California Solar Initiative

RD&D: Research, Development, Demonstration and Deployment Program

Making Solar Smarter, Stronger and Sustainable

The goal of the California Solar Initiative (CSI) Research, Development, Demonstration, and Deployment (RD&D) Program is to foster a sustainable and self-supporting customer-sited solar market. To achieve this, the California Legislature authorized the California Public Utilities Commission (CPUC) to allocate **$50 million** of the CSI budget to an RD&D program. Strategically, the RD&D program seeks to leverage cost-sharing funds from other state, federal and private research entities, and to target funding across four key stages of RD&D

- **Research: 20%** - Fundamental research to improve performance of solar energy technologies. The research component of the CSI RD&D program ($10 million) is dedicated to the Lawrence Berkeley National Laboratory Solar Energy Research Center
- **Development: 10-15%** - Activities that convert research into working prototypes of improved technologies.
- **Demonstration: 45-55**% - Activities that bring promising technologies closer to market by demonstrating their real-world feasibility to manufacturers.
- **Deployment: 5-10%** - Aiding new technologies in gaining wide-scale adoption or to reach a "tipping point" into widespread commercialization.

Target activities across these four stages:

- Grid integration, storage, and metering: 50-65%
- Production technologies: 10-25%
- Business development and deployment: 10-20%

Target milestones for results:

- Results in 1-3 year horizon: 60%
- Results in 4-7 year horizon: 20%
- Results in 8+ year horizon: 20%

There have been three program solicitations to-date that have awarded over **$28.5 million** in funding for projects, leveraging over **$23 million** in match funding. The funded projects cover three target areas plus a fourth cross cutting focus area.

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SEVEN KEY PRINCIPLES OF THE CSI RD&D PROGRAM

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
7. **Support efforts to address the integration of distributed solar power into the grid** in order to maximize its value to California ratepayers

C S I R D & D P r o g r a m

Focus Areas of Research

1. Grid Integration: High Penetration of PV

Project	Grantee
Development and Analysis of a Progressively Smarter Distribution System	UC Irvine (APEP)
Planning and Modeling for High-Penetration PV	SunPower Corporation
Advanced Modeling and Verification for High Penetration PV	Clean Power Research
Improving Economics of Solar Power Through Resource Analysis, Forecasting and Dynamic System Modeling	UC San Diego
Analysis of High-Penetration Levels of PV into the Distribution Grid in CA	Southern California Edison / NREL
High Penetration PV Initiative	Sacramento Municipal Utility District
Tools Development for Grid Integration of High PV Penetration	BEW Engineering
Quantification of Risk of Unintended Islanding and Re-Assessment of Interconnection	General Electric International, Inc.,
High-Fidelity Solar Forecasting Demonstration for Grid Integration	University of California, San Diego
Screening Distribution Feeders: Alternatives to the 15% Rule	Electric Power Research Institute, Inc.
Integrating PV into Utility Planning and Operation Tools	Clean Power Research

2. Improved Solar Technologies

Project	Grantee
PV and Advanced Energy Storage for Demand Reduction	SunPower Corporation
Improved manufacturing and innovative business models to accelerate commercialization in California of hybrid concentrating photovoltaic/thermal tri-generation (CPV/T-3G) technology	Cogenra
Proving Performance of the Lowest Cost PV System	Solaria Corporation
Improved Cost, Reliability, and Grid Integration of High Concentration Photovoltaic Systems	Amonix, Inc.

3. Innovative Business Models

Project	Grantee
Innovative Business Models, Rates and Incentives that Promote Integration of High Penetration PV with Real-Time Management of Customer Sited Distributed Energy Resources	Viridity Energy
Advanced Grid-Interactive Distributed PV and Storage	Solar City
Reducing California PV Balance of System Costs by Automating Array Design, Engineering and	SunLink
Solar Energy & Economic Development Fund (SEED Fund)	Strategic Energy Innovations, Inc.

4. Cross-cutting: Integration of energy efficiency, demand response and storage with PV

Project	Grantee
BEopt-CA (EX): A Tool for Optimal Integration of EE/DR/ES+PV for California Homes	Davis Energy Group / NREL
Specify, Test and Document an Integrated Energy Project Model	kW Engineering
Low-Cost, Smart-Grid Ready Solar Re-Roof Product Enables Residential Solar Energy Efficiency Results	BIRAenergy (formerly ConSol)
West Village Energy Initiative	University of California Davis

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CSI RD&D website: calsolarresearch.ca.gov

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Feb 2013

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Grid Integration: High Penetration PV

Solar Resource Modeling and Forecasting

Due to the rapid growth in distributed PV systems, utility grid operation models and planning tools often lack the ability to account for the variability of distributed PV generation technologies and resources. Problems can also exist with the current methods for estimating solar resources and predicting PV system output. Existing solar resource models are based on lower resolution insolation data sets and usually provide only hourly resource values. It is recognized that rapid changes in atmospheric conditions over relatively small areas can have significant impacts on the aggregated PV system output and on the associated electricity distribution system.

Advanced Modeling and Verification for High Penetration PV

Clean Power Research

Partners: NREL, SUNY, NYSERDA, LIPA, SMUD, NYPA, SEPA, SRP

Clean Power Research developed a portal for solar resource data (ca.solaranywhere.com) that provides high temporal and spatial resolution data for use in forecasting and planning tools. The high resolution data for California is available free of charge to anyone as part of this grant. The project also developed an algorithm for PV Output Variability through data collection and validation in various geographical locations and included the algorithm in PV modeling tools. A tool was also developed for calculating the economic value of distributed PV fleets and includes energy value, generation capacity value, environmental value, fuel price hedge value, T&D capacity value, and loss savings. The project was completed in April 2012.

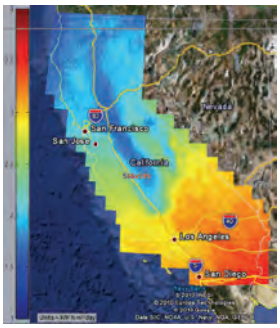
Integrating PV into Utility Planning and Operation Tools Clean Power Research

Clean Power Research

Partners: CAISO, UCSD, EPRI, SUNY, SEPA

In this follow on project the Clean Power Research team is developing, validating and integrating PV fleet simulation tools that will enable utilities and independent system operators (ISOs) to cost-effectively integrate distributed PV resources into their planning, scheduling and operating strategies. The solar resource data on the SolarAnywhere portal (ca.solaranywhere.com) will continue to be processed with additional temporal and spatial resolution and inclusion of forecasting algorithm that generates data upon demand. The main focus of this project is the interface with CAISO and the use of solar forecasting data in their operations and planning to enable handling of increasing penetration of solar on the grid.

Improving Economics of Solar Power through Resource Analysis, Forecasting and Dynamic System Modeling



University of California, San Diego

Partners: EPRI, Enernex, CAISO, SDG&E

This project focuses on providing utilities and the solar industry with electricity system planning, design and operation modeling tools for accurately assessing and forecasting energy output from distributed PV systems. Geographic shading profiles along with one-year solar irradiance dataset (downscaled from metered 15 minute generation data to less than a second data) has been generated for locations throughout the state. A forecast of PV power output throughout California for up to 6 hours ahead will be developed. These high resolution (both temporal and spatial) resource maps and modeling tools will be a critical component in addressing high penetration PV.

High-Fidelity Solar Forecasting Demonstration for Grid Integration

University of California, San Diego

Partners: SDG&E, Green Power Labs, CAISO

This project will demonstrate that solar resource forecasting can be the most cost effective strategy for integrating large amounts of PV into distribution systems. Initially historical aggregate PV ramp rates will be analyzed and a baseline of solar forecast performance under the extreme ramps will be created. Additionally, sites for additional measurements to improve solar forecast accuracy will be proposed based on statistical analysis. For resource adequacy applications, the team will then improve and demonstrate forecasts for the marine layer meteorological conditions that affect a large fraction of solar PV in SDG&E territory on summer mornings. High resolution numerical weather prediction and statistical models will be developed and applied to improve forecast accuracy. Local applications of solar forecasting using sky imagery will also be demonstrated on five typical feeders with variations in PV penetration, location/meteorology, and voltage regulation equipment. On these feeders, fast demand response potential based on demand and solar forecasting and dynamic loading will be demonstrated. Through increased granularity in modeling distribution feeder voltages and their reaction to fluctuations in solar PV output, geographic diversity is expected to reduce previously observed impacts at high solar PV penetration.

Grid Integration: High Penetration PV

Hardware and Software for High Penetration PV

Successful grid integration of high-penetration PV requires a robust grid, PV communications, 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 to improve reliability. New software and hardware tools will emerge in response to these needs. Field testing and demonstrations are needed before these new tools can realize widespread market adoption.

Development and Analysis of a Progressively Smarter Distribution System

University of California Irvine
Advanced Power and Energy Program

Partner: PG&E

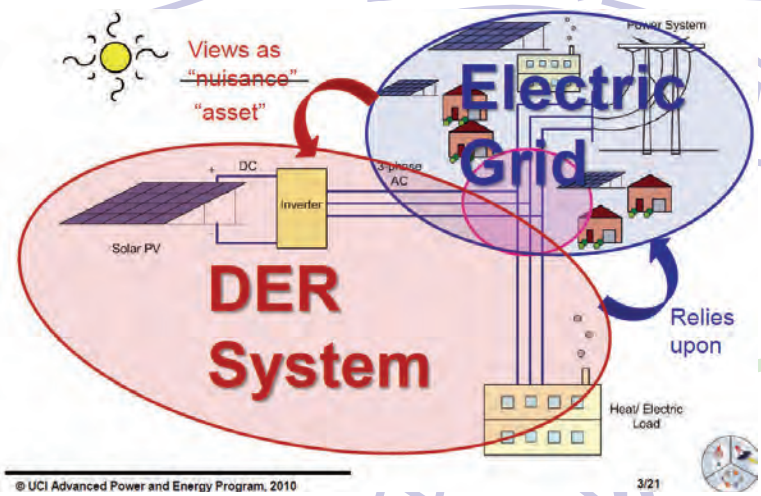
The goals of this project are to utilize modeling and simulation to quantify PV integration limitations on distribution circuits, assess advanced inverter strategies and to develop and evaluate progressively smarter distribution systems so that higher levels of PV can be accommodated. Monitored field data was used to develop and verify distribution circuit models. The team is evaluating advanced inverters, control strategies, standards and hardware necessary to enable and support increased PV penetration on the distribution system. Results from the project will be used to inform advanced standards.

Planning and Modeling for High Penetration

SunPower Corp.

Partners: AWS Truepower, Sandia National Lab, KEMA, California ISO

The SunPower team generated a higher solar resolution sample dataset based on meteorological information and delivered a preliminary methodology report that focused on the methods used to generate simulated solar resource data. A sample simulated dataset (15-minute, 1-minute and 1-second sample files) was generated using the developed methodology. The team produced specifications for representation of PV output variability in simulation as well as a baseline assessment report before pulling out of the project in June 2012.



Analysis of High-Penetration Levels of PV into the Distribution Grid in California

Southern California Edison/NREL

Partners: NREL, Satcon, CPR, Electrical Distribution Design

This project 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 penetration levels of PV. For the first phase of this project, the team conducted modeling, simulations, and testing of possible advanced hardware and software solutions. Laboratory testing has been conducted on advanced inverters and control systems, and these advanced systems will be installed in projects in the Southern California Edison territory. During the second phase, the team will evaluate the advanced technologies that were developed during the earlier project.

C S I R D & D P r o g r a m

Grid Integration: High Penetration PV

Utility Planning and Modeling for High Penetration PV

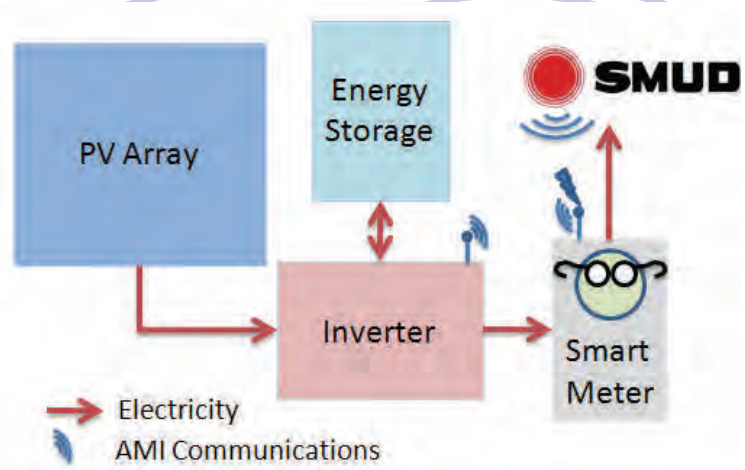
Distributed PV systems are often outside the scope of most utility planners and engineers, due to their small size and historically low market-penetration and utility personnel may not be familiar with the operational characteristics of these systems. Existing methods for predicting and planning for high penetration PV limit the ability of utilities to strategically locate this technology within their T&D systems. New solar resource and utility planning models provide utilities with the means to identify optimal locations for high penetration levels of PV. As PV and other DG resources form a larger portion of the electricity generation mix, it will be increasingly important to have electric system planning, design, and operation modeling tools that provide utilities and others in the solar industry, with the ability to accurately assess and forecast energy output and account for distributed PV systems.

High Penetration PV Initiative

Sacramento Municipal Utility District

Partners: HECO, NREL, EPRI, New Energy Options, Areva, Siemens Irradiance and other consulting firms

SMUD, in partnership with Hawaiian Electric Company (HECO) is demonstrating new hardware and software tools that provide communication and management between PV systems and utility controls using advanced metering infrastructure (AMI). The team is developing a software visualization tool that enables identification of high value locations for distributed PV. The tools developed through this project are being tested and validated at residential, commercial, and utility-scale deployments in California and Hawaii. The project will provide utilities the with tools to integrate increased levels of PV into the grid.

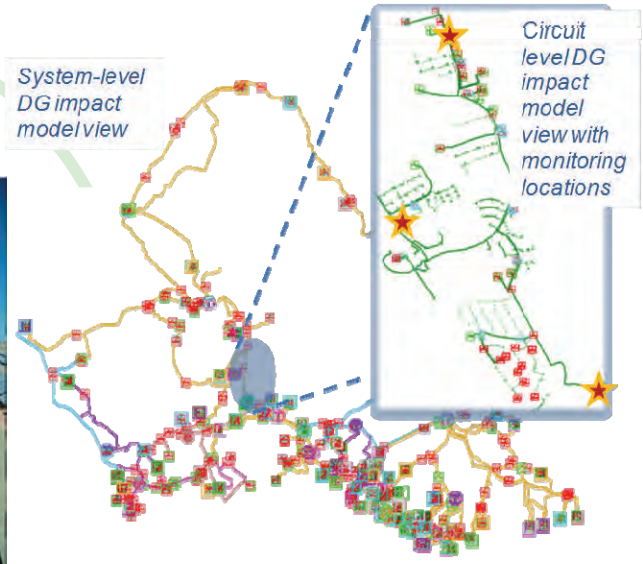


Tools Development for Grid Integration of High PV Penetration

BEW Engineering

Partners: SMUD, HECO/MECO/HELCO, PG&E, Roseville Electric

This research targets the development of methodologies and software for evaluating high-penetration PV on the distribution grid and builds on work conducted under the Sacramento Municipal Utility District (SMUD) CSI RD&D #1 project. The BEW team will explore a nodal approach for locating PV strategically by integrating the distribution grid and a global visual mapping tool into an expanded locational value analysis. The visual map locates potential PV development areas such as roof space and vacant lots. The nodal approach aggregates and assesses impacts across the system from a strategic development and grid enhancement perspective. The methodology and process will be used by utilities to facilitate expansion of PV into the grid without negatively impacting system performance. The four utility partners will select different feeder configurations to demonstrate, evaluate, and validate high PV penetrations under steady-state, contingency, and dynamic scenarios. The project also plans to conduct case studies for evaluating PV penetrations on the distribution grid.



Grid Integration: High Penetration PV

Interconnection Studies

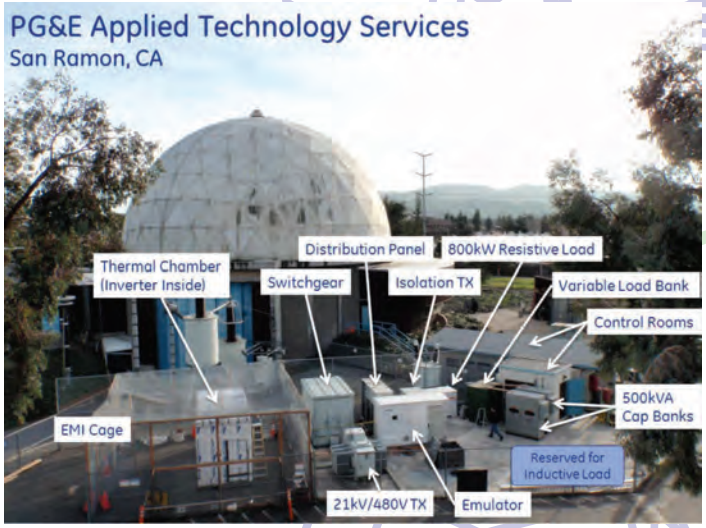
Investor-owned utilities in California use the Rule 21 Tariff for interconnection, operating and metering requirements for distributed PV systems under 2 MW. The procedures for interconnection include a series of screens to identify whether a PV project can qualify for a simplified interconnection process or whether a detailed study is required. Interconnection requirements are considered to be quite conservative and can result in delays and added costs for interconnection of distributed PV that may not negatively impact the grid or the customer. A clear, data driven and streamlined interconnection process will lead to greater adoption of PV both in California and across the nation.

Quantification of Risk of Unintended Islanding and Re-Assessment of Interconnection Requirements in High-Penetration of Customer-Sited Distributed PV Generation

General Electric International, Inc., Energy Consulting

Partners: PG&E

This collaborative project will quantify the risks of unintended islanding in distribution circuits with high penetration of customer-sited distributed PV generation. The GE/PG&E team will use full-scale laboratory testing to determine the risks to both utility and customer equipment that may result from an unintended islanding situation. Additionally, the team will review PG&E's interconnection requirements with respect to islanding and provide recommendations on potential changes based on the findings from this project. The results of this research will inform PG&E's interconnection requirements and also will be of value to the other utilities (both investor-owned and publicly-owned). This research can also inform the CPUC in making decisions regarding interconnection requirements relating to anti-islanding operations of PV inverters (Rule 21).

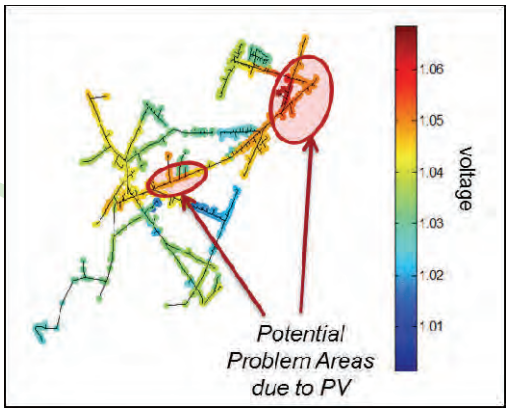


Screening Distribution Feeders: Alternatives to the 15% Rule

Electric Power Research Institute, Inc.

Partners: NREL, Sandia National Lab, Clean Power Research

This project is developing an interconnection screening methodology that takes into account individual distribution feeder characteristics. Distribution modeling and simulation techniques will be used to determine the level of PV that can be accommodated on individual feeders without impacting distribution system operations. This measure of "hosting capacity" is expected to become more critical as PV deployment increases. The utility partners will help to detail which tools and penetration screens are most commonly used and which procedures have been most effective for evaluating PV interconnection requests in California. The utilities will also help review distribution feeder classification methods currently used in California to identify and map areas with additional capacity for hosting PV. Factors that are known to be important to feeder hosting capacity will be used to develop a higher-level screening methodology that can then be applied to other distribution systems without necessitating the need for detailed analysis .



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C S I R D & D P r o g r a m

Improved PV Production Technologies

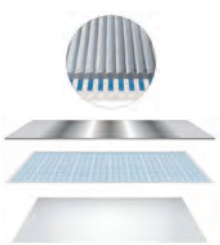
The improved PV production technologies focus includes testing and demonstration of new solar technologies and strategies with improved performance/reliability or lower costs. The projects funded in this focus area aim to demonstrate the viability of distributed concentrating PV (CPV), PV and solar thermal, and combining PV with energy storage. The current market place lacks data on the reliability and long term performance of new and innovative systems to allow for financing of these projects. Providing long term performance data and information to establish the bankability and reliability will enable confidence with adoption of PV technologies in the distributed generation market.

Solaria: Proving Performance of the Lowest Cost PV System

Solaria Corporation

Partners: PG&E

This Solaria project seeks to overcome the primary obstacle to wide-scale deployment of its PV technology in that the financial community will only invest in projects that use solar technology with a history of proven performance. To overcome this barrier, the Solaria team is conducting demonstrations at two California sites (Fremont and Dublin). The Fremont demonstration at the Solaria manufacturing facility is a 110 kWp tracking system. The second system, installed at the Alameda County Santa Rita Jail, is testing and comparing three types of tracking systems with Solaria modules: single axis, dual axis, and polar axis. These tests may support further cost and performance comparisons by validating the optimum tracker technology with Solaria modules. The data and results from these demonstrations will support the reduction of risk by investors finance these projects, thereby accelerating the deployment of solar in California .

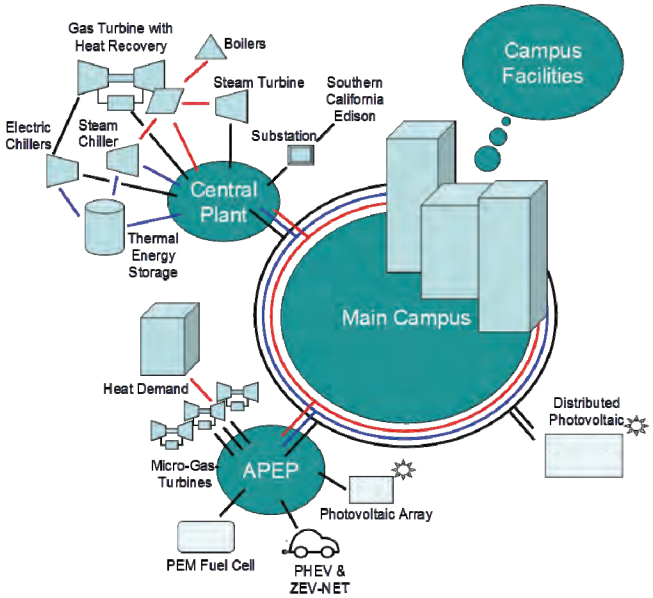


PV and Advanced Energy Storage for Demand Reduction

Amonix, Inc.

Partners: UC Irvine APEP, NREL, SCE

The Amonix project is working to decrease costs and expand the market adoption of high concentration photovoltaic (HCPV) systems. The Amonix team is monitoring the performance of two 53 kW HCPV systems and associated circuits on the University of California, Irvine electric infrastructure. Metered data and associated models are being used to evaluate and compare grid interconnection and energy management strategies. The team is also look at how to correlate measured weather data with accelerated testing in order to predict lifetime and reliability validation that will help to secure financial investments for future HCPV system deployment.



C S I R D & D P r o g r a m

Improved PV Production Technologies

PV and Advanced Energy Storage for Demand Reduction

SunPower Corp.

Partners: KEMA, Sandia National Lab, Kohl's Stores, UCSD, Ice Energy, ZBB Energy, PG&E

The SunPower project is demonstrating the integration of advanced energy storage systems in combination with existing PV systems at customers' sites. Two energy storage systems are being demonstrated at two sites - the University of California, San Diego campus and Kohl's Store in Redding, California.

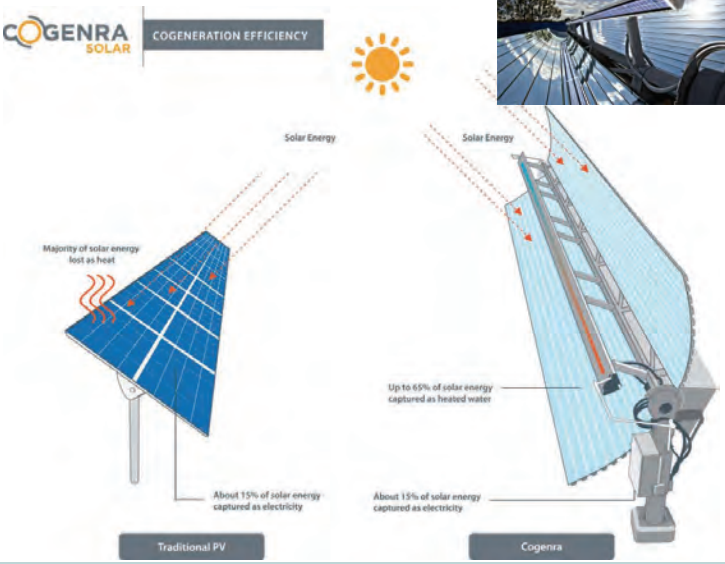
The SunPower team is assessing whether the combination of PV and energy storage is of higher value to the customer and utility than either one alone considering time-of-use rates and a demand response tariff, under actual operating conditions. In addition, they are evaluating the capabilities, reliability and potential degradation of the storage technologies and the ability of the storage technologies to respond to actual or simulated demand response events. This research will provide valuable information regarding the coupling of energy storage with PV in terms of both the economics and the reliability of storage technologies.

Improved Manufacturing and Innovative Business Models to Accelerate Commercialization in California of Hybrid Concentrating Photovoltaic/Thermal Tri-generation (CPV/T-3G) Technology

Cogenra

Partners: Sonoma Wine Company, Patch Engineering, PG&E

Cogenra has developed, prototyped and validated the performance of a concentrating PV (CPV) and thermal co-generation technology. For this project they conducted an 80 kW demonstration of their technology at the Sonoma Wine Company. Improved manufacturing and assembly methods were developed and demonstrated at subsequent sites including the Kendall Jackson Winery site and a Southern California Gas Company testing site. The field performance of the systems were measured and used to refine economic and financial models. The Cogenra team developed an Energy Purchase Agreement business model to facilitate third-party financing for these systems. The solar co-generation system was modified to support tri-generation of electricity, heating and cooling. Tri-generation expands the market for this technology to commercial sites that require cooling and limited hot water. The system was modified to provide thermal energy storage for use during peak demand. The project was completed in January 2013.



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C S I R D & D P r o g r a m

Innovative Business Models

The Innovative Business Model focus area includes projects that provide support to build the market for solar energy. Successful deployment of new business models is required to meet the goals and objectives of the CSI Program. Testing and demonstration of innovative business models will help support expansion of cost-competitive solar technologies by reducing costs or increasing value of the solar system to owners or utilities. The program supports activities that enhance the competitiveness of new technologies, or to help reach a 'tipping point' to widespread commercialization. This can include projects that involve testing of technologies or measures that enable streamlining of regulatory processes or standards in ways that allow new products to come to market more quickly and at lower costs.

Reducing California PV Balance of System Costs by Automating Array Design, Engineering and Component Delivery

SunLink

Partners: Rutherford and Chekene, Pacific Earthquake Engineering Research Center (UC Berkeley)

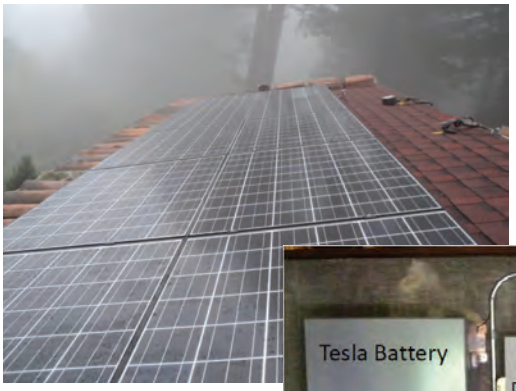
This project focused on decreasing the time spent on engineering system layout to final package including appropriate documentation for permitting purposes. The project developed an automated string layout tool (an AutoCAD plugin) for the solar industry to efficiently and cost effectively engineer smaller PV systems; this enables a wider range of contractors who can potentially deliver fully-engineered PV system installations. Additionally, SunLink demonstrated time efficiency in using an automated documentation management system from project approval through system installation and also developed an online solar permitting documentation database for over 1000 jurisdictions in the state which allows for efficient look up of information. The team conducted seismic and wind testing for ballasted systems which may result in structural code changes for roof mounted PV systems, allowing more cost and time efficient designs. This project was completed in December 2012.

Advanced Grid-Interactive Distributed PV and Storage

SolarCity

Partners: Tesla Motors, UC Berkeley, PG&E

The ability to firm intermittent renewable resources can result in peak demand reductions and system-wide grid network benefits. This project builds upon an operational FirmPV installation in San Francisco, which is a combination of Tesla Motors vehicle battery system with SolarCity's SolarGuard dispatch and monitoring platform. The team is conducting demonstrations at 9 sites to assess system performance along with assessing the economic, reliability and carbon reduction impacts of large-scale deployment of a FirmPV product. The team is conducting analysis to determine an optimal tariff product or rate plan that will provide the benefits of FirmPV at the lowest overall cost, along with exploring a range of financing mechanisms that will best enable FirmPV deployment.



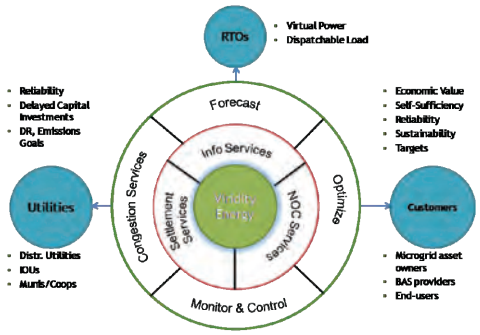
Innovative Business Models

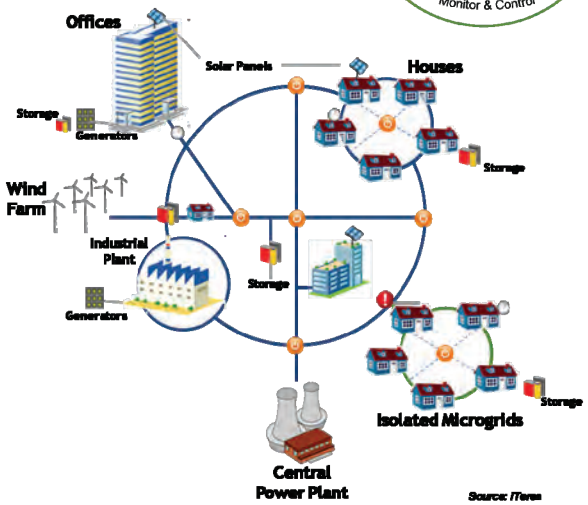
Innovative Business Models, Rates and Incentives that Promote Integration of High Penetration PV with Real-Time Management of Customer Sited Distributed Energy Resources

Viridity Energy

Partner: UC San Diego, E3, SDG&E

Viridity Energy demonstrated its VPower software at the University of California, San Diego (UCSD) campus. The software consolidates diverse microgrid assets to allow for comprehensive decision making. VPower allows a microgrid operator to balance supply and demand to maximize costs and benefits in real time. New business models were identified for integrating up to 1,000 MW of high penetration PV with distributed energy resources (DER) at UCSD. Additionally, new tariffs and incentives scenarios were developed and vetted with SDG&E and the California Independent System Operator (CAISO) and tested on the UCSD Microgrid. Lastly, the team performed an integrated cost-benefit analysis of the business models and management strategies and recommended rates and incentives that balance the costs and benefits from the utility, customer and ratepayer perspectives. This research provided valuable information to support both utility operations and the CAISO. The project completed in February 2013.





Solar Energy & Economic Development Fund (SEED Fund)

Strategic Energy Innovations, Inc.

Partner: Optony, Inc.

Strategic Energy Innovations and Optony are using the SEED Fund Project to demonstrate an innovative solar procurement business model that utilizes a public-private revolving fund mechanism to support public entities (municipalities and schools) in adopting solar technologies. Public entities are motivated to adopt PV; however the upfront costs and lack of technical capabilities serve as barriers to adoption. The SEED Project will demonstrate that a 1-2% upfront investment in collaboration results in a 10-12% project cost savings, lower project risks with higher returns, reduced transaction costs and reduced administrative efforts. In addition to the revolving fund mechanism, the SEED team will provide expert technical support. The initial project procurement activities will involve 15 public partners with up to 100 potential sites resulting in a minimum of 5 MW of solar contracts. The revolving fund will be replenished through a modest fee on projects moving forward with the idea that the fund will then be available for additional rounds of collaborative procurement. Project website: solarroadmap.com/seed

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C S I R D & D P r o g r a m

Cross-cutting: Integration of Energy Efficiency, Demand Response and Energy Storage with PV

For utilities, energy efficiency and distributed PV can help defer the need to build additional peaking generation and T&D system infrastructure. For utility customers, distributed PV provides more control over energy costs. Installing a PV system is one of a number of options available to these customers. Their other choices include energy efficiency, energy storage, and demand response. Energy efficiency provides the most cost-effective means for addressing energy use within a home, business or community. Implementing energy efficiency measures not only reduces electricity demand but also helps reduce the size and required capital for a PV system. There is a gap in the current market for services that combine energy efficiency along with PV for the residential sector.

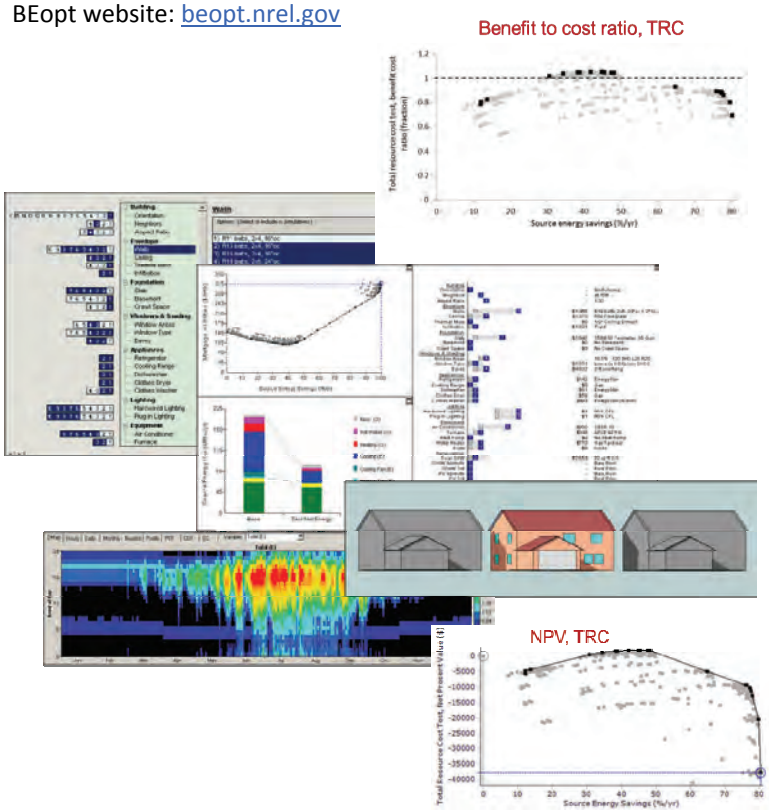
Beopt-CA (EX): A Tool for Optimal Integration of EE/DR/ES+PV for California Homes

Davis Energy Group/NREL

Partners: PG&E, E3

This project is developing the Building Energy Optimizer for California Existing Homes Beopt-CA (EX) modeling tool that supports the integration of energy efficiency, demand response, and energy storage with PV with a focus on getting to "Zero Net Energy" in the residential retrofit market. The project is enhancing the capabilities of the original BEopt tool developed by NREL to address the residential retrofit market. It is also extending the economic analysis to allow utility program managers (utility cost tests) and contractors the ability to optimize the integration of EE, DR, ES with PV, from their unique perspectives. The team is exploring the option of making the tool more relevant in California by linking it to the California Simulation Engine (CSE) used for building code compliance.

BEopt website: beopt.nrel.gov



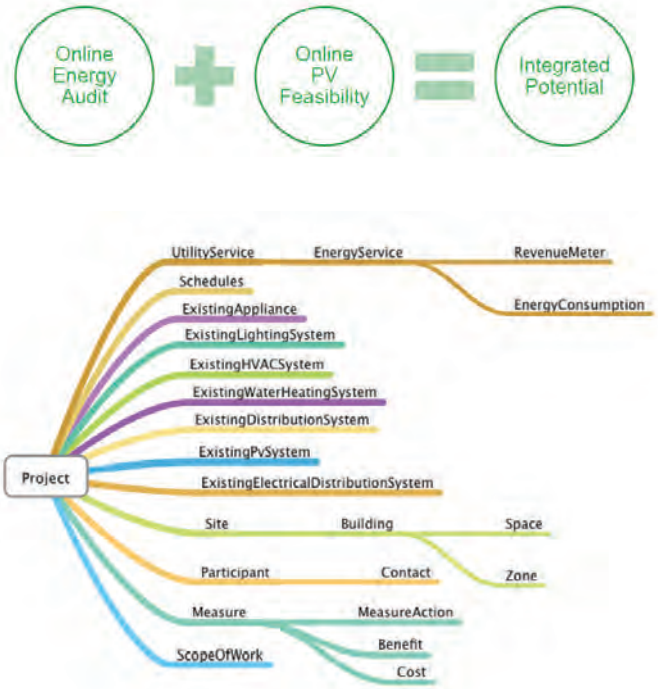
An Integrated Energy Project Model

kW Engineering

Partners: Solarnexus, Save Energy 123

This project developed an Integrated Energy Project (IEP) data model that enables the capture of best practices for integrating energy efficiency measures with PV system deployment. The IEP Model introduces a common language to project stakeholder software applications for assessing energy efficiency or solar and provides a comprehensive, standardized definition for EE/DR+PV projects. This data model is publically available and aims to simplify and streamline the procurement process, reduce time and costs for both the consumer and contractors, produce a better return on investment for both, and remove a key market barrier for the adoption of both efficiency measures and PV. The project was completed in April 2012.

Project website: www.iepmodel.net



Cross-cutting: Integration of Energy Efficiency, Demand Response and Energy Storage with PV

Low-Cost, Smart-Grid Ready Solar Re-Roof Product Enables Residential Solar Energy Efficiency Results

BIRAenergy

Partners: General Electric, SDG&E

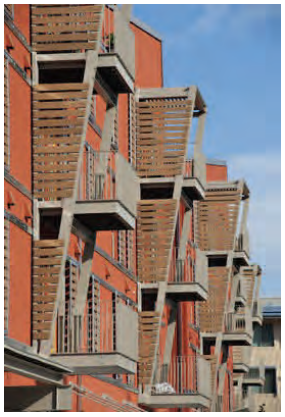
This project is focused on demonstrating a new plug and play PV system as a cost-effective retrofit measure during a residential re-roof or other deep retrofit event. The plug and play PV is being installed on six demonstration homes in the SDG&E service territory, spanning a range of economic, geography, vintage, and energy efficiency levels. One of the six is a showcase home in Chula Vista, CA which in partnership with the city and SDG&E, is a high efficiency home used for community tours and education. A second home in Santee, CA will demonstrate a "zero net energy" retrofit, which includes additional efficiency measures, demand-responsive appliances, an integrated home energy management (HEM) system and an energy storage system along with PV. Key activities include: 1) Evaluation of the installation costs, barriers and performance of a new plug and play PV retrofit system. 2) Assessment of existing and potential financing options to cover the costs of the PV system, energy efficiency upgrades and non-energy building retrofits (e.g., re-roof) in a single, readily available package. 3) Analysis of target markets and marketing materials for this PV retrofit system. 4) An assessment of the impact that this PV retrofit product, along with efficiency improvements and demand response capability will have on the utility distribution-grid. 5) Development of a business plan for contractors performing re-roofs to also install a PV retrofit system as a sustainable product offering, independent of the availability of incentives for renewable systems.

West Village Energy Initiative: CSI RD&D Project

UC Davis

Partners: UC Davis Energy Institute, Davis Energy Group, E3, GE, PG&E

The West Village Project at the University of California, Davis, is one of the first large scale communities to be Zero Net Energy entirely through energy efficiency and on-site generation. The UC Davis team will test and demonstrate existing and new storage technologies for smaller systems in community-wide applications. The team will also research and demonstrate the integration of Advanced Metering Infrastructure (AMI) with PV and DG as well as test and demonstrate hybrid solar (PV/Thermal). The West Village Project will be used to test and evaluate several business models for deploying community distributed solar and will document the most promising ones. Lastly, the team will test, demonstrate and assess virtual net metering approaches, energy storage to mitigate the impacts of high penetration PV deployment and the use of solar resource forecasting to optimize storage charging and dispatch.



LEARN MORE:

One stop for all solar in California: GoSolarCalifornia.ca.gov

CSI RD&D website: calsolarresearch.ca.gov

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