
t&d

CEC EPC Project 14 - 079

Assessing the Ability of Smart Consumer Devices to Enable More Residential Solar Energy

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Project Overview

This project will **identify, implement, and test** (both in lab and field) optimal methods by which smart inverters can mitigate the issues that otherwise would limit local high penetrations of residential PV. This project will identify how Rule 21 functions can be used and configured so that multiple smart inverters work in harmony (supporting one another's actions).

This project will also identify how other common consumer devices, such as electric vehicle chargers and other smart loads, can serve to further enable high penetration levels of residential solar PV into the distribution system.

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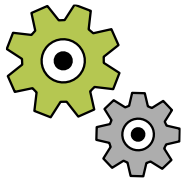
RESEARCH QUESTION

Can residential controllable load devices be effectively managed to enable more PV on the grid, while still meeting customer expectations?



PROGRESS TO DATE

1. Algorithm for Smart Inverters identified
2. Lab test demonstrates that home energy management system supports communication between smart devices
3. Technology extension feasibility identified by Intwine to support demand response

Next Steps

OPPORTUNITIES TO EXPLORE

- Test location that has multiple, appropriately equipped homes on the same transformer
- Test DR and storage capability using smart consumer devices

LEVERAGE POINTS

- SMUD and SCE both interested in further tests
- Intwine Will Kit demonstrated interoperability
- Off the shelf, market availability
- Ease of consumer adoption can facilitate program deployment cost effectively

Our Challenges

FINALIZE TEST BED DESIGN

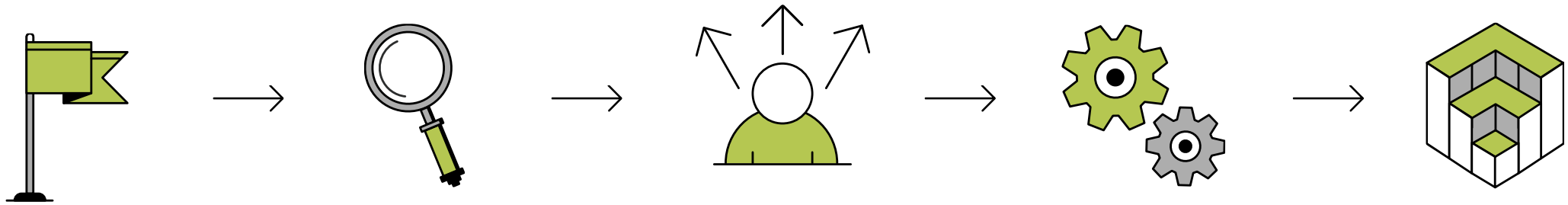
- Meeting field deployment requirements to continue testing
- DR capability needs to be added as a project addendum to original CEC scope

ENGAGE SPONSORS AND PARTICIPANTS

- Collaborate with SCE and SMUD in scoping optimal test bed locations
- Identify project stakeholders to lead demand response capability testing

Logic Model Assessment Structure

Updated: September 2018



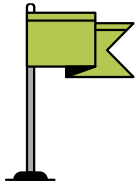
PROJECT GOALS
Goals of this EPIC research and development project

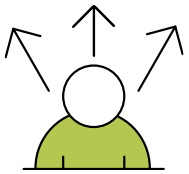
KEY FINDINGS
Successes and challenges identifies through research and development.

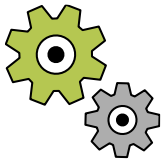
OPPORTUNITIES
Activities or circumstances that could fill in the gaps and leverage points to enable forward movement.

EXPECTED OUTCOMES
Most likely near term and longer term outcomes identified by the TA&D project team.

NEXT STEPS
Knowing what we know now, these are the suggested next steps.







PROJECT GOALS

KEY FINDINGS

OPPORTUNITIES

EXPECTED OUTCOMES

NEXT STEPS

SMART INVERTER TECHNOLOGY

Determine if combinations of traditional inverters and smart inverters using Rule 21 functions can operate side-by-side in a stable and beneficial fashion to enable more PV on the grid.

SUCCESS
- Extensive lab testing procedures have been developed
- Lab verification of Rule 21 behavior has begun for three inverter models

CHALLENGES
- Reliable inverters preconfigured with Rule 21 settings are scarce
- Tested inverters (from major manufacturers) are not sufficiently mature for field testing

MISSING PIECES
- Additional inverter models for lab testing
- Mature Rule 21 inverters for field testing
- Second field test utility partner
- CA-wide Rule 21 standard

LEVERAGE POINTS
- Incentive for manufacturers
- Real-world Rule 21 inverter experience for other utilities.

NEAR-TERM OUTCOMES
- Confirmation of acceptable behavior of adjacent Rule 21 inverters
- Improved settings to avoid undesirable interactions

LONGER-TERM OUTCOMES
- Field test completed
- Research question answered
- Recommendation to move forward or not

NEXT STEPS
1. Recommend new Rule 21 settings
2. Additional field testing
3. Testing of other Rule 21 inverters

ACTIVITY/ OWNER
1. EPRI, IOUs, CPUC
2. EPRI; CEC
3. EPRI, IOUs

CONTROLLABLE LOAD DEVICES

Determine if power sharing among neighboring controllable loads can enable more PV on the grid. Devices tested include:
1) Variable-Speed Pool Pump, 2) HPWH, 3) Programmable Communicating Thermostats, AND 4) EV Charging Equipment

SUCCESS
- Distributed control algorithm with PV-aware scheduling of flexible loads
- Ability to communicate with devices using Intwine-developed software
- Fully distributed and autonomous; no communication with utility required

CHALLENGE
- A common method to manage assets behind the meter
- Communication with pre-Phase 2 inverters

MISSING PIECE
- Test location that has multiple, appropriately equipped homes on the same transformer

LEVERAGE POINTS
- SMUD engaged
- Easy, wireless installation
- Participants receive (and can retain) upgraded load devices
- Subset off devices will work for field test

NEAR-TERM OUTCOMES
- Test sites secured
- Testing commences within the next year

LONGER-TERM OUTCOMES
- Integrate the application for future models of ZNE homes
- Ready for commercialization
- Increased hosting capacity of PV

NEXT STEPS
1. Additional field testing
2. Engage SCE in field demonstrations.
3. Perform field testing

ACTIVITY/ OWNER
1. CEC; EPRI
2. SMUD; SCE
3. Intwine.

TECHNOLOGY EXTENSION FOR DR

Extend load control technology and algorithms from CEC project to enable flexible DR

SUCCESS
- Extensible controls architecture can be extended to support DR-control objectives
- Intwine Connect estimates full integration in 6 mos

CHALLENGE
- Not part of CEC project

MISSING PIECES
- DER devices could also include storage
- Utility champion for further research

LEVERAGE POINTS
- SCE
- Controls vendors

NEAR-TERM OUTCOMES
- Champion secured
- Testing location determined

LONGER-TERM OUTCOMES
- Controllable consumer load provides DR capability
- Plan for commercial deployment

NEXT STEPS
1. Secure project champion
2. Field test

ACTIVITY/ OWNER
1. Engage possible champions
2. Share opportunity

Thank you for coming

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