SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
The Power To Do More.®
P.O. Box 15830, Sacramento, CA 95852-1830; 1-888-742-SMUD (7683)

July 20, 2011
LEG 2011-0372

DOCKET
11-IEP-1G
DATE JUL 20 2011
RECD. JUL 20 2011

Via Electronic Mail to docket@energy.state.ca.us
Chairman Robert Weisenmiller
Commissioner Karen Douglas
Commissioner Carla Peterman
California Energy Commission
Dockets Office, MS-4
Re: Docket No. 11-IEP-1G, 11-IEP-1H
1516 Ninth Street
Sacramento, CA 95814-5512

Re: "Dockets #11-IEP-1G, 11-IEP-1H "Distribution Infrastructure and Smart Grid"

Dear Chair Weisenmiller and Commissioners Douglas and Peterman:

Thank you for the opportunity to submit these comments regarding implementing the proposed goal of 12,000 MW of clean local distributed generation (DG) using Smart Grid solutions. The Sacramento Municipal Utility District (SMUD), participated in the June 22 workshop, and below provides general comments on the interaction of the proposed goal with Smart Grid technologies and plans, 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 part of 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 is also moving forward in the transition to a Smart Grid in our service territory, in order to give customers more flexibility and choice in their electricity use. Full deployment of SMUD's initial phase of the Smart Grid – installation of functional Advanced Metering Infrastructure, or Smart Meters -- is expected by the end of the first quarter of 2012. Smart meters are the first step toward a Smart Grid, tying together all aspects of electricity delivery and consumption with two-way wireless communications connecting our customers to SMUD. As the system develops, customers will be able to go online and see detailed information about their energy use, and make adjustments as desired via their cell-phone or computer.

In the next couple of years, SMUD will implement additional aspects of the Smart Grid system in our service area, including the technical and communications infrastructure necessary for system optimization and the cyber-security protocols needed for system security. SMUD will develop demand response, conservation voltage reduction and volt/var optimization programs that will work with the new Smart Grid to reduce costs and GHG emissions. In addition, SMUD's Smart Grid will involve significant additional distribution system automation, including installation of SCADA equipment at substations and automated switching devices on distribution and sub-transmission circuits to reduce outage duration and frequency.

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's storage research focuses on demonstrating various levels of enhanced integration of intermittent photovoltaic and wind resources, generic peak load reduction and provision of system voltage support. SMUD plans to demonstrate and analyze customer-sited, utility-sited and substation-sited storage, using a variety of storage technologies. SMUD's high-penetration photovoltaics research is identifying the potential for significant distributed solar in the Sacramento area, developing methods for better forecasting the intermittency of distributed solar resources, demonstrating use of storage and efficiency in high-penetration solar applications, and researching communication and control technologies that will potentially allow better integration of distributed generation into the Smart Grid, including the ability to control generation remotely.

As mentioned in our comments on the May 9 workshop, SMUD strongly supports clean local generation, as expansion of these resources fits well with our Board's sustainability and local focus goals. SMUD still maintains that the common goal of additional clean local generation should be considered in the context of: 1) maintaining grid reliability; 2) cost-effectiveness; 3) timing of resource need; 4) expansive eligibility of resources; 5) interaction with the state's other policy goals; and 6) flexibility to respond to local conditions.

However, as discussed in our May 9 comments and further below, we are also concerned that implementation should not get too far ahead of the necessary research to get an adequate understanding of the cumulative impacts on the grid and the best

solutions for those impacts for smooth and reliable integration. Further research is needed on issues related to integrating and interconnecting DG into the existing electricity system and grid, the potential operational impacts on utilities of increased interconnected DG capacity, and potential ways to mitigate these impacts. This research will help point to the amount of and timing of new DG that will be optimal for California.

Answers to CEC Questions

Planning for the Future

1. ***What is your vision for your distribution system?***

Response: The primary mission for our distribution system is keeping the lights on for our customers in a manner that leads the industry in safety, reliability and customer service.

2. ***Have you developed a plan and roadmap of distribution system upgrades to address aging infrastructure issues, and the two-way power flow? How are these plans integrated with your Smart Grid deployment plans?***

Response: Yes, SMUD has a plan of distribution system upgrades to address aging infrastructure that focuses on replacing failing underground cables and rotten wood poles. SMUD's Smart Grid deployment and substation maintenance plan will replace a number of electro-mechanical relays with digital relays, at many of our medium voltage substations. At present, this work is not intended to facilitate two-way power flow, as the new digital relays are not designed with bi-directional capability, just as SMUD's legacy medium voltage distribution over-current relays were not bi-directional to begin with.

The principal challenge for two-way power flow is voltage regulation. Presently, the regulation options provided by the new digital voltage regulating relays provide no better solution than the more limited options offered by their electromechanical predecessors.

Where applicable, SMUD's distribution upgrade plans are integrated with our Smart Grid deployment plans. SMUD's Smart Grid deployment plans on the distribution system include Volt/VAR optimization (VVO), Conservation Voltage Reduction (CVR) and Automated Sectionalization and Restoration (ASR). The goals of these programs are increased system efficiency, improved power factor, reduction of system losses, reduction of energy consumption and decreased outage frequency and duration.

SMUD also notes that moving to a Smart Grid and advanced metering infrastructure (AMI) will significantly improve our knowledge about circuit specific

conditions. 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 and address the potential for two-way power flow.

3. ***Have you received American Recovery and Reinvestment Act (ARRA) funds for Smart Grid projects? What is the status of your ARRA projects and how might they advance distributed generation?***

Response: Yes, SMUD received an ARRA Smart Grid grant of $127.5 million to help develop and implement various Smart Grid solutions in Sacramento. Overall, the "SmartSacramento" project is estimated to cost $308 million, with SMUD contributing $158.1 million, and an additional $22.1 million from SMUD's partners.

In addition, SMUD received $16.3 million in ARRA grants to help fund $88.1 million in Smart Grid-related research and development demonstration projects. Projected Smart Grid spending at SMUD is currently budgeted at almost $400 million through 2015.

SMUD is partnering on this grant with the California State University, Sacramento (CSUS), California State Department of General Services (DGS) and Los Rios Community College District (LRCCD). The SmartSacramento project will modernize SMUD's electric distribution system through a comprehensive deployment of an end-to-end Smart Grid covering 100% of the load in SMUD's service territory. When completed, SMUD's comprehensive Smart Grid will enable informed participation in its energy profile by customers, allow the creation of new customer services and solutions, improve the reliability and efficiency of utility operations, and facilitate integration of distributed and intermittent forms of clean and renewable energy.

SMUD's SmartSacramento project includes: 1) full installation of smart meters throughout our service area; 2) an evaluation of customer behavior in response to varying dynamic pricing options; 3) development and installation of a demand response management system; 4) development of related customer applications such as integrated energy management control systems and electric vehicle charging solutions; 5) distribution system automation; 6) development of cyber security protections for the grid; and 7) development of overall Smart Grid technology infrastructure systems.

The SmartSacramento project is currently being implemented, with approximately 30% of the project already installed. Most of the in-place aspects involve installed smart meters – approximately 60% of the customer meters in our service area have been replaced with smart meters, with the remainder scheduled to be replaced by March of 2012. SMUD has also made significant progress on developing the designs and plans for dynamic pricing customer behavior studies,

increasing the automation of the distribution system, and developing overall Smart Grid infrastructure.

4. What strategies will you be implementing to achieve this vision in the near-term (1-2 years), mid-term (2-5 years), and long-term (5 years or longer)?

Response: SMUD's strategies include:

In the near-term:

- **Implement an advanced operating system (AOS) throughout 15% of SMUD's service territory that will automatically sectionalize and restore (ASR) power to customers after an outage, optimize distribution circuit voltage to enable energy savings through CVR and increase system efficiency to reduce losses through VVO. This will be achieved through:**
  - **Installation of SCADA at 35 substations;**
  - **Installation of automated line devices with two-way communication;(line sensors, reclosers and capacitors) on 90 distribution circuits (15% of total);**
  - **Installation of automated line devices with two-way communication (motor operators and fault indicators) on 12 of SMUD's sub-transmission circuits (22% of total); and**
  - **Installation of wireless communication system.**

In the mid-term:

- **Implement a Distribution Management System (DMS) with advanced analytics that optimizes the distribution system and improves reliability;**
- **Integrate customer programs with DMS;**
- **Provide tools and real-time data necessary to study the impacts and limits of renewable generation on the distribution system; and**
- **Evaluate benefits of Smart Grid technologies and build long-term Smart Grid road map.**

In the long-term:

- **Implement long-term Smart Grid Road map.**

5. What are the most pressing technical challenges associated with the integration of 12,000 MWs of Distributed Generation (DG) by 2020?

Response: At this point, SMUD has not concentrated on identifying the pressing technical challenges for such implementation. To determine what the most pressing technical challenges will be, a deployment strategy is required. The most pressing challenges will be based on the amount, size, location, and voltage

levels of the interconnected resources; the capabilities of those resources for dispatch and communication (and similar Smart Grid capabilities); and the ability of the grid to accept generation at multiple distributed sites and flow power as needed in the opposite direction as initially designed.

When considering the addition of significant amounts of DG on the system, SMUD is concerned with technical challenges beyond those related to distribution integration problems related to Balancing Authority performance requirements. Specifically, requirements articulated in the NERC Control Performance Standards (CPS1 and CPS2) and the NERC Disturbance Control Standard (DCS) must be evaluated. With significant penetration of distributed photovoltaics, meeting these standards on partially cloudy days and/or following system transients may be especially challenging. SMUD is currently studying these issues, and potential solutions to them, including interconnection and controls requirements on PV systems, battery and storage systems coordinated with PV production changes, and other utility scale flexible capacity alternatives.

6. ***In addition to meters, please provide an overview of what commercially available technologies and telemetry you are currently using or planning to secure in the next two years that will improve your ability to monitor and manage increasing penetrations of DG?***

Response: SMUD is currently using technologies that merely allow identification of the location of distributed generation on its system. SMUD research projects are examining the potential for significant monitoring and control of distributed generation through Smart Grid communications, but SMUD has no plans to procure widespread adoption of such technology prior to receiving the results of our research projects. These results may point to greater procurement of such technologies or to the need for further research.

7. ***How are you planning to leverage load management programs and storage to help manage increased penetrations of DG?***

Response: At present, SMUD has developed a robust storage R&D program focused on the demonstration of storage to mitigate the negative impacts of intermittent PV, peak load reduction and voltage support. Several demonstrations are planned for 2012 deployment that will demonstrate customer sited, utility sited and substation sited storage. Technologies include lithium ion, zinc bromine flow, sodium nickel chloride based energy storage systems. Through these demonstrations, SMUD will learn the feasibility of using storage to manage increased penetrations of DG.

SMUD is also developing a Demand Response Strategic Plan, with a primary purpose of defining a two-, five- and ten-year road map for the development of DR resources that can be used in place of conventional supply side resources for meeting system requirements, including integration of distributed generation and

renewable resources. SMUD has a long history of operation of a wide variety of demand response programs that have provided as much as 8% peak load reduction capability (in 1995) and have been used to support a variety of operational requirements. As part of the DR Strategic Plan, SMUD will be examining expanding our DR portfolio and using DR resources for relatively new purposes, such as helping to manage increased penetrations of DG and helping to integrate renewable resources.

Interconnecting DG to the Distribution System

1. ***Modifications to the Wholesale Distribution Access Tariff for some utilities and the California Independent System Operator Generation Interconnection Procedure allow for the study of interconnection applications in clusters. It is assumed that these new coordinated processes will be more efficient. Beyond revisions to these processes, please provide suggestions for how the overall process could be improved?***

Response: SMUD understands the movement towards a clustering analysis in an environment where distribution generation interconnection approvals are backlogged and individual projects may need to be studied in the context of other projects on the same circuit/line that may affect the projects' interconnection costs and prospects when eventually analyzed. However, clustering of projects can also lead to delays, to the extent that projects must wait to have their interconnections analyzed until they can fit into a "cluster", perhaps within specific time "windows" for such analysis. So far, SMUD has been relatively successful with quick sequential analysis and sees no need to move to a clustering approach in our service area.

SMUD supports the recent restarting of the Rule 21 working group at the California Public Utilities Commission with the intent of discussing and to the extent possible, resolving some of the issues related to the current amounts and types of interconnection requests utilities are receiving in California. SMUD has been an active participant in the standardized Rule 21 development effort in California. SMUD has voluntarily chosen 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.

However, given the Governor's proposed goals and the statewide focus of the goals, SMUD believes that the CEC could take a more significant role in the Rule 21 group, similar to the role the CEC played prior to mid-2007. It is clear that some changes to Rule 21 and to other interconnection protocols for larger systems, as well as enhanced coordination of these interconnection structures will be beneficial to achieving the Governor's goals at lowest cost. While SMUD believes

that the revived CPUC process is beneficial, we feel that it may be easier and more appropriate to achieve statewide consistency in a process more similar to the earlier CEC-led Rule 21 process.

2. ***What analytical tools or models do you currently use to analyze the impact of DG projects on system performance? What new tools have you added or plan to add in the next two years that will improve your ability to quickly, but safely process the growing number of interconnection applications?***

Response: SMUD presently uses Synergy, Aspen One-liner, and Easy Power modeling tools using data from its Geographic Information System to evaluate the distribution system. We continue to quickly and safely respond to interconnection applications. In addition, SMUD is partnering with Hawaiian Electric Company (also a Synergy user) on a High Penetration PV research project that will in part examine potential improvements in Synergy's DG modeling algorithms. Lastly, SMUD has been investigating new approaches that integrate transmission and distribution models into a single model in order to better facilitate optimization analysis of grid improvements.

3. ***Given that a growing number of wholesale or system-side renewable DG projects are applying for interconnection, many of which may not be located within or close to load centers, what planning process should be used to determine the need and timing for expanding the distribution infrastructure to accommodate these new generators? Should the process be coordinated with the CAISO? How should the costs for these upgrades be allocated and what suggestions do you have for allocating these costs in the future?***

Response: In general, the standard procedures are still sufficient at present for SMUD. The planning and interconnection process should consider potentially affected systems, and to the extent that transmission systems are affected, there is obviously a need for coordination with the local balancing authority, and for input into the statewide transmission planning process at the CEC. However, in most cases distribution level infrastructure expansion is likely to impact only the local distribution system, not portend impacts beyond that. Costs should be allocated as they currently are: costs that primarily benefit a particular project should be shouldered by that project, while upgrades that have a broader system benefit should be allocated along with other distribution system upgrades.

4. ***In comments filed for the May 9th Localized Renewable DG IEPR workshop, the Clean Coalition suggested that "The establishment of predefined standardized interconnection costs would avoid these issues [cost-related issues causing multiple studies of projects that add to bottlenecks in the queue and study process], providing transparency and predictability to the process while greatly reducing study requests for projects that will not be built." Would using a similar approach to Germany's in trying to predetermine costs by posing formulas that estimate the technical performance levels of a proposed DG***

project improve the interconnection process? Is a standardized table of assigned interconnection costs feasible? If not, why?

Response: Both of these sound like worthy approaches to consider for developing ballpark estimates of interconnection costs to be used for project screening and initial evaluation. As every circuit has different electrical characteristics and each DG project can have a different system impact, most larger projects will require some degree of custom analysis and could induce significantly different costs.

- ***What are the drivers of interconnection costs? Do costs increase as volume increases?***

Response: The drivers of interconnection costs are: electrical connectivity, ampacity, metering and telemetry costs, voltage regulation, and, to a much smaller extent, protection requirements. The costs per unit of DG typically do not increase as the amount of DG increases (more often they decrease with volume). Nevertheless, both per unit and total costs can increase as DG penetration increases, depending upon the amount and type of DG. The costs include but are not limited to the costs of storage or otherwise managing DG variability as necessary and the potential costs of system upgrades which are a function of location and the expected amount of DG. These factors impact thermal ratings and interconnection voltages which impact equipment design requirements (and hence costs), particularly insulation requirements.

- ***Currently, the CAISO is using a cluster approach for interconnecting to transmission systems. After conducting a study of the impacts of a cluster of proposed projects, the CAISO determines the costs of interconnecting the cluster of projects, then allocates the cost to the number of participants in the cluster. Would this approach be feasible for the utilities to use to establish a standardized interconnection cost table for distributed generation?***

Response: SMUD doesn't use the cluster approach, projects are processed sequentially. Each project pays the costs associated with its interconnection. To provide predictability SMUD provides high level preliminary cost estimates, at no cost to the applicant. This provides the applicant an incentive to find the sites with the lowest total cost to construct for their project (this might be lost with standard interconnection costs). SMUD uses standard unit costs to quickly develop these preliminary estimates, such as:

Cost per 1000' of reconductoring light wire to heavy wire (overhead),
Cost per 1000' of line extension 12kV (overhead)
Cost per 1000' of line extension 69kV (overhead)
Cost per metering installation w/telemetry

5. ***Should a new integrated infrastructure planning process that includes both distribution and transmission studies be established to ensure that investments in both the transmission and distribution systems are coordinated statewide?***

Response: There are already processes in place to coordinate transmission planning statewide and region wide. Within California, the primary regional coordination on transmission happens with the California Transmission Planning Group. However, distribution systems in the various transmission owners and utility distribution company service areas are generally electrically isolated from one-another. Hence, a statewide distribution planning process is most likely not as fruitful, but an expansion of sharing of planning practices and experience might be worthwhile. It may also be important for information about the expected and actual distribution level interconnections in the various service areas to be more consistently provided to the transmission planning process.

SMUD does not believe, however, that it would be beneficial to institute an integrated "infrastructure planning process" at this time, including both distribution and transmission planning in one process. SMUD does not believe that such tight coordination is needed, and suggests that attempting this runs the risk of establishing a significant new delaying process for interconnection of resources to the distribution system.

Smart Grid to Support State Environmental Goals

1. ***For the Investor Owned Utilities: Smart Grid Implementation Plans will be filed at the CPUC on July 1, 2011. What Smart Grid technologies have already been included in your current General Rate Case (GRC) at the CPUC, or if you are just filing your GRC, what Smart Grid technologies are you requesting funding for?***

Response: This question does not apply to SMUD.

2. ***For the Publicly Owned Utilities: What Smart Grid technologies have already been included in your current budget, and or do you plan to include? What Smart Grid technologies are you requesting funding in your next budget cycle?***

Response: SMUD has committed to the following Smart Grid projects through 2015: Advanced metering infrastructure (full deployment), distribution automation (automate 35 substations, 90 distribution circuits and 12 subtransmission circuits), consumer behavior study (study impacts of time of use and critical peak rates), customer applications (electric vehicle infrastructure, energy management systems with customers, auto DR), demand response, technology infrastructure and cyber security. In addition, SMUD is performing demonstration projects that include several energy storage projects (customer, at distribution transformers, substations and other locations), microgrid demonstration, several electric

transportation projects, residential information and controls pilot, smart controls in multifamily, solar highways, dairy digesters and high penetration PV studies. The results from these projects will be used to determine future projects and expenditures.

3. ***Developing and achieving the vision articulated in SB 17 for a Smart Grid is an evolutionary process. Smart meters are being installed throughout the state and the focus is on capturing the value of customer data and information. Moving forward, when do you anticipate focusing on distribution grid modernization?***

Response: SMUD has been automating all new substations for over 20 years and is currently retrofitting 35 substations with SCADA automation, automating 90 distribution circuits and 12 sub-transmission circuits. Automated Sectionalization and Restoration (ASR), Conservation Voltage Reduction (CVR) and Volt/Var Optimization (VVO) are part of those projects. SMUD is also developing a plan for electronically mapping the entire distribution system so studies can be performed to determine optimal locations for Smart Grid technologies over time. SMUD's goal is to cost-effectively optimize the distribution system. Current projects will be evaluated to determine system benefits and to make decisions concerning future automation projects.

The plan is for the different Smart Grid systems (AMI, DR, distribution system, distributed technologies, etc.) to be interoperable and to communicate in such a way as to continually optimize efficiency and grid operations.

4. ***What emerging Smart Grid technologies and software offer near term opportunities to support the monitoring and management of DG on the distribution system?***

Response: There are several software packages that support monitoring and management of DG on the distribution system. Most of these packages are very new so it is difficult to determine overall product reliability, accuracy and whether the products will be supported long-term. This is an area where further demonstration projects and pilots are needed to assess the viability of new products.

5. ***When doing a cost benefit analysis of Smart Grid technologies, how do you value societal benefits associated with state goals (e.g. environmental benefits, increased renewable generation)?***

Response: The societal benefits to our customers, including contributions to SMUD's progressive environmental, energy efficiency, and renewable goals are recognized in the SMUD Board Strategic Directives (SDs), particularly SD-7 and SD-9 (these can be found at: http://www.smud.org/en/board/Pages/strategic-direction.aspx. These directives lead SMUD to strongly value achievement of goals such as the 33% target by 2020. In addition, SMUD includes an anticipated cost of carbon in the evaluation of efficiency programs and resource procurement.

Inverter Functions to support integration of 12,000 MW of DG & Storage. Can California move forward sooner rather than later?

1. ***What are the key distribution system operational challenges from high penetrations of distributed generation and storage (including EVs)? Managing fluctuations due to renewable source variability? Managing DER power output to avoid transformer overloads and/or reverse power flow in "sensitive environments"? Managing volt/vars? Minimizing impacts from voltage and frequency deviations? Low voltage ride-through? Mitigating transmission system impacts? Coping with excess "must run" energy? Other?***

Response: Voltage regulation can become a significant concern when high PV generation output and minimum local load coincide. Voltage regulation is of particular concern on bus regulated substation transformer banks (one regulating device for multiple distribution feeders). It is becoming apparent that local voltage issues are likely to precede protection, load, fault, harmonic, and stability issues as penetration increases.

2. ***How will/should the IEEE 1547.8 requirements address those interconnection challenges? In particular, what communication monitoring and control requirements (including autonomous, pre-set controls) for "sensitive environments" should be included?***

Response: While IEEE P1547.8 may help solve distribution system operational challenges and address larger grid (Bulk Transmission) operational issues associated with greater penetrations of distributed generation, it has the potential of inducing more challenging distribution interconnections. The active anti-islanding of IEEE 1547 compliant inverters act to make interconnection approval of such systems significantly easier. Each IEEE P1547.8 interconnection will require some additional remediation, such as direct transfer trip, to compensate for the loss of the active anti-islanding feature. In addition, some yet to be designed additional form of active Volt/VAR management of the inverters or of other feeder equipment in response to the autonomous actions of the inverters will become necessary. Smaller, net-metered systems may be handled more quickly and cost-effectively for some time using the current IEEE 1547 protocol, while addressing some of the high penetration issues with larger systems via the proposed IEEE P1547.8.

3. ***What advanced DER inverter functions are being defined that can help meet the high penetration challenges and the 1547.8 requirements? What other functions may be needed to manage high penetrations of DER, including EVs and storage?***

Response: The ability of inverters to communicate and being remotely monitoring and controlled will be key inverter functions necessary for high penetrations of DG going forward. SMUD is currently conducting a research

project to demonstration monitoring and control of PV and/or storage inverters through our AMI smart meters. The objective of this work is to understand the limitations and capabilities of our AMI network to monitor and control distributed inverter DG systems. Controllable variables for inverters will include power factor setting, under and over frequency and voltage relay settings, voltage and var dispatch points, power ramp rates up and down, and others. Through this research, SMUD will understand if our AMI network has sufficient bandwidth and minimal latency for controlling inverters or just monitoring them.

4. ***What communications infrastructure will be needed for supporting those functions? What might be the optimal mix of autonomous (pre-set) DER actions, commanded control actions, and/or broadcast actions? Why is interoperability and use of communications standards important?***

Response: SMUD has no answer to this question at this time.

5. ***How can California best utilize the inverter functions which have been defined in the IEC 61850 standard and mapped to DNP3 (and eventually to SEP 2.0)? What implementations and demonstrations of these functions are taking place or planned in the U.S.?***

Response: The IEC 61850-7-420 is a communication standard that is catching up to the industry. SMUD's standard for SCADA communication has been DNP3 for about a decade. Common assignment of function locations will save some time in the future, especially as the function counts increase. I'm not sure why a demonstration would be necessary.

6. ***Compensation for customers – tariff-based or pricing-signal-based? Rates through energy service providers? Separate contracts with commercial and industrial customers? Different tariffs for different customers? Providing incentives to install DER systems while not penalizing those customers who may not be able to install DER systems?***

Response: SMUD believes that the issue of compensation for customers is important, but is not sure exactly how to answer the multitude of short questions here. Tariff-based rates are what utilities use, and they do send price signals, particularly to the extent that they are time-of-use, tiered, seasonal, etc. In some cases, different tariffs may be offered to different customers (with some customer choice), and separate contracts may be necessary for some individual installations – but too much complexity will also be a problem. While incentives may be useful to elicit customer behavior and procure the benefits of clean local generation in some cases, SMUD shares the concern that such incentives may act to penalize those customers that may not be able to install DER systems.

One way that SMUD has handled this latter issue is through our SolarShares program. Here, customers that cannot easily install DER systems at their homes

or businesses can participate with a "share" of an off-site DG system that is associated with their load via the SMUD program.

SMUD also notes that at some point of increasing installations, the existing incentive represented by net metering needs to be addressed. While the current 5% cap on mandatory net metering acts to limit the cost of this incentive to non-participating customers, any similar installations beyond that cap should follow consideration of a restructuring of the net metering paradigm to eliminate or significantly reduce the subsidy from non-participating customers. In particular, there should be consideration of NEM customers paying (compensating other customers) for using the grid like a battery – sending electricity offsite and bringing it back onsite at a different time.

Finally, if larger DG systems are compensated via a Feed-In Tariff structure or renewable auction mechanism, SMUD prefers that the structure be based upon an estimate of the value of the energy to ratepayers in general, in order to minimize penalties to customers overall. In general, compensation that is based on subsidies acts to transfer costs to non-participating customers, and so any such compensation should be limited to situations where system benefits act to offset the implicit penalties these transferred costs represent.

7. ***NIST has proposed five standards for adoption by FERC, including IEC 61850 which supports the inverter functions. These standards are fundamental to Smart Grid interoperability overall. How important is the adoption of these standards by FERC and/or State regulators to developing uniform and interoperable communications systems between distribution operations and DER systems?***

Response: SMUD has no response to this question at this time.

8. ***In comments filed by SCE in response to Committee Workshop on Renewable, Localized Generation on June 5, 2011, on standards and the standard process, SCE indicated it will take several years to finalize new requirements to take into account the interconnection of high penetrations of solar DG which are addressed in the current Institute of Electrical and Electronics Engineers (IEEE) Standard 1547. SCE suggests that, "In the interim, load serving entities would need to put their own rules in place to avoid having a large base of installed equipment that does not support the grid under a high-LER-penetration scenario." Could SCE or other utilities comment on what they anticipate these rules would be?***

Response: SMUD has no response to this question at this time.

9. ***Also included in the SCE comments, it was suggested that developing models to evaluate the performance of the distribution grid, comparing the results through laboratory tests, field data, and benchmarking models against existing***

situations in Europe where high penetration levels exist is necessary to mitigate the risk that current system models can no longer predict performance of a future system. Is this type of research currently planned? If not, when and who should do this research?

Response: 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 to model transmission and distribution impacts. 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 scientific 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.

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,

Timothy N. Tutt
Government Affairs Representative
Sacramento Municipal Utility District
P.O. Box 15830, M.S. B404
Sacramento, CA 95852-1830

TT:aa
cc: Rachel MacDonald, California Energy Commission (via email)
Linda Kelly, California Energy Commission (via email)
Suzanne Korosec, California Energy Commission (via email)
Corporate Files