

DRAFT

PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA
ITEM # 10 I.D. # 9199
ENERGY DIVISION
RESOLUTION E-4317
March 11, 2010

R E S O L U T I O N

Resolution E-4317. This Resolution approves eight winning grant recipients of the California Solar Initiative (CSI) Research, Development, Deployment and Demonstration (RD&D) Program's Solicitation #1, which focuses on grid integration of photovoltaic (PV) systems. Pursuant to Decision (D.) 07-09-042, this Resolution requires Commission approval. This Resolution is made on the Commission's own motion.

Estimated Cost: No new cost is associated with this Resolution. The \$9 million in recommended funding for selected grant recipients was authorized in D. 07-09-042.

Proposed Outcome: This Resolution determines that the Program Manager shall enter into grant agreements with the eight selected recipients. The recipients, in turn, shall begin work on their respective projects and will provide periodic progress reports to the CSI RD&D Program Manager, who will provide the Commission with updates.

SUMMARY

This Resolution, made pursuant to D. 07-09-042, approves eight grant recipients of the CSI RD&D Program's Solicitation #1, which focuses on PV grid integration. Resolution E-4317 orders the CSI RD&D Program Manager, Itron, Inc., to enter into grant agreements which will provide CSI RD&D grant funding to the winning recipients up to the stated award amounts, and to monitor and report on these recipients' activities pursuant to D. 07-09-042.

BACKGROUND

Senate Bill (SB) 1 (Murray, 2006) authorized the Commission to allocate \$50 million of the CSI program funds for research, development, demonstration, and deployment of solar technologies. The RD&D portion of the CSI program was adopted in September 2007 via D.07-09-042. In that decision, the Commission approved the “Adopted CSI RD&D Plan” which identified the goals and objectives of the CSI RD&D program, set forth allocation guidelines, and established criteria for solicitation, selection and funding RD&D projects. It also established the guidelines for the RD&D program administration and RD&D program evaluation.

To implement the Adopted CSI RD&D Plan, the Energy Division oversaw the competitive selection of Itron, Inc. as the CSI RD&D Program Manager (approved via Resolution E- 4179) in July 2008. The CSI RD&D Program is overseen by Energy Division staff, in accordance with D. 07-09-042. Operational administration of the CSI RD&D Program is carried out by Itron, Inc. Energy Division staff is responsible for monitoring the Program Manager’s expenses and assuring that they act in compliance with D. 07-09-042, as well as participating as a member of the Scoring Committee. The Commission authorizes funding awards via Resolution, as recommended by staff and the contract program Manager. The contract Program Manager is responsible for maintaining program data, developing requests for proposals (RFPs), evaluating grant requests, entering into grant agreements (after approval by Commission Resolution), monitoring progress on all approved projects, and reporting on approved projects. The CSI RD&D Program Manager maintains a program Web site: www.CalSolarResearch.ca.gov, which is linked from both the Commission’s CSI website and the Go Solar California website (www.GoSolarCalifornia.ca.gov), the statewide consumer information site for the State’s solar programs.

The CSI RD&D Program has a budget of \$50 million, running through 2016 and funded by the electric ratepayers of California’s three largest investor-owned utilities, namely Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E).

The Adopted CSI RD&D Plan lays out the seven key principles of the CSI RD&D Program. These principles include:

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

1. Improve the economics of solar technologies by reducing technology costs and increasing system performance;
2. Focus on issues that directly benefit California, and that may not be funded by others;
3. Fill knowledge gaps to enable successful, wide-scale deployment of solar distributed generation technologies;
4. Overcome significant barriers to technology adoption;
5. Take advantage of California's wealth of data from past, current, and future installations to fulfill the above;
6. Provide bridge funding to help promising solar technologies transition from a pre-commercial state to full commercial viability; and
7. Support efforts to address the integration of distributed solar power into the grid in order to maximize its value to California ratepayers.

The Adopted CSI RD&D Plan establishes the allocation of funding across different types of RD&D. Demonstration projects will receive the largest portion of the RD&D budget at 45-55%, followed by research (20%), development (5-10%) and deployment (5-10%). The majority of funds will also be awarded to low-risk projects which project results within 1-3 years time. These targets were established by the Commission in September 2007 via D.07-09-042 approving the "Adopted CSI RD&D Plan".

Within the CSI RD&D Program, grant funding is further allocated into three target areas:

- Grid integration
- Production technologies
- Business development and deployment

NOTICE

The request for proposals (RFP) was posted on the R. 08-03-008 Service List as well as the CSI RD&D website: www.CalSolarResearch.ca.gov.

PROTESTS

Two parties submitted comments on the Draft Resolution, both in a timely manner. The Division of Ratepayer Advocates (DRA) submitted comments on February 18, 2010 which recommended modifying the Draft Resolution. The University of California, San Diego submitted comments on February 17th, 2010 clarifying the name of their institution.

DISCUSSION

Focus of the Grant Solicitation

The first CSI RD&D solicitation was issued in July 2009 and focused on grid integration of photovoltaic (PV) systems.¹ This target area was selected due to the importance of grid integration for achieving widespread solar adoption, and the Adopted CSI RD&D Plan's target that 50-65% of CSI RD&D Program funds be committed to grid integration. As more widespread adoption of solar technologies may require grid integration not only with solar but also with energy efficiency, demand response or energy storage systems, these were also incorporated into the first solicitation.

Three priority areas in particular were established for the grid integration solicitation:

- Planning and modeling for high-penetration PV
- Testing and development of hardware and software for enabling high-penetration PV, and
- Addressing the near-term integration of energy efficiency, demand response and energy storage with PV

The CSI RD&D Program Manager used various information resources to identify critical areas within the first solicitation and refine the priority areas identified above. These information resources include:

¹ The CSI RD&D Program first grant solicitation document is available here:
http://www.calsolarresearch.ca.gov/images/stories/documents/first_solicitation_final.doc

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

- The joint California Energy Commission and California Public Utilities Commission Solar Photovoltaic Research Plan (Roadmap)², which highlighted issues important to California, provided RD&D approaches, and set milestones.
- The Department of Energy's Solar Energy Grid Integration Systems (SEGIS) concept paper³ and renewable system interconnection reports⁴, which detailed the need for high resolution solar resource tools and utility planning tools to incorporate higher levels of PV.
- Direct contact with over two dozen entities involved in solar RD&D efforts⁵ to ensure that the RD&D program's efforts are not duplicative.

Timeline of the Grant Solicitation

The following outlines the timeline and process for the first grant solicitation.

- In June 2009, the grid integration solicitation and CSI RD&D grant agreement was issued in Draft form for public comment by the CSI RD&D Program Manager.
- In June 2009, comments on the grid integration solicitation were received from stakeholders. Comments were considered prior to the release of the final solicitation documents.
- On July 8, 2009 the revised grid integration solicitation was issued, including the Grant Agreement document.

² Solar Photovoltaic Research Plan, California Energy Commission, CEC-500-2007-038-SD, September 2007.

³ Solar Energy Grid Integration Systems "SEGIS" Program Concept Paper, Department of Energy, October 2007.

⁴ Fifteen topical renewable system integration reports developed out of the renewable system study and are available at <http://www1.eere.energy.gov/solar/rsi.html>.

⁵ Contact with other organizations involved in Solar RD&D included: California Energy Commission, U.S. Department of Energy (Solar American Initiative and Solar American Board of Codes and Standards), U.S. Department of Energy national laboratories (NREL, Sandia), NYSERDA, New Jersey's Edison Innovation Commercialization Fund and Clean Energy Manufacturing Fund, Massachusetts Technology Collaborative Congestion Relief Pilots, Oregon Department of Energy, Hawaii Clean Energy Initiative, Sacramento Municipal Utility District's ReGen Program, Los Angeles Department of Water and Power's Sunshares program, a variety of California universities (including California Institute of Technology, Stanford University, UC San Diego, UC Davis, UC Merced, and UC Santa Cruz), a variety of universities in other states (including Arizona State University, Colorado State University), and leading solar industry companies.

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

- On July 23, 2009, a bidder's conference webinar was held to review the intent and goals of the program, and to allow prospective bidders to ask questions.
- On July 24, 2009, written questions were submitted to the CSI RD&D Program Manager regarding the solicitation.
- On July 30, 2009, responses were posted to the CSI RD&D Program website.
- On August 24, 2009, proposal responses were due to the CSI RD&D Program Manager. Twenty one proposals were received; two subsequently were eliminated due to incompleteness.
- In the fall of 2009, CSI RD&D proposals were reviewed in two phases. First by a Technical Review committee and next by a Scoring Committee. Nineteen proposals totaling \$26.5 million in requested funding and over \$17 million in match funding underwent Technical Review by industry experts. This initial review assessed the practical feasibility and path to implementation of the various proposals. Separately, a Scoring Committee comprised of industry veterans with a combined 40 years of RD&D experience and a representative of the Commission evaluated the 19 proposals using the Proposal Evaluation criteria described below.
- In January 2010, the Scoring Committee made a final recommendation for funding the proposals identified below and the Energy Division prepared this Resolution for Commission consideration.

Proposal Evaluation Criteria for Grant Solicitation

The grant solicitation identified the proposal evaluation criteria. All 19 proposals were scored using this proposal evaluation criteria identified in Table 1.

Proposals needed to obtain 75 percent (or 150 points) of the possible 200 points to be considered for funding. Of the nineteen proposals that were evaluated and scored by the Scoring Committee, eight passed the minimum 75 percent passing score and are recommended for funding.

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

Table 1: Proposal Evaluation and Scoring Criteria

SCORING CRITERIA	MAXIMUM POINTS POSSIBLE
1. Does the proposed project address an important target activity included in the CSI RD&D Program Plan?	10
2. Does the proposed project have the potential to significantly expand the solar market in California? Will the proposed project contribute to the CSI goal of 3,000 MW of new electricity generation from solar energy by 2017?	30
3. Is the proposed project located in California? Is the proposed research organization located in California? Does the proposed project address an issue that is important to California?	10
4. Is the funding request reasonable? Is the funding request in-line with the potential benefits that can be realized?	20
5. How well does the proposed project leverage funds from other organizations? Does the proposed project provide added value by collaborating and coordinating with other RD&D organizations?	20
6. Is the proposed team for the project highly qualified to conduct the working being proposed? Do they have prior experience conducting similar work?	20
7. Does the proposed project include utility participation? Is utility participation significant or needed?	10
8. How likely is it that the proposed project will be successful? Is the proposed project advancing a proven technology or strategy?	30
9. How well has the proposal demonstrated the match-funding component of the proposed project? How close is the proposed project to commercialization?	20
10. Does the proposed project have an educational, technical transfer, or informational component?	10
11. Overall merit of the proposed project	20
Total Points Possible	200
Points Needed to Pass (75% of total)	150

Proposals Recommended for Funding from Grant Solicitation

The Scoring Committee recommends the Commission fund all eight proposals that passed the minimum points necessary to be considered for funding. The proposals recommended for funding are identified in Table 2. The selected proposals requested \$9.3 million in funding, and expect to have matching funds of \$6.1 million. The proposals are from a variety of organizations, including utilities, universities, national laboratories, and private companies.

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

Table 2: Funding Requests and Match Funding of Proposals Recommended for Funding

Applicant	Proposal title	Funding Request	Match funding	Score out of 200
Sacramento Municipal Utility District	High Penetration PV Initiative	\$2,968,432.00	\$1,293,259.00	176
Clean Power Research	Advanced Modeling and Verification for High Penetration PV	\$976,392.00	\$2,293,000.00	174
National Renewable Energy Laboratory	Beopt-CA (EX): A Tool for Optimal Integration of EE/DR/ES+PV for California Homes	\$985,000.00	\$329,000.00	171
kW Engineering	Specify, Test and Document an Integrated Energy Project Model	\$942,500.00	\$250,000.00	168
National Renewable Energy Laboratory	Analysis of High-Penetration Levels of PV into the Distribution Grid in CA	\$1,600,000.00	\$1,400,000.00	166
APEP/UC Irvine	Development and Analysis of a Progressively Smarter Distribution System	\$300,000.00	\$100,000.00	163
SunPower Corporation	Planning and Modeling for High-Penetration PV	\$1,000,000.00	\$320,000.00	161
University of California San Diego (UCSD)	Improving Economics of Solar Power Through Resource Analysis, Forecasting and Dynamic System Modeling	\$548,148.00	\$137,037.00	159
	Total	\$9,320,472.00	\$6,122,296.00	

The proposals recommended for funding are described in detail in Appendix A to this Resolution.

The eight proposals recommended for funding cut across the three focus areas of the solicitation as shown in Table 3 below. Table 3 also identifies the name and “Project ID” number. The Project ID number was used for administrative purposes for keeping track of the proposal review materials.

Table 3 identifies that four proposals recommended for funding fell into the focus area “planning and modeling for high-penetration PV”. Two of the

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

proposals fell into the focus area “testing and development of hardware and software for high penetration PV”. Two of the proposals fell into the focus area “addressing the near-term integration of energy efficiency, demand response and energy storage”.

Table 3 further identifies the subcategories within each focus areas to better demonstrate the similarities and differences of projects within the same focus area. For example, proposals 703, 710 and 722 addressed each of the subcategories within the “planning and modeling for high-penetration PV” focus area, whereas proposal 706 addressed only one subcategory.

Table 3: Comparison of Proposals by Focus Area

Project ID	Proposal title	Applicant	Planning/ Modeling for High Penetration PV				Testing and Demonstration of Hardware/ Software for High Penetration PV				Integration of Energy Efficiency and PV		
			Enhance Solar resource models	Validate forecast models	Integrate forecast model with utility load model	Enhance T&D models	Monitoring and communication s software and systems	Controls systems and operations	Mini or micro grid integrated sub systems	Optimal locations within T&D	Energy Efficiency	Demand response	Energy Storage
715	High Penetration PV Initiative	Sacramento Municipal Utility District											
702	Analysis of High-Penetration Levels of PV into the Distribution Grid in CA	National Renewable Energy Laboratory											
722	Advanced Modeling and Verification for High Penetration PV	Clean Power Research											
706	Development and Analysis of a Progressively Smarter Distribution System	Advanced Power and Energy Program-UC Irvine											
710	Planning and Modeling for High-Penetration PV	SunPower Corporation											
703	Improving Economics of Solar Power Through Resource Analysis, Forecasting and Dynamic System Modeling	UCSan Diego											
716	Beopt-CA (EX): A Tool for Optimal Integration of EE/ DR/ ES+PV for California Homes	National Renewable Energy Laboratory											
709	Specify, Test and Document an Integrated Energy Project Model	kW Engineering											

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

There were eleven applicants whose proposals did not score above the minimum threshold of 150 out of 200 points and therefore were not considered for RD&D funding. These proposals are listed in Table 4 below.

Table 4: Summary of Proposals not selected for funding

Project ID	Proposal title	Applicant	Funds Requested	Match Provided
721	Investigation of Real-Time Solar Metering and Bi-Directional Customer and Inverter Communications	Solar City Corporation	\$1,659,169	\$1,025,338
713	Testing / Demonstration of Innovative Software Tools for High Penetration PV	KEMA, Inc.	\$1,978,560	\$500,570
704	Solar Power Forecasting and Verification at High Spatial and Temporal Resolution	The Regents of the University of California	\$998,800	\$340,042
718	Smart Grid Integration PV Generator at Grid Parity LCOE Providing Utilities on-Demand Control of Advanced Grid Stability and Power Quality Management Capabilities	Array Converter, Inc.	\$1,257,301	\$518,703
714	Decision Support for Coordination of Photovoltaic and Energy Resource Investments in the Home and Small Business	Palo Alto Research Center, Incorporated	\$996,632	\$332,211
708	KACO US Grid Interactive Storage Device (GISD) Proposal	KACO new energy	\$711,800	\$690,500
712	Real World High Penetration PV Performance Through Granular Data and Active Control Experimentation	Accurate Solar Power	\$895,890	\$418,415
711	Integrating Renewables, Efficiency and Demand Management to Achieve Zero Energy Homes	Dept of the Environment-City and County of San Francisco (SF Environment)	\$588,000	\$400,000
705	EnergyREView Enhanced Solar Inverter Development	Xslent Energy Technologies, LLC	\$2,999,500	\$750,000
707	Demonstration of Promising Energy Storage to Permit Higher Penetrations of PV	Fluidic Energy	\$2,333,333	\$5,031,580
717	Dispatchable Distributed Storage Solar Power, Enabling High-Penetration PV, via 24-hour Dispatchable Cheap Solar Power to Fill PV Power Gaps Caused by Darkness and Clouds	Solar Storage Company	\$2,700,000	\$900,000

Proposal Summaries for Projects Recommended for Funding

The following discussion provides a short summary of each proposal recommended for funding. In addition, for each of the three focus areas, a brief comparison of the proposals recommended for funding within each of focus areas is provided.

Focus Area I: Planning and modeling for high-penetration PV

The planning and modeling focus area looks at development and demonstration of tools and products to help utilities and PV project developers better accommodate high penetration levels of PV in the electricity system. The solicitation identified the following four issues to help develop better planning and modeling tools:

- Solar resource models should provide capability to forecast solar output at higher PV penetration levels
- Forecast outputs from solar models should be validated by metered PV performance over large system populations
- Solar resource modeling applications should be integrated with utility load or resource forecasting models
- Transmission and Distribution (T&D) models should allow for easy identification for optimal location of high penetration of PV

1. Proposal 722: Clean Power Research

Proposal 722, from Clean Power Research (CPR), addressed all four of the issues; provides reasonably good leverage of match funds; the project team has demonstrated experience in the focus area and the project is focused on California issues. The project will develop a free solar resource model with enhanced spatial and temporal resolution.⁶ Spatial resolution is to increase 100-fold from the current solar model level of 100 km² to 1 km² while temporal resolution is to increase two-fold from a 1-hour time step to a 30 minute time step. PV performance forecasts will be validated using two existing high-penetration PV circuits in the state (SMUD's Anatolia and Rancho Seco

⁶ CPR has indicated that the improved solar resolution modeling will be "freely available to users throughout California."

distribution feeders) as well as by out of state utilities (the Salt River Project). PV modeling capabilities will be integrated with an open-source distribution engineering and analysis tool (Distribution Engineering Workstation or DEW) that is commonly used by utilities for distribution system planning. CPR intends to use the DEW modified utility planning tool in conjunction with economic screening criteria to enable utilities to pinpoint locations within the distribution system where high penetration levels of PV will provide distribution system benefits. Lastly, SEPA has committed to marketing and outreach efforts to ensure good dissemination of project findings.

2. Proposal 706: University of California (UC) at Irvine

Proposal 706, from UC Irvine, responded to just one of the issues: development of enhanced T&D models. However, the UC Irvine proposal received high scores for four reasons: 1) high quality work is being accomplished for a relatively small budget (e.g., \$300,000); 2) PG&E is working with UC Irvine on this project and will use PG&E distribution feeder data to validate the model results and test the model under utility conditions; 3) the team has prior experience in validating potential impacts of high penetration levels of fuel cells on distribution feeders; and 4) results from the project will be used to inform standards work critical to widespread adoption of higher penetration PV (i.e., IEEE 1547 and UL 1741). Three specific distribution system configuration scenarios will be evaluated – the first with many small PV systems, the second with fewer but larger PV systems, and the third with a mixture of smaller and larger PV systems. The objective of using project results to inform standards work is critical to establishing a broader platform from which other utilities and PV project developers can begin to deploy PV at higher concentrations on distribution feeders.

3. Proposal 710: SunPower Corporation

Proposal 710, from SunPower, responded to all four subcategory issues. It has a team with demonstrated experience in the areas being addressed in the proposal. Several of the team members are California based and the project is focused on California issues. In particular, the project will produce an improved solar resource model with temporal resolution ranging from 10 minutes to 1 second and spatial resolution going to below 4 km². Results of the higher solar resolution data will be validated against PV systems monitored by SunPower in California (at numerous sites at the higher 10 minute resolution level and at a

few sites at the 1 second time step). SunPower will use a modification of their PVSIM power model to make the output compatible with existing utility planning and operation models. Sandia National Labs will lead the effort to integrate the modeling results into commonly used utility planning and modeling platforms (e.g., PROMOD, GE's PSLF and SynerGEE), and work with the California Independent System Operator (CAISO) to ensure the results are utility compatible. Lastly, KEMA will use the results from the developed products in assessing and identifying optimal locations of high penetration PV in California's grid.

4. Proposal 703: University of California, San Diego

Proposal 703, from University of California, San Diego (UCSD), responded to all four issues within the focus area. The team is composed of representatives from the Electric Power Research Institute (EPRI), EDSA Power Analytics, the CAISO, and SDG&E. The project is focused on California specific issues. The UCSD proposal will primarily address three issues that must be addressed in resolving issues associated with increased penetration of PV in CA: 1) insolation data and PV performance that takes into account transients due to passing cloud cover; 2) logic software and associated software to communicate transient conditions between model and PV inverter to improve voltage regulation and 3) energy storage to reduce voltage sag due to cloudiness.

Overall Comparison of Focus Area I

The four proposals recommended for funding in the planning and modeling focus area bring different but complementary value to enabling increased levels of PV into California's grid.

For example, the CPR, SunPower and University of California, San Diego proposals are all developing high resolution solar resource models. The CPR high resolution model is based on a platform that can be readily adopted and at a 1 km² spatial resolution basis, represents a significant improvement in solar resource modeling. The SunPower model is less well known but represents a significant increase in the temporal resolution; offering an increase in time step resolution from the current 1-hour level down to 10 minutes, 1-minute and 1-second (in comparison, CPR's model goes to a 30 minute time step). Lastly, the UCSD high resolution model is based on extremely fine and dense solar radiation measurements (16 stations over 1200 acres) with 1 second time

resolution and continuous cloud mapping. Consequently, while the University of California, San Diego data is more limited geographically, it provides the type of solar data that will be critical to identifying the impact of rapidly moving cloud cover on the power output of high concentrations of PV systems.

Similarly, model validation is occurring differently in the proposals but in ways that complement one another. The CPR proposal will validate power output estimated by the model using actual PV measurements from SMUD distribution feeder circuits. The SunPower proposal has over 650 metered PV systems throughout California from which it can validate model outputs. The validation provided by SunPower represents a broader base, while the CPR proposal provides validation of output along distribution feeders. Similarly, the University of California, San Diego proposal provides validation at a very fine spatial and temporal level.

In terms of integrating PV production models into utility system planning models, both SunPower and CPR offer different but balancing approaches. The SunPower team will be integrating the models for such commonly used utility planning and modeling platforms as PROMOD, GE's PSLF and SynerGEE. CPR's team will be integrating the model using DEW, which also is commonly used by utility planners and modelers.

While the UC Irvine proposal only responded to one of the focus area subcategories (optimal location of PV within the T&D system), it had several features that made it a strong proposal. First, UC Irvine is collaborating with PG&E, who will validate the model output using their circuit data and work with UC Irvine on testing the model under utility conditions and assumptions. Second, output from the project would be used by UC Irvine to inform national PV standards-setting committees. The latter is critical to developing a broader platform that will be needed to deploy PV in the concentrations associated with achieving the CSI goals.

Overall, these four proposals bring enough variety for a broad perspective, but demonstrate sufficient overlap to be complementary.

Focus Area II: Testing and development of hardware and software for high-penetration PV

In addition to improved planning and modeling tools, successful grid integration of high-penetration PV will require development of robust grid-PV communication, control systems, and operational procedures. PV systems will need to be capable of dynamically interacting with varying frequency and voltage conditions on the grid including load and VAR (reactive power) control, thus helping to improve reliability. New software and hardware tools will emerge in response to these needs. The solicitation identified the following four issues to help develop in testing and development of hardware and software necessary for high penetration PV:

- Testing improved monitoring and communications software and systems
- Testing/demonstrating improved control systems and operations
- Integrated subsystems within the distribution system (including mini- or micro-grids)
- Assessing optimal locations within the T&D system

1. Proposal 715: SMUD

Proposal 715, from the Sacramento Municipal Utility District (SMUD), responded to all of the four subcategories; has a project team with demonstrated experience in the focus area; the project is focused on California issues; and provides a good leverage of match funds to the requested funding amount. In particular, the SMUD proposal will demonstrate and test new hardware and software tools for providing bi-directional communication and management between PV systems and utility controls using advanced metering infrastructure (AMI). SMUD will also test inverter controls of PV systems within a micro-grid setting. An important product being developed under this project is a software visualization tool presented in a “Heads-Up-Decision” display platform. This display overlays information on PV location and output against transmission and distribution system loadings to help easily identify high value locations for distributed PV in the distribution system, and to identify problem areas requiring modifications to enable high penetration PV. Additionally, the project team will develop and validate PV forecasting tools using high spatial and temporal resolution solar resource monitoring. Lastly, the hardware and software tools are to be tested and validated at residential, commercial and utility-scale deployments in California and Hawaii. The funding requested by

the SMUD project is nearly \$3 million, which is at the ceiling available for projects within the solicitation. However, the project involves development of critical products such as the Heads-Up-Decision display, conducts important testing and validation, and provides utilities and the industry with practical tools that will help integrate increased levels of PV into the grid in beneficial ways.

2. Proposal 702: NREL

Proposal 702, from NREL, focuses on accelerating the placement of high levels of PV penetration into the existing distribution circuits and identifying new circuit configurations that will help increase new penetration levels of PV. For the first year of this project, the NREL team will conduct modeling, simulations and testing of possible advanced hardware and software solutions. Laboratory testing will be conducted on advanced inverters and control systems and these advanced systems will be installed in projects in the SCE territory. During the second year, the team will evaluate the advanced technologies that were developed during the first year of the project. The final results will be summarized into technical reports and best practices designed to assist utilities with the integration of high levels of distributed PV into the electricity distribution grid.

Like the SMUD project, the NREL proposal will develop controls for managing high PV penetration into the distribution and transmission systems. In the NREL proposal, SCE distribution feeders (based on measured loading before and after deployment of PV systems) will be used to measure and validate the impacts associated with the controls. A leading inverter manufacturer (Satcon) will be responsible for developing advanced inverter systems and controls that will then be tested by NREL and subsequently field tested by NREL and SCE personnel.

Overall comparison of Focus Area II

The SMUD and NREL proposals complement one another well as the former provides breadth and the latter an in-depth hardware aspect. SMUD's proposal provides a complete set of tools to help bridge the gap between current low penetration levels and an understanding of how to integrate high penetration levels of PV into the grid. The tools being developed within the SMUD proposal represent critical stepping stones that will be needed for utilities and the solar industry to develop thoughtful strategies to deploying PV in locations and in amounts that provide reliability and cost benefits to California's electricity

system. The NREL proposal lacks this breadth but instead provides much more in-depth development and testing of the advanced inverter and controls necessary to implement the approach being proposed in the SMUD project. There is some overlap -- primarily in the development of the software control logic and the types of field validation work to be conducted. However, this overlap will provide a variety of perspectives in the implementation of high penetration PV into the grid.

Focus Area III: Integration of Energy Efficiency, Demand Response, Energy Storage and PV

As clean energy generation sources located directly at demand centers, distributed PV systems provide both utilities and utility customers with unique opportunities. For utilities, distributed PV systems provide the means to help defer the need to build additional peaking generation and T&D system infrastructure. With the development of energy storage, advanced energy-management systems, and integrated operation of distributed generation resources, distributed PV systems may also become part of the utility reserve capacity. However, utility customers contemplating PV systems are limited by available capital and roof space. Installing a PV system is only one of a number of options available to these customers. Among their other choices is a wide variety of energy efficiency (EE), energy storage (ES), and demand response (DR) strategies.

At present, there are no clear guidelines (especially in retrofit situations) on the extent of EE, ES or DR measures that utility customers should consider prior to or in conjunction with procuring a PV system. Further, there is a critical gap in the ability of the current market to provide combined EE audit/measure implementation and PV installation services for the residential sector. There are few PV installers that are qualified to provide energy efficiency audits and recommend and install appropriate efficiency measures. In general, energy efficiency audits and PV installation services are provided separately. Consequently, residential and small commercial customers are left to make their own decisions about the best mix of the system components—energy efficiency and demand response measures; and PV system type, size and module orientation characteristics—and usually need to employ separate service firms to implement their choices.

The solicitation identified the following issues that can help with the near-term integration of EE/ES/DR and PV systems:

1. Develop a model for identifying and implementing a balanced, optimal, and cost-effective integration of energy efficiency measures and PV system sizing within the residential and small commercial retrofit market
2. Implement and test effectiveness of scenarios for balanced and integrated EE/DR/ES+PV approaches
3. Development of a “best practices” integrated EE/DR/ES+PV retrofit approach

1. Proposal 716: National Renewable Energy Lab (NREL)

Proposal 716 from NREL targets the development of a software tool (BEopt-CA (Ex), which stands for Building Energy Optimizer for California Existing Homes). The intent of the software tool is to provide utility program managers and contractors in the EE/DR/PV market place with a means of balancing the integration of EE, DR and energy storage with PV within the residential retrofit market. The NREL proposal addresses all three of the subcategory issues; has a very strong team (i.e., PG&E, Davis Energy Group, E3 and SunPower) with demonstrated experience in the EE/DR and solar PV arena; and will use PG&E and SunPower data to validate the prototypes developed in the modeling tool (using a statistical approach). Based on the variety of results obtained by examining different mixtures of EE/DR/ES/PV measures, the NREL team will then develop a recommended series of best practices for integrating PV with EE/DR and energy storage.

2. Proposal 709: kW Engineering

The kW Engineering proposal focuses on developing and then verifying an Integrated Energy Project (IEP) Model that will help identify best practices for integrating EE measures with PV system deployment. This model will be built upon a building energy analysis process and is intended to streamline the process of integrating EE and PV, thereby reducing time and costs for both consumers and contractors. The kW Engineering team will describe the model components, document the communication interchange between systems, implement a test version of the model, and identify regions to conduct consumer and contractor tests, conduct a pilot test of the model and document the results. The final product can be integrated with other consumer energy efficiency audit,

contractor bidding or project management tools on the market. A key feature of the kW Engineering proposal is the concept of developing a standardized but comprehensive definition of an integrated EE/DR/PV system. Such a standardized definition is important in enabling a diverse set of demand side and supply side contractors to communicate clearly about what constitutes complementary EE/DR/PV features and the manner in which the measures should be pursued to optimize cost effectiveness for rate payers.

Overall Comparison of Focus Area III

The NREL BeOpt proposal represents an in-depth modeling tool that can be used by utility program managers to identify balanced blends of EE/DR/ES and PV measures across a wide spectrum of strata (e.g., building stock, climate zones, tariff structures, etc.). The BeOpt tool can also provide a user-friendly interface that can make it useful to contractors investigating what blend of EE/DR/ES and PV features they should be considering for implementation to individual facilities. As such, the NREL proposal delivers the tool necessary to enable broad implementation of an integrated approach. The kW Engineering proposal represents a hands-on, field deployment approach to identifying the types of integrated EE/DR/PV measures that are acceptable to the market and then determining how well those measures actually work. Whereas the NREL project relies on a statistical approach to validation, the kW Engineering approach is a bottom-up, site by site validation method. Both approaches are powerful and provide data necessary for a successful attempt at integrating EE/DR/ES and PV measures in a cost-effective and market- acceptable fashion. In addition, the NREL approach allows an over-arching analytical approach that lends itself to sensitivity and scenario analyses, but the kW Engineering approach provides good “field-truthing” of the ins and outs of implementing an integrated approach with building contractors who have to sell an integrated approach to consumers with a limited understanding of the different options.

Projects Recommended for Funding

The CSI RD&D Program Manager will need to create a grant agreement with each proposer recommended for funding based upon the submitted scope of work.

The CSI RD&D Program scoring process revealed that the CSI RD&D Program Manager will need to review the budgets of each proposal prior to finalizing a

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

Grant Agreement with each recipient. During the months since the proposals were submitted, the funding levels may have shifted if, for example, a proposer has since received funding from another source for the same work. Therefore, the CSI RD&D Program Manager will need to ensure that the funding levels are still accurate in light of any potential changes to project partners, project scope, or matching funds. If projects have received funding from another source (or lost matching funds) since the submittal of the proposal, the budget will be modified to reflect this new information, while remaining within boundaries of matching fund requirements.

In addition, several of the proposals appear to be able to be refined to include more solar data from projects in investor-owned utility territories. Some proposals could have obviously and easily been enhanced if there was a utility partnership opportunity.⁷ The CSI RD&D Program Manager will review the scope of work and budgets of each selected proposer to see if there is an easy opportunity to refine the data sets or applications to include a utility partnership.

Finally, nearly all of the proposals received by the CSI RD&D Program in the first solicitation will likely benefit from a technical advisory committee process. Several California utility representatives and industry stakeholders have offered to participate in an informal advisory committee process to aid in the success of the RD&D projects selected under this solicitation. As discussed above, several selected proposals work in similar areas using different methods and it seems logical that the different recommended winners should have an opportunity to share their approaches and work products. The CSI RD&D Program Manager will work to create a technical advisory committee process to aid in the success of the CSI RD&D grant recipients. This process will provide input to the grant recipients early in their projects, provide an opportunity for peer review of projects while in process, and create a forum to share results towards the end of

⁷ In advance of the CSI RD&D Program's second solicitation, the CSI RD&D Program Manager made a concerted effort to get potential bidders in contact with the appropriate utility personnel to allow for an up front opportunity for utilities to collaborate, if desired, with potential project applications. Due to the timing of the first solicitation, it is possible that not all opportunities for utility partnership were fully explored.

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

projects when results have been achieved. The CSI RD&D Program Manager will ensure this activity is included in all grant agreements via the scope of work.

The CSI RD&D Program Manager will reach a final grant agreement with each of the award recipients approved for funding. The grant agreement will codify the scope identified in the proposal, enhanced or modified in a mutually agreeable manner as specified above and in the best judgment of the CSI RD&D Program Manager under the oversight of the Commission's Energy Division. The grant agreement will specify a CSI RD&D Program funding amount up to the exact funding level specified in the proposal, modified in a mutually agreeable manner as specified above and in the best judgment of the CSI RD&D Program Manager under the oversight of the Commission's Energy Division.

COMMENTS

Public Utilities Code section 311(g)(1) provides that this Resolution must be served on all parties and subject to at least 30 days public review and comment prior to a vote of the Commission. Section 311(g)(2) provides that this 30-day period may be reduced or waived upon the stipulation of all parties in the proceeding.

The 30-day comment period for the draft of this Resolution was neither waived nor reduced. Accordingly, this draft Resolution was mailed to parties for comments on January 29, 2010, and comments were received by February 18, 2010.

University of California San Diego (UCSD) filed comments stating that the Draft Resolution incorrectly spelled the name of their institution in two instances. This error has been corrected in this version of the Resolution. We intend to refer to the "University of California San Diego" not "University of San Diego".

DRA raised four points in its comments which are summarized below.

1. Cost- Sharing

DRA argues that many of the recommended awardees do not meet Commission adopted cost-sharing guidelines.

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

Decision (D.) 07-09-042 states “Specific cost-sharing requirements will be according to the Adopted CSI RD&D Plan and on a per-RFP basis” (page 25). Appendix A of the decision indicates that the cost-sharing targets for various stages of RD&D differs (Development (10%), Demonstration (50%), Deployment (75%)), but the same section of the Appendix has a footnote that states “Cost-sharing guidelines vary depending on the nature of a project.” A Draft of the Grant Solicitation that included the cost-sharing guidelines for this grant solicitation was released for public comment on June 4th, 2009. The Commission notes that DRA did not raise this issue when the Draft Grant Solicitation was released. After receipt and review of the comments, the cost-sharing guidelines that were part of the final grant solicitation stated:

The CPUC has established that funding for projects that are closer to commercialization should rely increasingly on support from the private sector. Therefore, match funding is required to participate in this solicitation. The minimum match funding required for projects in this solicitation is 25 percent. Match funding can originate from a variety of sources including the applicant or other team members, the federal or state government (including the American Recovery and Reinvestment Act of 2009), non-governmental organizations, industry stakeholders, private companies, or utilities. Match funding may include, but is not limited to, the contribution of cash or in-kind services. Cost-share funding for activities not directly related to the project will not count toward match funding. If the submitted project includes a scope that goes beyond the eligible technologies listed above, the proposal will not be rejected but CSI RD&D funds may only be used for the eligible technologies portion of the project. Scoring will reflect the magnitude and value of the match. In general, greater contributions of match and more secure match will receive higher match funding scores.

The Grant Solicitation did not require projects to self-identify as either Development, Demonstration, or Deployment. The various RD&D stages are not absolute and discrete, and as demonstrated by the definitions provided below the categorizations are open to some subjective opinion. The Scoring Committee did attempt to categorize the projects into various buckets, and those categorizations were included as part of the Appendix to this Resolution for information only.

Definitions of RD&D Categories

- Development – Activities that convert research outcomes into prototypes.
- Demonstration – Activities that bring technologies closer to market and demonstrate real-world feasibility.
- Deployment – Activities that enhance the competitiveness of new technologies or help reach a “tipping point” into widespread adoption.

The Scoring Committee reviewed the cost-sharing achieved by each proposed bidder. There was a scoring category for cost-sharing, and proposer received more points if they had more cost-sharing. The need for cost-sharing varied depending on the type of project. Projects closer to commercialization were held to higher cost-sharing standards than projects farther from commercialization. Proposers that did not meet the minimum threshold for cost-sharing in the proposal were excluded from review.

The cost-sharing guidelines that were part of the Grant Solicitation were consistent with the direction in the Commission's D.07-09-042. The application of the cost-sharing guidelines that were part of the solicitation was consistent with Commission decision. The level of cost-sharing achieved across the first solicitation was sufficient on both a per project basis, and also overall. Overall the level of cost-sharing achieved was over 65 percent. No changes have been made to the Resolution with the exception of the addition of one additional Finding, #14.

2. Coordination with Smart Grid proceeding

DRA noted that CSI RD&D projects which focus on “grid integration” should be coordinated with the Commission’s Smart Grid proceeding. This Resolution already notes that the CSI RD&D Program Manager will review budget to ensure that projects are not receiving extra match funding from outside sources including the Department of Energy and the California Energy Commission. DRA did not raise any instance where a project could receive multiple streams of funding, and this situation is explicitly screened for. No changes have been made to the Resolution.

3. Transparency in Scoring

DRA stated that the CSI RD&D Program Manager should provide greater transparency and public participation in the grant selection and award process. DRA states that they have no means to determine if the proposals were accurately scored, or if the recommended eight projects are truly the best of the 19 submissions.

The Commission established a method for administering the CSI RD&D Program, and the Energy Division has oversight over the CSI RD&D Program Manager to ensure that they abide by the requirements established by the Commission. The Energy Division actively participated in the review and scoring of the proposals.. The CSI RD&D Program Manager has provided feedback to bidders and to DRA upon request regarding proposals not selected for funding. The Commission has amended this Resolution to provide the names of principal investigators, project titles, requested funding amounts, and match funds provided for those bidders who were not selected for funding (See Table 4).

4. Guarantee of results

DRA requests that contracts with awardees should ensure that promised results are delivered. Otherwise, these funds may not be used as promised or yield results.

This Resolution orders the CSI RD&D Program Manager to enter into grant agreements with selected winners. The grant agreement, which is publicly available at www.calsolarresearch.ca.gov, requires that for all payments/invoices the recipient must provide a progress report. Section 6.1 of the Grant Agreement states:

"Payment shall be made to the Grantee after receipt of a complete, accurate invoice and progress report ("**Payment Request**")"

DRA's concern has already been in the design of the grant agreement which requires project deliverables prior to payment. Furthermore, due to the inherent nature of RD&D, no RD&D program can guarantee that all selected projects will achieve success. No changes have been made to the Resolution.

FINDINGS

1. The CSI RD&D first grant solicitation on PV grid integration was carried out in accordance with the Commission direction establish in D. 07-09-042.
2. The CSI RD&D Program Manager had appropriate oversight by Energy Division during the first grant solicitation.
3. The CSI RD&D Program Manager issued the RFP and Sample Grant Agreement in July 2009.
4. The CSI RD&D Program Manager received proposals in August 2009.
5. The CSI RD&D Program Manager reviewed the grant proposals in a manner consistent with the plan set forth in D. 07-09-042.
6. The CSI RD&D Program Manager undertook a two part scoring process, including a Technical Review and a Scoring Review, as set forth in D. 07-09-042.
7. The CSI RD&D Program scoring process has resulted in the recommendation of eight proposals that met the 75% scoring threshold and are recommended for funding. These eight grant recipients, described in detail in Appendix A to this Resolution, have submitted proposals which will fulfill the goals of the RD&D Program as described in D. 07-09-042.
 - a. Proposal #715 – Sacramento Municipal Utility District – up to \$2,968,432
 - b. Proposal #722 – Clean Power Research – up to \$976,392
 - c. Proposal #716 – National Renewable Energy Laboratory (BeOpt) – up to \$985,000
 - d. Proposal #709 – kW Engineering – up to \$942,500
 - e. Proposal #702 – National Renewable Energy Laboratory (High Penetration PV) – up to \$1,600,000
 - f. Proposal #706 – University of California at Irvine – up to \$300,000
 - g. Proposal #710 – SunPower – up to \$1,000,000
 - h. Proposal #703 – University of California, San Diego – up to \$548,148
8. The CSI RD&D first grant solicitation was released with a sample Grant Agreement that should be used to execute with selected grant recipients.
9. The CSI RD&D Program Manager needs to modify the Grant Agreement with each recommended proposer based upon the submitted scope of work and budget. The CSI RD&D Program Manager will reach a final

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

Grant Agreement with each of the award recipients approved for funding. The grant agreement will be for the scope identified in the proposal, enhanced or modified in a mutually agreeable manner as specified above and in the best judgment of the CSI RD&D Program Manager under the oversight of the Commission's Energy Division. The grant agreement will be for up to the exact funding level specified in the proposal, modified in a mutually agreeable manner as specified above and in the best judgment of the CSI RD&D Program Manager under the oversight of the Commission's Energy Division.

10. The CSI RD&D Program Manager will need to ensure that the funding levels for each project are still accurate, or need to be revised in light of any potential changes to project partners, project scope, or matching funds.
11. The CSI RD&D Program Manager will need to work with grant recipients to refine the budget and scope documents if there is an opportunity to refine the data sets used in the project to include investor-owned utility territory data sets or applications.
12. The CSI RD&D Program Manager will work to create a technical advisory committee process to aid in the success of the CSI RD&D grant recipients. This process will provide input to the grant recipients early in their projects, provide an opportunity for peer review of projects while in process, and create a forum to share results towards the end of projects when results have been achieved.
13. Comments were submitted by DRA and the University of California, San Diego, in timely manner.
14. The cost-sharing guidelines that were part of the Grant Solicitation were consistent with the direction in the Commission's D.07-09-042. The application of the cost-sharing guidelines that were part of the solicitation was consistent with Commission decision.

THEREFORE IT IS ORDERED THAT:

1. The CSI RD&D Program Manager shall execute Grant Agreements for the following eight proposals:
 - Proposal #715 – Sacramento Municipal Utility District – up to \$2,968,432
 - Proposal #722 – Clean Power Research – up to \$976,392

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

- Proposal #716 – National Renewable Energy Laboratory (BeOpt) – up to \$985,000
 - Proposal #709 – kW Engineering – up to \$942,500
 - Proposal #702 – National Renewable Energy Laboratory (PV) – up to \$1,600,000
 - Proposal #706 – University of California at Irvine – up to \$300,000
 - Proposal #710 – SunPower – up to \$1,000,000
 - Proposal #703 – University of California, San Diego – up to \$548,148
2. The CSI RD&D Program Manager shall monitor and report on the progress of grant awards to the Commission pursuant to D. 07-09-042.
 3. The Energy Division shall continue its ongoing oversight of the CSI RD&D Program by reviewing all Grant Agreements prior to their execution.
 4. This Resolution is effective as of today.

I certify that the foregoing Resolution was duly introduced, passed and adopted at a conference of the Public Utilities Commission of the State of California held on March 11, 2009 the following Commissioners voting favorably thereon:

Paul Clanon
Executive Director

Appendix A

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

Project_ID		Proposal title	
715		High Penetration PV Initiative	
Proposal Score			
176 out of 200			
Applicant		Partners	Target Area
Sacramento Municipal Utility District		Hawaiian Electric Company, Inc. (HECO),, BEW Engineering, Inc, National Renewable Energy Laboratory (NREL) , Sunpower, New Energy Options, Areva, New Energy Options, Inc., Irradiance Inc., Solar Consulting Services, Augustyn & Company, SynerGEE and other	Testing/Demo of Hardware/Software
Contact			
Elaine Sison-Lebrilla			
Funding Request		Match funding	Match funding split
\$2,968,432.00	Dev Funding	\$1,293,259.00	SMUD (\$337,529 in-kind and \$200,000 cash)\$537,529 HELCO and HECO \$317,000 SunPower \$325,000 New Energy Options \$113,730
	Demo Funding		
	90.00%		
	Dep Funding		
	10.00%		
Project Summary			
In partnership with the Hawaiian Electric Company, the Sacramento Municipal Utility District (SMUD) will demonstrate and deploy new methods for understanding PV as a distributed generation resource as well as new hardware and software tools for providing communication and bi-directional flow management throughout the grid. A key task for this project is to develop a software visualization tool to identify high value locations for distributed PV in the distribution system, and to identify problem areas requiring modifications to enable high penetration PV. Additionally the project team will develop and validate PV forecasting tools using high spatial and temporal resolution solar resource monitoring. The tools will be tested at residential, commercial and utility-scale deployments in California and Hawaii.			
Deliverables			
Impact analysis for SMUD & HECO systems, report on cloud cover impacts to distribution system, locational value maps, PV potential maps for rooftop and Greenfield opportunities, report on validation of distribution models, report on results of inverter communications and control using AML, visualization tool, defined mitigation strategies and costs, and various PV Production Forecasting Reports.			
Potential Market Connection			
All of the analysis, maps, reports and tools developed through this research will help SMUD, HECO, and the other utilities integrate high penetrations of PV into their systems. Input will be sought from IOUs on their specific needs and training sessions on the tools will be conducted at the conclusion of the project. To further connect this research to the market, the team will make presentations at two appropriate conferences.			
Recommendation			
Recommended for funding. This project is a fully integrated package for addressing utility issues facing high penetration PV. It ties the development of conceptual solutions to actual circuit loading and testing in those circuits. It also develops tools needed by utilities in planning for and implementing high penetration PV by modifying existing software tools commonly used by utilities (i.e., SynerGEE and DEW). Note: The scoring team recommends that SMUD actively solicit and involve IOU input in the tools and models being developed for this project. Workshops and training sessions with the IOUs should also occur at the end of the project to ensure that the results are widely distributed.			

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

Project_ID		Proposal title	
722		Advanced Modeling and Verification for High Penetration PV	
Proposal Score			
174 out of 200			
Applicant		Partners	Target Area
Clean Power Research		NREL, State University of New York (SUNY) at Albany, New York State Energy Research and Development Authority (NYSERDA), Solar Electric Power Association (SEPA), Sacramento Municipal Utility District (SMUD), Long Island Power Authority (LIPA), Salt River	Planning/Modeling
Contact			
Thomas E. Hoff			
Funding Request		Match funding	Match funding split
\$976,392.00	Dev Funding	\$2,293,000.00	DOE (cash) - \$1,753,000
	25.00%		NYSERDA (cash) \$100,000
	Demo Funding		Solar Electric Power Assoc. (in-kind) \$55,000
	75.00%		SMUD (in-kind) \$96,000
	Dep Funding		Long Island Power Auth. (in-kind) \$96,000
			Salt River Project (in-kind) \$48,000
			New York Power Auth. (in-kind) \$48,000
			Clean Power Research (license fees) \$100,000
Project Summary			
Clean Power Research and project participants will provide enhanced spatial and temporal resolution to an existing PV performance model. PV performance forecasts will be validated using two existing high-penetration PV circuits in the state. PV modeling capabilities will be integrated with an open-source distribution engineering and analysis tool. The team will also create a unique PV value assessment tool for use by utilities to select and target the best locations for PV. All of the data and tools from this project will be made available for public use by California installers, manufacturers, agencies, utilities and other stakeholders engaged in transformation of the electric power grid.			
Deliverables			
Report on High Resolution SolarAnywhere Webservice, PVSimulator Field Verification Report, Distribution Engineering Tool Report and Distribution Benefits Evaluation Tool			
Potential Market Connection			
Strong market connection with the utilities directly engaged in demonstrating and evaluating these tools using actual utility data. The Solar Electric Power Association will serve as the prime entity with dissemination of information and results.			
Recommendation			
Recommended for funding. This project develops several different tools that will help utilities address issues facing high penetration PV into the electricity system. It builds off of existing tools and provides field verification.			

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

Project_ID		Proposal title	
716		Beopt-CA (EX): A Tool for Optimal Integration of EE/DR/ES+PV for California Homes	
Proposal Score			
171 out of 200			
Applicant		Partners	Target Area
National Renewable Energy Laboratory		Pacific Gas and Electric (PG&E), Davis Energy Group, Energy and Environmental Economics, Inc. (E3), Sunpower Letter of Support: California Energy Commission	Integration of EE/PV
Contact			
Craig Christensen			
Funding Request		Match funding	Match funding split
\$985,000.00	Dev Funding	\$329,000.00	PG&E (in-kind) \$109,606 PG&E (subcontract to Davis Energy Group) \$124,510 PG&E (subcontract to E3) \$70,300 PG&E (subcontract to SunPower) \$25,000
	50.00%		
	Demo Funding		
	50.00%		
	Dep Funding		
Project Summary			
<p>The market lacks adequate tools to optimize energy efficiency, demand response and energy storage with PV for existing buildings. This project will provide support to the National Renewable Energy Laboratory (NREL) to develop BEopt-CA (Ex), which stands for Building Energy Optimizer for California Existing Homes. This project builds upon the Department of Energy (DOE) funded BEopt™ tool, which optimizes the integration of energy efficiency and PV in the design of new homes. BEopt-CA (Ex) will have the capability of balancing the integration of energy efficiency, demand response and energy storage with PV within the residential retrofit market. The results of this research will be made widely available to interested stakeholders.</p>			
Deliverables			
BEopt-CA (Ex) Beta Software, Impact Assessment and Validation Reports, Educational, Outreach and Training Materials and BEopt-CA (Ex) v1.0 Software			
Potential Market Connection			
<p>Excellent market connection including communications with the CEC about BEopt informing future standards and home energy rating systems. IOUs will be actively involved in the development of the project to ensure that BEopt is fully integrated into residential audit tools. The team will conduct training sessions on BEopt tool for utility and non-utility personnel.</p>			
Recommendation			
<p>Recommended for funding. Utilities and PV system suppliers need a tool that helps them better understand how to integrate PV and EE measures into the built environment. The tool being developed can be used by utility program planners in developing strategies of PV/EE combinations and by PV system installers in assessing cost-effective EE/PV combinations. Note: The scoring team recommends that the model have a simplified front-end that will be useful to contractors. The project team should also offer training in the model to ensure that the tools will move rapidly into the market.</p>			

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

Project_ID		Proposal title	
709		Specify, Test and Document an Integrated Energy Project Model	
Proposal Score			
168 out of 200			
Applicant		Partners	Target Area
kW Engineering		Solarnexus, Save Energy 123	Integration of EE/PV
Contact			
Devan Johnson			
Funding Request		Match funding	Match funding split
\$942,500.00	Dev Funding	\$250,000.00	Solar Nexus (in kind) \$125,000 Save Energy 123 (in kind) \$125,000
	33.00%		
	Demo Funding		
	67.00%		
	Dep Funding		
Project Summary			
<p>The kW Engineering team will leverage their existing software products and skills to develop and test an Integrated Energy Project (IEP) Model. This model will integrate the building energy analysis process with the implementation of energy efficiency and solar projects. The model is expected to streamline the process of integrating energy efficiency and PV reducing time and costs for both consumers and contractors. The kW Engineering team will describe the model components, document the communication interchange between systems, implement a test version of the model, identify regions to conduct consumer and contractor tests, conduct a pilot test of the model and document the results. The final product can be integrated with other consumer energy efficiency audit, contractor bidding or project management tools on the market.</p>			
Deliverables			
<p>Integrated Energy Project (IEP) Model specification – the Model will integrate energy efficiency, demand response and PV. Application programming interface documentation, conduct trial deployment of test software and monitor and evaluate impacts. Final report will provide results model deployment, survey findings, analysis of impacts of model and lessons learned.</p>			
Potential Market Connection			
<p>The trial deployment (pilot testing) will target CA building owners and as the deployment proceeds, a wider range of projects will be included. Benefits of IEP Model will be provided to software and other providers through conferences, trade publications, articles and blog posts.</p>			
Recommendation			
<p>Recommended for funding. Integration of PV with energy efficiency strategies is important to moving adoption of PV into a wider mainstream audience. As we move beyond the still earlier implementers, there will be increased pressure to have templates for how best to integrate PV/EE in a cost-effective and workable fashion. This project provides needed insights into development of such templates by not only examining current approaches, but conducting pilot tests of refined approaches and then providing a tool that can be used within the project bidding phase.</p>			

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

Project_ID		Proposal title	
702		Analysis of High-Penetration Levels of PV into the Distribution Grid in CA	
Proposal Score			
166 out of 200			
Applicant		Partners	Target Area
National Renewable Energy Laboratory		Southern California Edison (SCE), Clean Power Research, Electrical Distribution Design, Satcon	Testing/Demo of Hardware/Software
Contact			
Ben Kroposki			
Funding Request		Match funding	Match funding split
\$1,600,000.00	Dev Funding	\$1,400,000.00	NREL (DOE funds) \$600,000 SCE (in-kind) \$300,000 Clean Power Research (in-kind) \$125,000 Electrical Distribution Design (in-kind) \$125,000 Satcon (in-kind) \$250,000
	15.00%		
	Demo Funding		
	85.00%		
	Dep Funding		
Project Summary			
The focus of this NREL project is to accelerate the placement of high levels of PV penetration into the existing distribution circuits and identify new circuit configurations that will help increase new penetration levels of PV. For the first year of this project, the NREL team will conduct modeling, simulations and testing of possible advanced hardware and software solutions. Laboratory testing will be conducted on advanced inverters and control systems and these advanced systems will be installed in projects in the SCE territory. During the second year, the team will evaluate the advanced technologies that were developed during the first year of the project. The final results will be summarized into technical reports and best practices designed to assist utilities with the integration of high levels of distributed PV into the electricity distribution grid.			
Deliverables			
Distribution system assessment, development of advanced inverter hardware/software, test and deploy advanced inverter and report results.			
Potential Market Connection			
This research targets IOUs as well as municipal utilities. SCE is a partner in the project and will gain specific knowledge regarding integrating large PV deployments into their operations. The results of the research will be widely distributed to all utilities.			
Recommendation			
Recommended for funding. High penetration of PV onto California's transmission and distribution system could pose a major slowdown in deployment of PV. This project proposes possible solutions to both the hardware and software hurdles facing high penetration PV.			

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

Project_ID		Proposal title	
706		Development and Analysis of a Progressively Smarter Distribution System	
Proposal Score			
163 out of 200			
Applicant		Partners	Target Area
Advanced Power and Energy Program-UC Irvine		PG&E	Planning/Modeling
Contact			
Dr. Scott Samuelsen			
Funding Request		Match funding	Match funding split
\$300,000.00	Dev Funding	\$100,000.00	University of CA Irvine (salary support) \$20,000 PG&E (in-kind) \$80,000
	50.00%		
	Demo Funding		
	50.00%		
	Dep Funding		
Project Summary			
<p>The University of California Irvine and PG&E will collaborate to quantify the limitations of PV integration as well as the development and evaluation of a progressively smarter distribution grid. This project will evaluate the control and integration of existing major components on both the primary and secondary distribution system. Three specific distribution system configuration scenarios will be evaluated – the first with many small PV systems, the second with fewer but larger PV systems, and the third with a mixture of smaller and larger PV systems. The project will identify PV integration limitations of standard operating procedure and develop a progressively smarter distribution system to mitigate distribution circuit limitations that might otherwise delay the goals of the CSI program.</p>			
Deliverables			
<p>Model designs and comparisons to grid monitored data, PV integration limits in typical distribution circuits, risks and benefits with advanced inverter control, progressively smarter integrated distribution system controls, feasibility of the proposed integrated distribution grid controls.</p>			
Potential Market Connection			
<p>The outcomes of this work will provide insights into PV integration limits and strategies to enable increased penetration of renewables. Results from the evaluated models will inform the following advance standards (IEEE 1547 and UL 1741)</p>			
Recommendation			
<p>Recommended for funding. This relatively low cost project will help accelerate development of standards critical to the future widespread deployment of PV within the electricity system. It provides a logical stepping stone towards California's movement towards a smart grid that incorporates PV.</p> <p>Note: The scoring team recommends that PG&E, a partner in the project, supply sufficient distribution line loading data such that circuit data results from UC Irvine are representative of customer characterization, feeder operation and location.</p>			

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

Project_ID		Proposal title	
710		Planning and Modeling for High-Penetration PV	
Proposal Score			
161 out of 200			
Applicant		Partners	Target Area
SunPower Corporation		AWS Truewind, Sandia National Laboratories, KEMA, California ISO	Planning/Modeling
Contact			
Matt Galland			
Funding Request		Match funding	Match funding split
\$1,000,000.00	Dev Funding	\$320,000.00	SunPower (in-kind) \$200,000 KEMA and AWS (in-kind) \$104,000 CAISO (in-kind) \$16,000
	40.00%		
	Demo Funding		
	40.00%		
	Dep Funding		
	20.00%		
Project Summary			
<p>This project with the SunPower Corporation team will produce tools and resources necessary to facilitate the study of high penetration PV scenarios in California using industry-standard simulation tools. The team will develop a solar radiation database for use with existing PV power modeling programs. A PV power model will be developed and validated that is compatible with existing utility planning and operations models. Reference data sets will be build for selected high penetration PV deployment scenarios and at various time resolutions. With the participation of the CAISO, the team will develop specific recommendations for integration of high penetration PV into system planning operations. Lastly, the team will assess the potential benefits and issues associated with high-penetration PV. The results will be of high value to the California utility grid planners, providing accurate information about PV system behavior under any condition and its impact on the transmission and distribution circuits.</p>			
Deliverables			
<p>Reports on High-Resolution Solar Resource Data, High-Resolution PV Power Forecasting, Model Integration and Optimal Siting for High-Penetration PV.</p>			
Potential Market Connection			
<p>Solar manufacturers will benefit from this research which will provide for a better understanding of high penetration PV – this should ultimately increase the adoption of PV along with reducing costs. Utilities will benefit from a better understanding of high penetration PV grid impacts.</p>			
Recommendation			
<p>Recommended for funding. This project brings forward a major PV system supplier with a series of tools to help address the issues facing high penetration PV. It brings forward good predictive tools that will help identify more optimal siting of high penetration PV.</p> <p>Note: The scoring team recommends that the project increase the number of small PV sites to be modeled at the distribution feeder level as well as increase the number of distribution feeders to be modeled.</p>			

CSI RD&D Program Grant Awards for First Grant Solicitation/NMR

Project_ID		Proposal title	
703		Improving Economics of Solar Power Through Resource Analysis, Forecasting and Dynamic System Modeling	
Proposal Score			
159 out of 200			
Applicant		Partners	Target Area
UC San Diego		Electric Power Research Institute (EPRI), EDSA Power Analytics, California ISO, SDG&E Letter of Support :NREL, California Solar Collaborative (CEC)	Planning/Modeling
Contact			
Jan Kleissl			
Funding Request		Match funding	Match funding split
\$548,148.00	Dev Funding	\$137,037.00	CEC – CA Solar Collaborative (cash) \$124,980 UCSD (cash) \$12,057 NREL (cash) \$100,000 – not counted in match as there is intention but no commitment
	40.00%		
	Demo Funding		
	40.00%		
	Dep Funding		
	20.00%		
Project Summary			
The University of California (UC) San Diego's project focuses on providing utilities, the solar industry and utility customers with electricity system planning, design and operation modeling tools with the ability to accurately assess and forecast energy output and account for distributed PV systems. This will be done using the existing infrastructure and databases through the state to improve the temporal and spatial resolution of solar maps and resource tools. It becomes increasingly important to predict and balance the impact of transient cloudiness (or intermittency) through geographic dispersion of sites as we move toward performance based incentives. The central output of the models will be the integration into utility forecasting tools and transmission and distribution models based upon the needs of California Independent System Operator and the utilities in the state.			
Deliverables			
Improved solar resource and PV performance models, improve datasets, solar resource forecasting, visualization tools and validation and integration of solar intermittence model.			
Potential Market Connection			
Target audience for research includes utilities, system integrators and the solar industry. Team includes leaders from EPRI, CAISO and the solar industry to enhance information transfer and market connection and adoption.			
Recommendation			
Recommended for funding. High resolution (temporal and spatial) solar resource models will be a critical component in addressing high penetration PV. This project will provide improved high resolution solar data sets and models validated with field data.			