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

## EPC-14-079 Project

**Walt Johnson**
Technical Executive
Project Manager

**EPIC Innovation Symposium**
December 3, 2015

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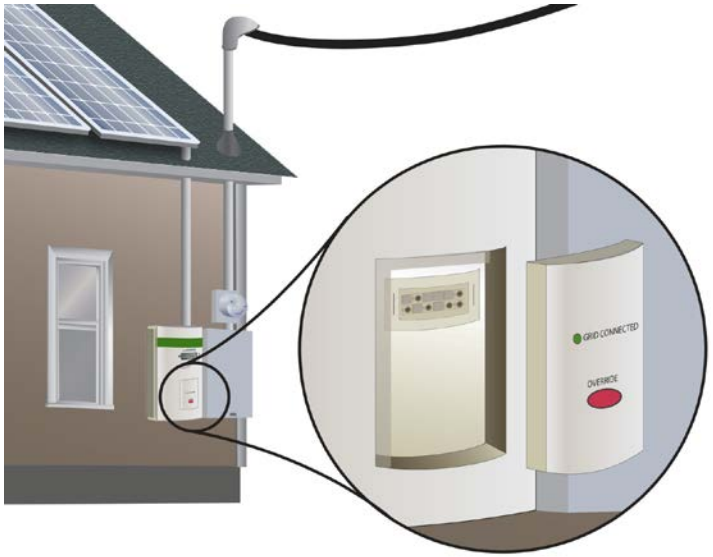
# Topics for Discussion




- Project Overview
  - Issues and Challenges
- Project Methodology
- Key Questions
- Core Innovations
  - Relation to Ongoing State Proceedings and Programs
  - Recommendations for Future Work

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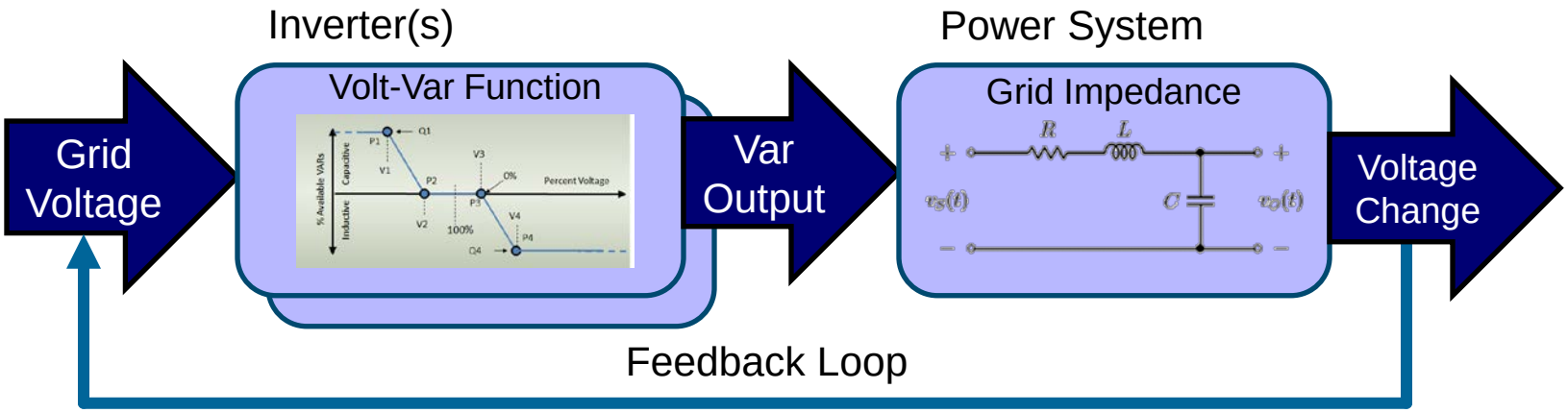
# Issues and Challenges




1. Successful Side-by-Side Operation of Smart Inverters
   - It is not known whether multiple inverters can operate side-by-side in a stable and beneficial fashion when each are performing smart-inverter functions.
   - Lack of timing-specific requirements in IEC 61850-90-7 smart inverter standards leaves a risk that multiple devices could interact negatively.
   - Present inverter certification practices (such as UL 1741) do not assess the potential for this kind of interaction.
2. Using Other DER to Enable More PV on the Grid
   - It is not known to what extent onsite advanced loads can help mitigate impacts of distributed solar generation and enable higher penetrations thereof.
   - More research is needed in the application of general demand management of these kinds of consumer products to enable more solar energy.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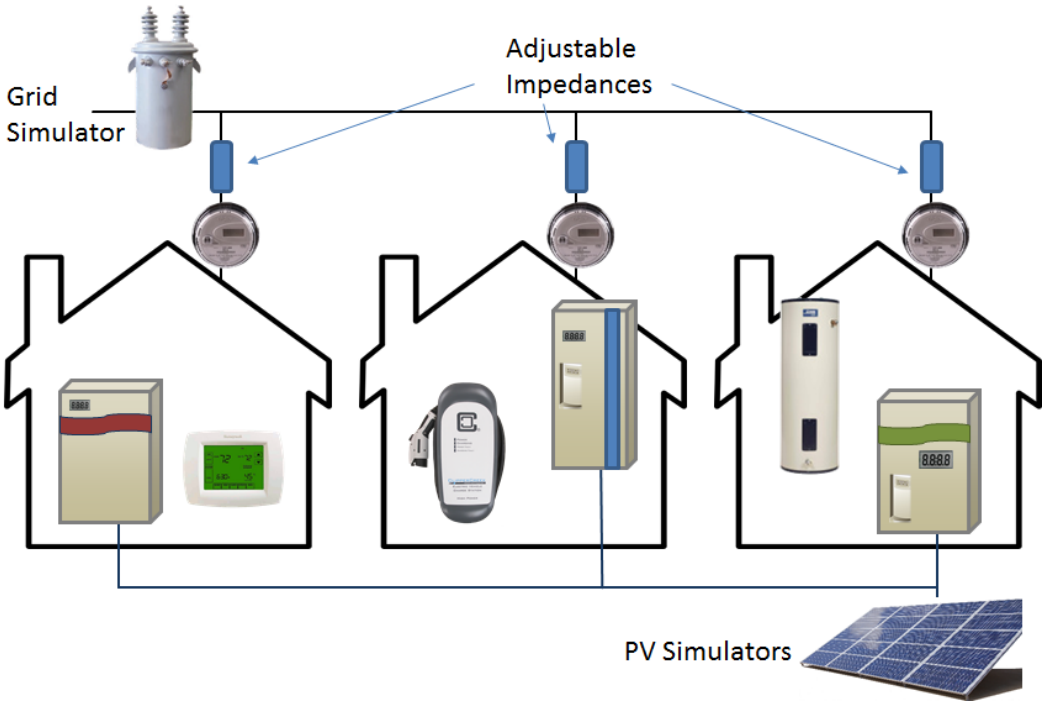
# Lab Testing at PG&E ATS Facility




- Three simulated homes will be set up, each with a solar inverter and a collection of other DER.
- Bulk impedances will be inserted between the homes and the common tie point at the transformer to simulate the various secondary line lengths that would be found in California's communities.
- The lab testing will be carried out in two steps: multi-inverter testing and tests with inverters plus other DER.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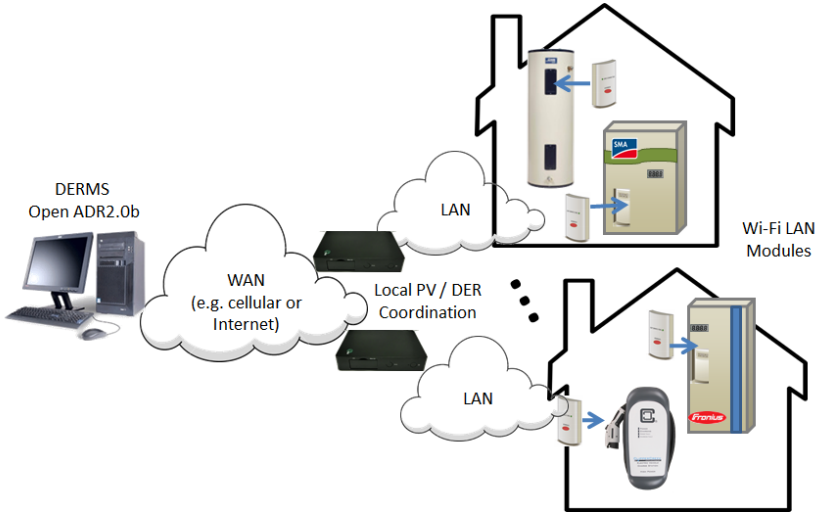
# Field Testing with SCE and SMUD




- Field testing will be done at SCE and SMUD.
  - All of these PV systems will be outfitted with smart inverters that provide the functionality identified in the California Rule 21 revisions.
  - Those inverters that performed best in the laboratory testing and/or that offer the greatest opportunity to learn about interactions in the field will be selected for this test phase.
- Field testing provides an opportunity to gain several additional key insights regarding:
  - Operation and interaction of a greater number of inverter units;
  - Real-world noise and variability conditions; and
  - Real-world communication integration.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# Key Questions

1. Can multiple inverters performing smart-inverter functions operate side-by-side in a stable and beneficial fashion?
2. Can onsite DER, such as electric vehicle chargers, advanced heating/cooling, water-heating, and pool pumps, act in a way to enable substantially higher penetrations of solar generation while still meeting consumer expectations for these products?
3. What are the upper limits on solar PV hosting that may be achieved using smart inverters and naturally-occurring DER products?

   Can the hosted production (KWh) of residential systems be increased by 15% and enable support of an installed PC capacity (kW) that is improved by 30%? This could result in an annual production increase of around 900 KWh and an annual consumer savings of $178.


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# Core Innovations and Future Work

- Insight into whether specific function and control-loop timing parameters are necessary to enable successful side-by-side inverter operation
- Advance the industry's knowledge regarding how consumer loads can be most effectively managed to enable more PV on the grid
- Specifically-developed algorithms and the equipment used will be viable for mass-market adoption
- Findings will be coordinated with the IEC and other relevant standards organizations, so that solutions can be standardized and issues can be addressed globally
- Enabling mass-deployment of solar PV and battery storage in California and beyond


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**Walt Johnson**

hwjohnson@epri.com

(650) 855-2013



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