GO solar CALIFORNIA

CSI RD&D PROGRAM

Business Development and Deployment

Grantee:
SunLink Corporation

Partners:
Pacific Earthquake Engineering Research Center, Rutherford & Chekene, Autodesk, Computers & Structures, Inc.

CSI RD&D Funding:
$996,271

Match Funding:
$1,263,465

Project Timeframe:
2011-2012

RD&D Project Portal:
calsolarresearch.ca.gov/csi/77

Reducing Photovoltaic Costs by Automating Array Design, Engineering, and Component Delivery

OVERVIEW AND OBJECTIVES

Approximately one-half of the installed cost of a photovoltaic (PV) system is the modules, which continue to see cost reductions. The remaining half (balance-of-system) includes the inverter, labor, and other components and fees (engineering, permitting, interconnection). To see any significant decline in the total cost of a system, balance-of-system costs must be reduced. SunLink, a provider of PV mounting and balance-of-system components, leveraged past research, and established the following research project objectives:

- Reduce the time for PV array design.
- Reduce the time for project permitting.
- Enable fully optimized designs for smaller commercial roof-top systems.
- Decrease 'on-roof' time through factory manufacturing of array harnesses and matching combiner boxes.

This project scope included automation of structural engineering, full-scale seismic testing of PV array behavior, analysis of wind tunnel testing for dynamic modeling of wind loads, development of a publicly accessible database of permitting agency requirements in jurisdictions across California, the creation of an automated document management system, and work that will facilitate code updates to overcome barriers to non-attached (non-roof-penetrating) designs that are necessary for wide-scale building owner acceptance of rooftop solar. Each of these separate tasks demonstrates opportunities for balance-of-system cost reduction.

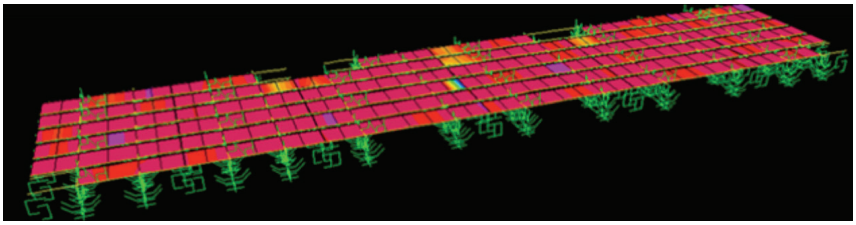
This document provides a brief project description. For more detail on the project and the California Solar Initiative's (CSI) Research Development, Demonstration & Deployment (RD&D) Program, please visit calsolarresearch.ca.gov

The CSI RD&D Program is managed by Itron on behalf of the California Public Utilities Commission (CPUC).

Itron CSI RD&D PROGRAM MANAGER

METHODOLOGY

The SunLink team automated array structural analysis to significantly reduce engineering time requirements. They also developed the SunLink String Layout Tool, which automates project-specific wiring layouts. These layouts are used for the off-site fabrication of wiring harnesses. In addition to system design tasks, the team conducted seismic and wind array research to quantify the structural integrity of unanchored arrays. SunLink conducted seismic testing of two full-scale production systems at the Pacific Earthquake Engineering Research (PEER) center. The tests were used to validate and calibrate non-linear seismic analysis models that predict total horizontal displacements for unattached PV arrays. Lastly, the team created a web-accessible database application that includes contact information for the engineering and permitting of solar projects within building departments across all 58 California counties.



SunLink String Layout Tool

RESULTS AND OUTCOMES

SunLink created a suite of integrated design tools for layout and model generation that significantly reduces the time required for structural and project engineering of a typical roof-mounted commercial installation. The tools SunLink created enable accurate and consistent documentation as well as rapid iteration of the custom designs required for maximizing solar power output on rooftop installations. The team developed a database of local permitting requirements which can be expanded as projects arise in new localities. Solar stakeholders can use this information to facilitate the delivery of documentation that best illustrates to building officials the code compliance of optimized design and better meets the requirements of local permitting agencies in California. The PV arrays tested at the PEER center successfully withstood the complete matrix of test loads, which included approximately 100 earthquakes. The testing validated the analytical models developed by SunLink and demonstrated that the analysis can accurately and consistently predict array response to a wide range of seismic events. These validated models support the position that unattached PV arrays can be safely and predictably utilized in seismic regions.

PUBLIC BENEFITS

Will help the industry to cost-effectively provide optimized designs for PV systems as small as 5 kW.

Will expand the range of contractors who can successfully install fully-engineered PV installations, including general and electrical contractors.

Provides the functionality and features worthy of consideration for a document management system and serves as a starting point for solar organizations to pursue document management.

Will help inform new structural permitting standards that support the use of unattached PV mounting installations in areas of high seismic activity. Because ballasted systems are less expensive to install and maintain than connected systems, these test results will ultimately help to lower costs for rooftop solar and open up the potential for projects on building roofs previously considered unsuitable.

Resulted in The California Agency Permit Document Requirements Database, a single point of access for information to support building code officials and the California solar industry with new structural permitting standards requirements. The database has been populated for 1,527 cities and towns in California.

Resulted in significant outreach with numerous technical publications, white papers, peer-reviewed and trade journal articles, and conference and webinar presentations.