procurement -- we secure such resources as cost-effectively as possible for when we need them. In the next few years, SMUD will continue to examine the system requirements for integrating additional amounts of DG, and monitor carefully the market for and costs of these resources.

SMUD believes that overly prescribing the path by which utilities attain the proposed goal, via arbitrary timing, technology, or geographical targets, is likely to result in economic inefficiencies (e.g., investments being made too early, investments made in less cost-effective technologies or policies, etc.). We are also concerned that imposing aggressive goals for renewable DG prior to a good understanding the impacts on the grid and the best solutions for those impacts could lead to reliability issues.

2) Related to the above question, some utilities have noted in the California Public Utilities Commission's Rule 21 Working Group and its Renewable Distributed Energy Collaborative (Re-DEC) that up to 15 percent of peak load for individual circuits could reliably interconnect with minimal system upgrades. Other utilities have said that individual circuits could handle distributed generation additions for up to 50 to 100 percent of minimum load. Could a 15 percent of peak load or 50 to 100 percent of minimum load penetration rate be implemented statewide? If so, how much renewable capacity would be installed per utility?

Response: SMUD has been an active participant in the standardized Rule 21 development effort in California. SMUD voluntarily chose to adopt the same Rule 21 language, screens and procedures as required of the IOUs because SMUD believes standardization of the interconnection processes Statewide will benefit the DG community – allowing them cost reductions through consistent requirements regardless of utility service territory. Penetration limits on a per circuit basis such as the 15% of peak load screen has served as a proxy for how much DG capacity could be interconnected to a circuit during minimum load conditions -- a condition of concern to utilities. Since there is generally a ratio of 3:1 between a circuit's peak load and average minimum load in California, the 15% of peak load is a proxy for 50% of average minimum load.

The 15% of peak load penetration limit could be used as a proxy for a technical estimate for utility capacity for inexpensive interconnections, but SMUD emphasizes that every circuit is different, and every DG installation has somewhat different effects. Any such proxy would need to account for pre-existing DG projects already interconnected and other considerations peculiar to each circuit. Rule 21 would still need to be followed to ensure that localized constraints don't preclude or make uneconomic individual interconnections, even up to the 15% proxy target.

SMUD also notes that moving to a smart grid and advanced metering infrastructure (AMI) will significantly improve our knowledge about circuit specific conditions and in particular minimum loads. This knowledge will improve our interconnection process and capability may eventually foster a detailed circuit-by-circuit potential rather than the 15% proxy screen. However, it will take time and experience with the new grid infrastructure for this improved knowledge and capability to be developed fully and brought to bear on the question of how best to integrate DG on a circuit-by-circuit basis.

3) Please provide comments on any methodologies discussed at the workshop. Indicate whether you support or oppose a particular approach and the rationale for your position.

Response: SMUD has no position on this at this time.

4) Should the state create incentives or penalties to ensure achievement of targets? If so, please suggest program design and implementation.

Response: Rather than concentrating on new incentives or penalties in this instance, SMUD reiterates that coordination with and building on existing policies and structures will help to make the proposed DG goal feasible and cost-effective. If the portion of the proposed DG that is renewable is considered part of the RPS, as SMUD advocates, then the general incentive/penalty structure for the RPS will apply, and no new penalties or incentives are needed. If the proposed DG goal encompasses and builds on the distributed solar resources the State is acquiring through the CSI (as SMUD advocates), then again, existing incentive and penalty structures will be in effect. If the proposed DG encompasses and builds on the State's mandated and voluntary Feed-In Tariff structures, as SMUD advocates, then no additional penalties or incentives are necessary.

SMUD does have two specific recommendations regarding potential incentive mechanisms.

First, to the extent that the proposed DG goal is expected to be accomplished with additional 'behind the meter' distributed solar resources installed on customer premises, SMUD believes that the existing incentive represented by net metering should be reexamined. The current 5% cap on mandatory net metering acts to limit the cost of this incentive to non-participating customers, and should not be increased without a restructuring of the net metering paradigm to eliminate or significantly reduce the subsidy from non-participating customers.

Second, to the extent that a Feed-In Tariff structure is considered as a way to help accomplish the proposed DG goal, SMUD stands opposed to the significant costs that are represented by the 'European' model of Feed-In Tariffs that are based upon an administratively determined estimate of the underlying technology costs in varying installation circumstances. SMUD prefers a general Feed-In Tariff structure or a Renewable Auction Mechanism that provides incentives for the most cost-effective renewables to be developed and compensated based upon an estimate of the value of the energy to ratepayers in general.

5) If the state established regional targets, should there be options to trade allocation requirements? If so, how should this be implemented?

Response: As long as the State coordinates the proposed DG goal with existing clean generation policies and allows flexibility on using many types of clean local generation to meet the proposed target, as well as allows flexibility on contract terms, location of the resource, and the use of TREC's for renewable resources, there is no need to have a separate market to trade allocation requirements. Such trading will already happen in the existing RPS and carbon markets, without needing to establish another complicated and duplicative trading structure. However, to the extent the State limits the types of local clean generation, mandates that the proposed goal must all be procured through specific, distributed, small scale production structures, or sets stringent minimum terms for new contracts, then flexibility to trade allocation requirements may be necessary to keep costs and rates down and at the same time allow a effective to way to be compliant.

6) What are the near-term and long-term actions needed to achieve 12,000 MW by 2020?

Response: In the near term, the State needs to make sure that existing programs intended to foster increased clean local generation are on track, and modify them as needed. Achieving the proposed goal depends upon building upon the success of these existing programs. The State also must clarify the eligibility of DG for meeting the requirements of the RPS targets, pursuant to the enactment of the 33% RPS requirement, which explicitly allows TRECs for RPS compliance. Coordinating these existing policies and building upon them will lead to easier consideration of a proposed DG goal.

In addition, there is a need to facilitate coordination among local land use agencies for permitting significant amounts of distributed generation. Without this up-front coordination, differential policies and structures in local jurisdictions could well act as a barrier to the most cost-effective installation of DG to meet the proposed goal.

In the mid and long term, federal and state governments, and private sector equipment manufacturers, need to continue investing R&D dollars in DG technologies. The early costs of DG technologies, such as solar photovoltaic systems, are still high in comparison to most electric generation technologies. In addition, there are still issues related to integrating and interconnecting DG into the existing electricity system and grid, distributed storage needs development and demonstration, and there are regulatory barriers such as air permitting in the case of DG biomass and biogas resources (see response to question 11). Further reduction in DG capital costs and increases in DG efficiency are necessary so that from a life cycle standpoint DG technologies are more cost competitive with other solutions, such as energy efficiency and traditional central station generation sources. Further research is also necessary regarding the potential operational impacts on utilities of increased interconnected DG capacity, and potential ways to mitigate these impacts.

II. Discussion on European experience integrating large amounts of DG

7) How are the European electrical distribution systems similar to or different from California?

Response: Based on the consultant work for the workshop, there are some differences between the German and Spanish DG systems and the system in California. The most obvious difference between European distribution systems and those in California is the design of the low voltage systems. In urban areas, European low voltage systems use larger service transformers (about ten times as large) directly serving significantly more customers. These low voltage systems distribute three phase power to every customer site. In contrast, California's low voltage systems have smaller transformers that typically serve about a dozen customers and provide only single phase service to residential customers.

In addition, many German and Spanish distribution networks operate at significantly higher voltages (15-30 kV versus 12-15 kV or lower in CA), and these circuits can take greater amounts of distributed generation.

Away from the urban centers, European distribution systems appear to be more similar to California's.

8) What challenges have European countries encountered from integrating distributed renewables that are applicable to California, what actions did they take to address the challenges, and what lessons are applicable to California?

Response: Germany and Spain have added significant amounts of distributed renewable generation, and appear, based on the consultant report, to have reached the point where impacts to the system are causing increased costs. Hence, Germany has recently required new interconnections of DG above 100 kW to have telemetry and dispatch capability by the system operator. In addition, these two European countries appear to be leaders in the ability to forecast the generation from distributed renewable generation, due to the large amounts of such systems that are now contributing to the grid. California should be prepared to consider similar DG telemetry and operation control as needed and available. While the report also provided a brief discussion of some protective relaying issues, it did not clearly cover the approach required to deal with the substation voltage regulation issues.

9) As California builds out its distribution system, what lessons can be learned from the European experience?

Response: Direct utility control of numerous larger solar fields, as proposed by Germany, may become important for California utilities, perhaps before enough have been deployed in Germany to learn from their experience.

In addition, the consultant reported that Germany had identified four quadrant relaying as a requirement for accepting reverse power flows through distribution substation transformers. This was not something SMUD has considered. (SMUD's distribution substation relays are typically non-directional).

Also, while inverter vendors in California have been reporting the widespread use of voltage source inverters in Spain, Germany, and throughout Europe, the consultant's actual finding was that Spain and Germany are still using current source inverters, as is the case in California. Nevertheless, Germany is planning on going forward with the use of voltage source inverter based installation in the near future.

III. Discussion of "Developing Renewable Generation on State Property, Installing Renewable Energy on State Buildings and Other State-Owned Property"

10) Please provide comments on the staff report and on lessons learned from the European or local experience that may be applicable to California.

Response: Information in the consultant report from the workshop indicates that Germany and Spain have not actively developed distributed renewable generation on federal or institutional property. In this regard, California may have more experience.

IV. How Research Development and Demonstration (RD&D) can Help Advance Distributed Generation

11) What is the role of RD&D in advancing distributed generation and helping achieve the Governor's Clean Energy Jobs Plan and other current and future state policy goals such as the Renewable Portfolio Standard and AB 32?

Response: RD&D can contribute to the Governor's DG goals by reducing costs of DG systems and by addressing market barriers to widespread adoption. The most critical issues facing DG deployments are cost and grid integration issues, and specifically operating costs and air permitting in the case of DG Biomass. The integration of variable DG into the utility grid and the development of a 21st Century distribution system in California that can accept powerflow in two directions should be priorities for public and private RD&D programs. Also, advanced storage systems may become a key part of the solution for widespread use of DG systems in California.

Federal and state governments, and private sector equipment manufacturers, need to continue investing R&D dollars in DG technologies. They need to reduce DG capital costs so these technologies can compete better with larger utility-scale generation. Research needs to investigate ways to more easily interconnect DG resources and mitigate impacts that these may have on operation of the electricity grid, including designing the systems to allow for dispatch where appropriate and better forecasting of and telemetry for system output. Improving DG efficiency, reliability and durability in order to reduce O&M costs will help DG technologies become more cost competitive with other solutions from a life cycle standpoint. A better understanding and quantification of benefits of DG and storage systems will help to justify market investment in these technologies. Finally, research needs to continue to address emission reduction technologies for fossil and biogas DG solutions so that California is not implementing DG technologies that are worse than central station power production.

12) Please comment on the maturity of distributed generation technologies. Which technologies or components should RD&D efforts focus on to address some of the barriers for advanced DG deployment?

Response: Combustion-based technologies, such as reciprocating engines and gas turbines, are the most mature DG technologies. Microturbines are the next most mature technology, followed by Stirling engines to round out the combustion based technologies. PV technologies are generally mature in terms of reliability and durability, and despite the great progress in the last decade, need further cost reduction and efficiency improvements. Lastly, fuel cell technologies are continuing to see reduction in first costs and operation and maintenance costs.

For commercially available reciprocating engines and gas turbines, R&D is still needed to improve the effectiveness of emission control technologies and their operating costs. Microturbines need to see continued R&D to reduce their first cost and improving their efficiency. Stirling engine technologies need continued R&D to improve their first cost, durability and reliability. Fuel cell technologies continue to be hampered by high first costs and high maintenance costs. R&D is needed to bring these costs down so the fuel cells can compete with reciprocating engines and turbines. R&D is also needed to reduce fuel cell susceptibility to contaminants in fuels, particularly renewable fuels.

13) Are currently existing technologies and tools enough to power facilities with nearly 100 percent renewables in a technically and economically feasible manner? What are some emerging technologies that may be able to reduce costs when produced at scale?

Response: SMUD does not believe existing technologies and tools are sufficient to supply 100% renewables cost effectively, except in very unique circumstances. Considerable technology development and research is needed to achieve 100% renewables in an economically feasible manner for grid-connected applications. Hawaii is dealing with adverse system impacts of high penetrations of PV that is causing the utility to curtail PV power plant output. SMUD currently is working closely with Hawaiian Electric Co. on an advanced high penetration R&D project. Penetration limits generally are not as high yet in the U.S. to understand the operational impacts of the intermittency of PV on utility systems. Sufficient tools that enable transmission system operators to plan for and operate distribution-sited renewables, demand responsive load control and energy storage are lacking. A better fundamental science understanding is needed of the impacts of variable generation renewables on the distribution system, and of the potential for and development of options to mitigate these issues. R&D is needed in the continued development of integrated T&D planning and operations tools that will give bulk system operators higher fidelity visibility and control of the distributed assets connected to the distribution system. Distributed storage needs further technical development, cost reduction, and demonstration.

14) What issues impede the deployment of distributed generation technologies in utility distribution territories that RD&D can help address? If so, please identify the issue and how RD&D can help in a manner that benefits both the utilities and customers.

Response: Some DG technologies (e.g., solar and wind) have other operational impacts on utilities that tend to increase with increased interconnected DG capacity. The costs of dealing with these operational impacts are typically born by utilities and research should focus on understanding the nature of these impacts and reducing the costs of solutions to mitigate these impacts.

For example, high penetration of PV can create an operational issue for utilities with respect to planning for contingency power. The intermittency of PV production can cause significant grid operation issues, and the industries' emerging capabilities to forecast PV production within the hour, one hour ahead, hours-ahead or day-ahead is lacking. Consequently, utilities currently will plan contingency reserves for this aggregate generation in a conservative fashion because forecasting techniques are unproven. R&D is needed to improve PV production forecasting so that utilities do not over plan contingency power needlessly, thus driving up PV integration costs. Wind integration has similar issues.

Another example is that high penetration of PV or other distributed generation may adversely impact voltage regulation on distribution substations and feeders. It may also impact protection schemes. R&D is needed to determine new methods for designing and controlling the distribution system with the existence of a high penetration of PV such that utilities can cost effectively maintain service voltages to customers and ensure faults are safely dealt with, all while maintaining high reliability for utility customers.

15) What other future research direction, focus, strategies or initiatives may be recommended for PIER to undertake so that RD&D can better help advance DG?

Response: A portfolio approach to R&D for DG specific issues as discussed above (e.g., first cost, operation cost, durability, reliability, efficiency, emissions), and grid integration research, is needed. Of these two, grid integration is of paramount concern to utilities presently. R&D to support these two issues in the next 10 years will provide needed knowledge to utilities and customers on how best to deploy and integrate DG and renewables to utility systems and customer facilities. But synergistic technologies, such as demand response and storage, may also be able to leverage this grid integration knowledge or may be part of the integration strategy for customers and utilities. Future R&D should take a broad perspective on how best to meet the customer and utility operational objectives and pursue all cost effective distribution sited technologies including demand response, storage, DG and renewables. Finally, research does not equate to real experience with operating and managing the

electricity system with increasing amounts of distributed generation. Time is needed to learn from experience as the amounts of DG increase within the system.

In closing, SMUD again expresses its appreciation for the hard work by CEC staff, their colleagues in the Governor's office and other agencies, and their consultants in the pulling together initial analyses and discussion questions for the May 9 workshop, and for the opportunity to submit these comments. We look forward to participating throughout the remainder of the IEPR process and other proceedings on the development of policies related to the Governor's proposed 12,000 MW DG goal.

Respectfully submitted,

/s/
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