CEC GRANT EPC-14-036

Smart Inverter Interoperability Standards and Open Testing Framework to Support High-Penetration Distributed Photovoltaics and Storage

DECEMBER 3, 2015

BACKGROUND

- High PV penetration with legacy inverters can adversely impact grid stability
- Diverse DER asset monitoring & control without standards is expensive & risky
- Lagging development of international standards to address technology gaps
- Lack of effective solutions constraining market and participation of DER in ancillary services

PROJECT PARTNERS

olivine demand responsible

SolarCity

Underwriters Laboratories

ABB

TESLA ENERGY

[e] enphase® ENERGY

SUNSPEC ALLIANCE

OSIsoft.

SMA

OutBack POWER

solaredge

UC San Diego

KACO new energy.

SOUTHERN CALIFORNIA EDISON An EDISON INTERNATIONAL® Company

IDEAL POWER

STRATEGEN STRATEGIES FOR CLEAN ENERGY

BUDGET

REIMBURSABLE COSTS = $ 2,000,000

MATCH FUNDS = $ 2,066,875

PROJECT OVERVIEW

- Enable high penetration of cost-effective solar PV-based DER beyond current IEEE limits
- Enable availability of well tested, “plug and play”, communications capable smart inverters
- Provide sufficient empirical data to evaluate the grid impacts of solar PV-based DER.
- Provide actionable data on economic & environmental benefits of solar PV-based DER

PROJECT GOALS

- Provide a standards-ready Test & Certification Framework
- Demonstrate PV penetration beyond 15% of total circuit
- Demonstrate DER assets providing ancillary grid services
- Identify revenue models for DER investors & operators
- Demonstrate benefits to California energy stakeholders

PROJECT IMPACT

LOWER COSTS

- IOU Cost Avoidance
- Commissioning Costs
- System Maintenance Costs
- Monitoring Switching Costs
- Supply Chain Costs

RELIABLE SUPPLY

- Power Delivery Reliability
- Capacity Optimization
- Flexible Resources

REDUCE EMISSIONS

- GHG Emissions

RETURN ON INVESTMENT

Grid Savings = $0.16 - $0.31 per watt | Cost Savings = $0.10 - $0.11 per watt

Demand Charge Savings = $0.06 per watt | Peak Avoidance Costs = $0.05 - $0.06 per watt

PROJECT SCOPE

- Develop California Rule 21 Compliance Test Framework and Evaluate Smart Inverters for Rule 21 Compliance
- Demonstrate and Evaluate Impact of High PV Penetration using Smart Inverter with Energy Storage on SCE Grid
- Demonstrate and Evaluate Impact of Coordinated DER Asset Participation in Demand Response Markets
- Analysis and Validation of Value Propositions

PROJECT METHODOLOGY & APPROACH

BASELINE ESTABLISHMENT

- Baseline cost estimates for underlying technologies
- Baseline cost savings and revenue enhancements

DATA COLLECTION

- Lab testing of SunSpec compliant smart inverters
- Simulation of distribution circuits with high penetration
- Field demonstration of smart DER assets on SCE grid
- Participation in Demand Response Markets
- Providing ancillary services to CAISO

DATA ANALYSIS

- Savings in system engineering &network integration
- Feasibility of participation in wholesale markets
- Value and impact of higher PV penetration
- Potential ancillary grid services that can be provided
- Value of the ancillary grid services and new markets

PRODUCTS & DUE DATES

TASK 2	CA Rule 21 Functional Test Plan – *12/30/2015*
	SunSpec System Validation Platform Extension Scripts – *02/19/2016*
	User Guide For SunSpec SVP Extension Scripts – *03/31/2016*
	Smart Inverter Evaluation Report – *08/31/2016*
TASK 3	Smart Inverters for High PV Penetration Report – *02/28/2017*
	PV Penetration Impact Report – *08/31/2018*
TASK 4	Field Demonstration Analysis Report – *12/29/2017*
TASK 5	Cost Reduction Forecast Report – *03/30/2018*
	Coordinated DER Assets Market Assessment Report – *05/31/2018*
	Value Proposition Report – *07/31/2018*
TASK 6	Project Case Study – *11/16/2018*
	Project Showcase Presentation – *12/17/2018*

FIT WITH CA PROCEEDINGS

- 50% Renewables by 2030 (SB 350)
  - Reduces total system costs, increases bankability
- California Smart Grid (SB 17)
  - Increases operational flexibility
  - Addresses Duck problem
- Integrated Energy Policy (SB 1389)
  - Expands deployment options

RECOMMENDED FUTURE WORK

- Standards for PV plant control and communication
- Standards for energy storage control and communication
- Standards for smart EV charging control and communication
- Standards for “DER with Smart Loads” control and communication

QUESTIONS ?