GO solar CALIFORNIA

CSI RD&D PROGRAM

Improved Technology

Grantee:
Cogenra

Partners:
Sonoma Wine Company, Patch Engineering, Pacific Gas & Electric

CSI RD&D Funding:
$1,466,973

Match Funding:
$2,200,958

Project Timeframe:
2010-2012

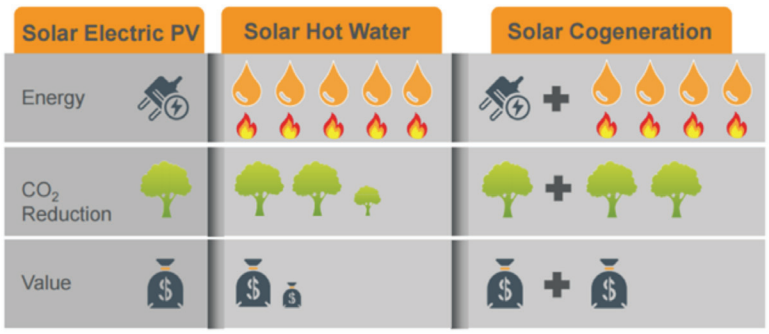
RD&D Project Portal:
calsolarresearch.ca.gov/csi/78

Improved Hybrid Concentrating Photovoltaic/ Thermal Tri-Generation Technology

OVERVIEW AND OBJECTIVES

The marketplace often lacks data on the reliability and long-term performance of new and innovative solar energy technologies and financial institutions are hesitant to finance these projects as they are perceived as risky. Providing long-term performance data and information to establish the bankability and reliability will enable confidence with adoption of photovoltaic (PV) technologies in the distributed generation market. Cogenra is one such project and their research focused on developing, prototyping, and validating the technical performance of an innovative concentrating photovoltaic (CPV)/thermal co-generation technology and conducted an 80 kW demonstration of the technology at the Sonoma Wine Company. This first generation system served as the baseline for performance modeling and evaluation, cost targets and reduction, and future integration with flexible distributed energy systems such as absorption chillers. The objectives for the project were to:

- Complete the specification of a second-generation technology,
- Measure the field performance of the technology and refine the economic and financial models,
- Adapt the system to enable advanced flexible energy delivery capabilities.



Comparison of Energy, CO_2 Reduction and Value

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).

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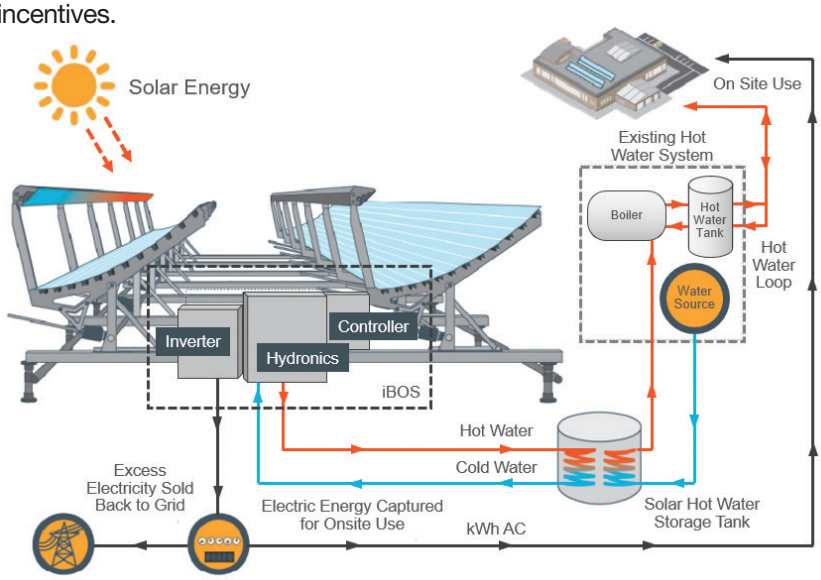
METHODOLOGY

The Cogenra team designed a second generation system with the ability to reduce overall system cost by up to 20%. The improved technology includes balances of system design for hydronics that reduces site engineering and permit requirements and allows for easy connection on site. The team collected detailed performance data from the Sonoma Wine Company demonstration system and used the data to develop more detailed generalized models both to control and optimally run systems and to support marketing, sales, and financing of subsequent systems. The team modified the system design to support delivery of higher temperature water, enabling tri-generation of electricity, heat, and cooling and variable water flows, enabling energy storage and *boost-on-demand* operation. *Boost-on-demand* allows the customer to capture additional value by generating more electricity when it commands the highest rates under variable time-of-use tariffs and by taking advantage of demand reduction incentives.



SunPack, Cogenra's Second-Generation Product

RESULTS AND OUTCOMES

As a result of this research, the materials, installation, and operational cost of the Cogenra system were reduced 50% from the baseline product installed at Sonoma Wine Company. The new product uses shared components and modular subassemblies and is able to be installed without heavy machinery or custom jigs. Modifications to the core Cogenra receiver yielded increased thermal and electrical performance while minimizing weight and installation time. The Cogenra energy models were validated and refined with a demonstrated 97% accuracy. A return on investment tool was developed that uses the energy models to provide detailed and comprehensive project financials both internally and to customers. Providing validated energy and financial modeling ensures accurate payback analysis and, ultimately, successful projects and repeat customers. The Cogenra receiver was successfully modified to perform at high temperatures allowing for tri-generation of solar heat, electricity, and cooling. The high temperature water output can be delivered to a thermal chiller (absorption or adsorption) to produce cooling. The first installation of the Cogenra product with an absorption chiller was installed at the Southern California Gas Company in Downey, CA in May 2012.

PUBLIC BENEFITS

Local component manufacturing and fully local installation provides revenue to California businesses.

Distributed energy generation reduces the stress on California's electrical grid and natural gas transmission lines.

Integration of distributed solar cogeneration at customers sites while lowering grid congestion and local greenhouse gas emissions.

Software tools that enable calculations of the energy output from a cogeneration system and supporting the financials models including the California CSI Thermal Rebate Program.

Use of California's wealth of human capabilities, mainly in engineering and software development.

Demonstration of financial viability for solar systems with improved economics with cogeneration.

Demonstration of tri-generation, which can lower electrical usage for air-conditioning, on hot days, on peak demand when the grid is congested.