# GO solar CALIFORNIA

## Low-Cost Solar & Energy Efficient Retrofits

ConSol

SDGE
A Sempra Energy utility℠

imagination at work

GAF
GAF MATERIALS CORPORATION

PUBLIC UTILITIES COMMISSION
EUREKA
STATE OF CALIFORNIA

# ConSol Background

- Over 25 years experience as energy consultant to building industry
- Over 20 years experience with utility program design and implementation
- Over 7 years experience as DOE Building America team lead (BIRA, over 80 partners)
- Co-Chair New Solar Homes Partnership Advisory Committee
- Led Residential Team in development of CA Long-Term Energy Efficiency Strategic Plan

# Department of Energy Building America Program

- **ConSol: BIRA Team Lead**
  - >80 partners, including GE, SDGE
  - 2011 60/40 (Retrofit/New construction)
  - NREL has not distributed 2011 tasks or budgets yet
- **Research Elements**
  - Gaps analysis
  - Technology assessment
  - Evaluation in Lab Home or Prototype Home
  - Community scale implementation
- **BIRA: Western US – Community-Scale Projects**
- **Sustainable Communities (New)**
- **Volume Retrofit**

# California Solar Initiative (CSI)

In 2006 the California Public Utilities Commission (CPUC) established a budget for the California Solar Initiative (CSI) Research, Development, Demonstration and Deployment Program (RD&D)

**Goal:**

- Install 3,000 megawatts of distributed solar by 2016
- Move the market from the current retail solar price to the retail price of electricity
- Develop new business models

# Program Overview

## Goal:

Reduce first-cost barrier for zero energy homes (ZEH) through low-cost solar system coupled with energy efficiency improvements, demand response (DR) and a home energy management (HEM) system.

## Method:

Six retrofitted demonstration homes in the San Diego Gas and Electric (SDG&E) territory

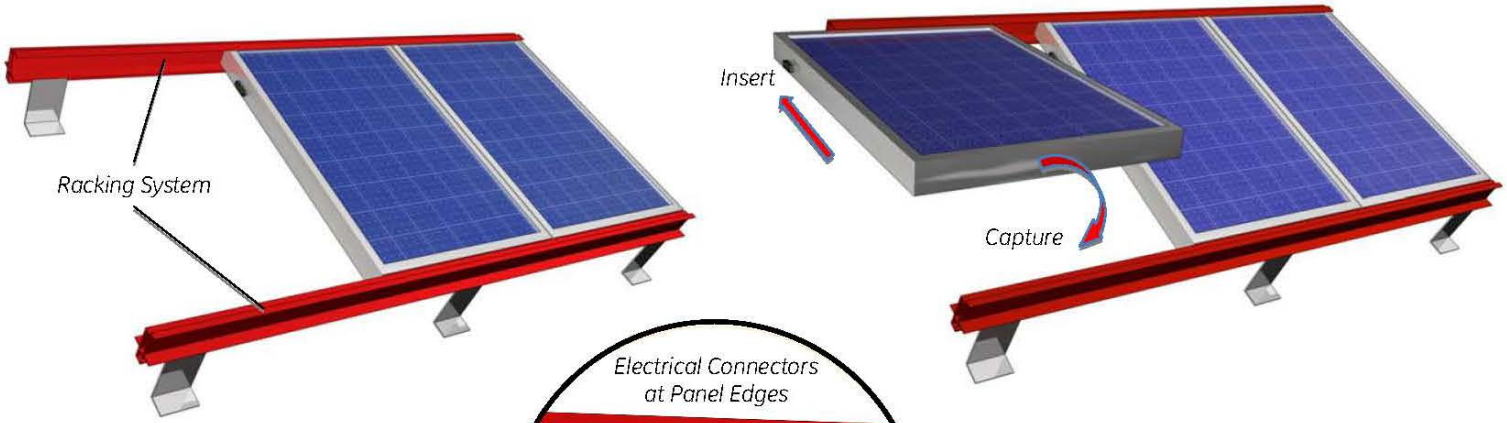
- One (1) demonstration of low-cost, roof-mounted PV system
- Five (5) test installation homes in different markets with different levels of energy efficiency, including one ZEH retrofit

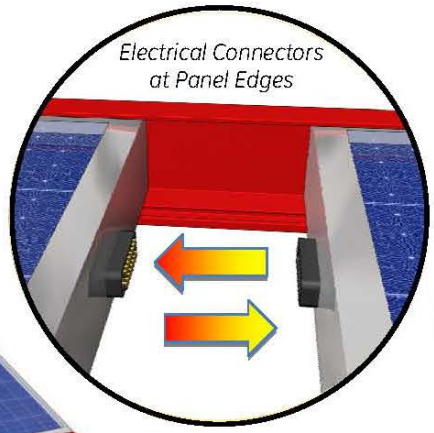
# Program Benefits

- **Solar panels installed by roofers at re-roof without extensive training and special tools**
- **DC-AC micro-inverter system**
  - no electrician on roof
  - enhances solar conversion performance
  - simplifies the electric-panel connection
- **Home Energy Manager (HEM)**
  - Communicates with the AMI
  - Provides real-time energy use and solar generation information
- **Low installed cost (target <$4.25/Watt)**
- **Innovative financing**

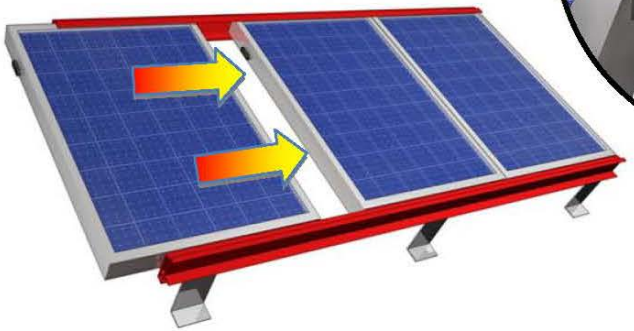
# "Plug and Play" – 120Vac PV System

**Step 1:** Insert module and rotate bottom edge down to capture in racking system

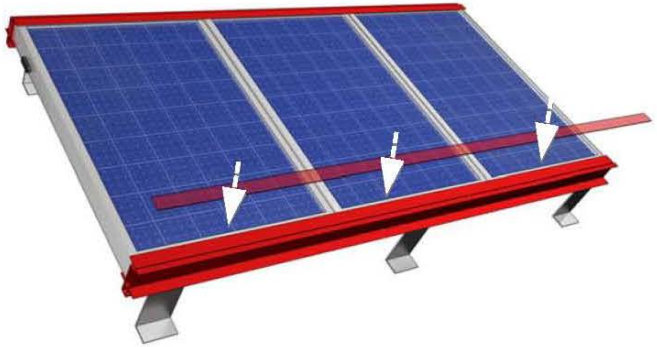



**Step 2:** Slide panels together to connect electrically



**Step 3:** Attach retainer trim to complete mechanical assembly



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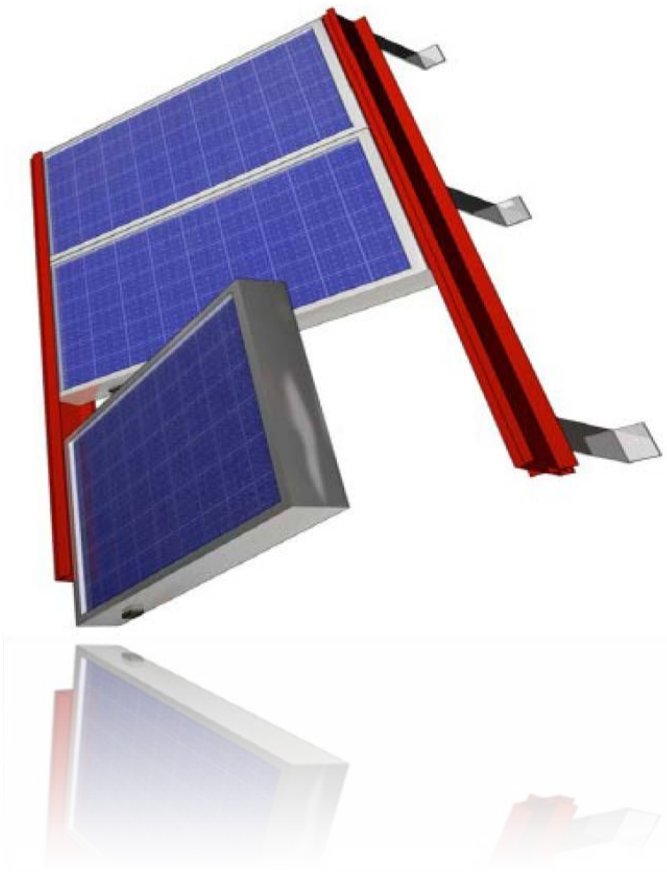
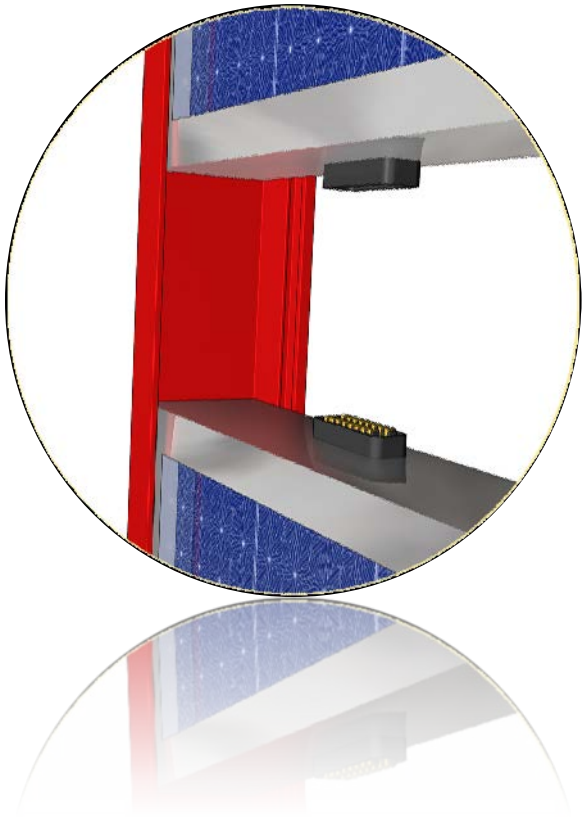
*Plug and Play interface integrates mechanical and electrical installation*

# The Product



- PV system features a simplified “insert and capture” mechanical mounting assembly
- Reduced assembly part count and “plug & play” $120V_{AC}$ micro-inverter PV system
- Designed for coordinated installation with asphalt re-roofing materials by standard roofer and electrical contractor
- No special tools
- No penetrations of asphalt shingles roof
- 20-year warranty that can cover both the roofing and PV system
- Target installed PV system cost is less than $4.25/watt, including:
  - An AMI-ready home energy monitor (HEM)
  - Demand response (DR) controller

# Task 1: Electrical Installation Best Practices



**Develop:**

- Installation criteria
- Electrical balance of system (BOS) agreement
- Preliminary Best Practices Guide
- Preliminary training materials
- Prototype installation kit

# Task 2: Demonstration Home Selection & Retrofit

- **Identify requirements and select demonstration house**
- **Install 4.8kW prototype system with dual AMI meters**
- **Evaluate installation for structural, design, permitting and warrantee issues**
- **Develop:**
  - Revised training materials, Best Practices Guide and installation kit
  - Preliminary cost estimate
  - Gaps analysis
  - Installation summary report

# Task 3: Demonstration Home Field Testing, Monitoring & Evaluation

- **Perform field evaluation and monitoring of retrofitted home**
- **Evaluate performance and operation of PV and HEM systems**
- **Develop:**
  - Final installation kit, Best Practices Guide and training materials
  - Revised cost estimate
  - Preliminary home performance analysis

# Task 4: Installed System Cost Roll-Up

- **Develop preliminary cost analysis based on:**
  - System bill of materials including all balance of system components
  - Installation time and materials costs
  - All other costs (permits, materials handling. . .)
- **Revise cost analysis based on results from test installations**

# Task 5: Marketing Materials & Market Surveys

- Evaluate existing estimates of solar retrofit market opportunities
- Evaluate consumer decision-making metrics
- Perform market surveys
- Identify target markets for test homes
- Develop marketing materials

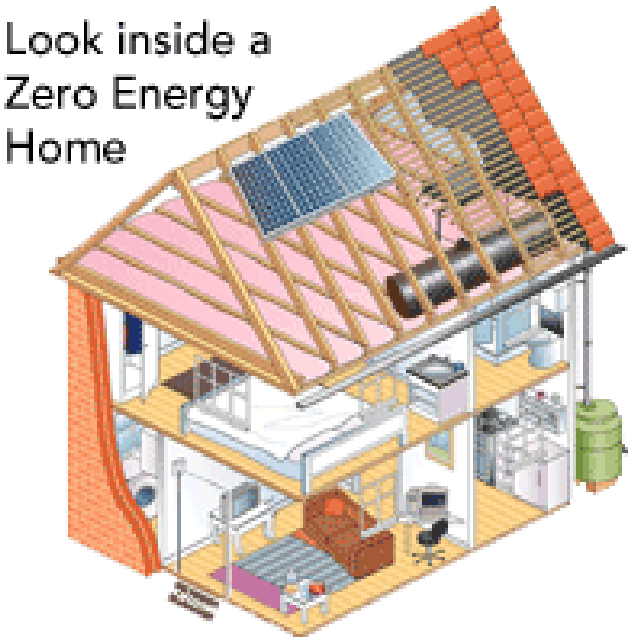
# Task 6: Financing


- **Identify and evaluate ownership and financing options that:**
  - Are simple to apply to and qualify for
  - Provide good interest rates
  - Combine financing for PV, reroof and efficiency
- **Develop:**
  - Report on financing options and financing issues

# Task 7: Contractor Test Installations


- **Identify five existing homes for test installations**
  - Target different climates, socio-economic levels
- **Model each test home**
- **Obtain historical usage data**
- **Install prototype systems**
- **Evaluate installation**
  - Dual AMI meters
  - Compare performance to expectations
- **Develop:**
  - Preliminary home performance analysis
  - Report on installation issues

# Task 8: Zero Energy Home (ZEH)




- **Select one of five test homes as ZEH**
  - Upgraded HEM system
  - Full energy efficiency upgrades
  - GE demand response appliances
  - Battery storage or plug-in hybrid system
- **Evaluate installation**
  - Compare performance to expectations
- **Develop:**
  - Preliminary ZEH performance analysis

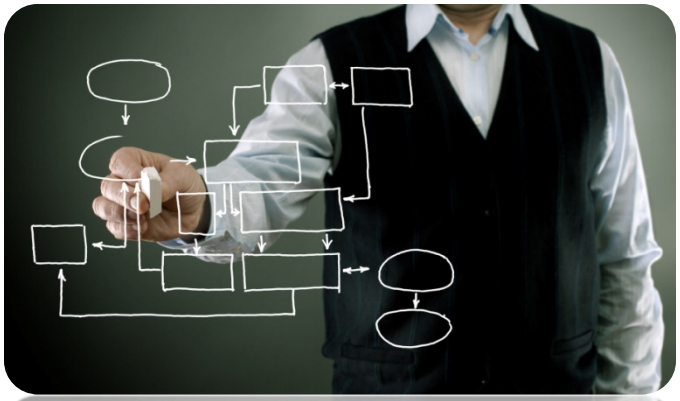
# Task 9: Data Aggregation

- **Develop and implement plan to:**
  - Aggregate and examine generation and load data
  - Extrapolate data to estimate system-wide impacts

# Task 10: Energy Use Impacts

- **Review performance analysis of each installation**
- **Evaluate energy use impacts of PV system and installed efficiency measures**
- **Develop:**
  - Report on energy use impacts

# Task 11: Business Model



- Develop business model based on re-roof as trigger for PV and EE upgrades
- Develop consumer value model
- Vet models with key partners

# Task 12: Program Management & Reporting

- **Program management and administrative support activities**
- **Hold critical project review (CPR) meeting**
- **Provide the following reports:**
  - One-page project summary
  - Monthly status reports
  - Twice yearly project reports
  - Final report

# Contacts

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