

**DOCKET****10-IEP-1F**

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## Southern California Edison ARRA Projects with PIER Funding

**ADVANCED  
TECHNOLOGY**  
Transmission & Distribution Business Unit



Percy Haralson  
July 13, 2010



## ISGD – SCE is Prime Recipient

<b>Awards:</b>	Irvine Smart Grid Demonstration (ISGD)
<b>Area of Interest:</b>	Smart Grid Regional Demonstrations
<b>Objectives:</b>	Demonstrate an integrated, scalable Smart Grid system that includes all of the interlocking pieces of an end-to-end Smart Grid system - from the transmission and distribution systems to consumer applications like smart appliances and electric vehicles.
<b>Project Size (\$):</b>	\$80.2 million
<b>DOE \$ Request:</b>	\$40.1 million
<b>Partner Cost Share:</b>	\$12.2 million*
<b>SCE Contribution:</b>	\$27.9 million*
<b>PIER Funding Requested:</b>	\$1 million (for direct labor and overhead)

\*Original budget figures



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## ISGD Objectives

- Energy Smart Customer Devices
  - Subproject I – Evaluating Zero Net Energy (ZNE) Home on the Grid
  - Subproject II – Plug-In Electric Vehicle (PEV) Charging at Home and Work
- Y2020 Distribution System
  - Subproject III – Distribution Circuit Constraint Management Using Energy Storage
  - Subproject IV – Enhanced Circuit Efficiency and Power Quality through Volt/VAR and Frequency Control
  - Subproject V – Self-Healing Distribution Circuits
  - Subproject VI – Deep Grid Situational Awareness for Transmission Operators Using Phasor Technology
- Superconducting Transformer (Waukesha)\*
- Secure Energy Network (SENet)
  - Subproject VII – Demonstrating End-to-End Cyber Security and Interoperability of Three Primary Networks Inter-Utility, Intra-Utility and Field Area
- Workforce of the Future
  - Subproject VIII – Identify the Organizational Impacts and Educational Curriculum Development to Produce the Next Generation Utility Worker

\*included in Waukesha FOA award



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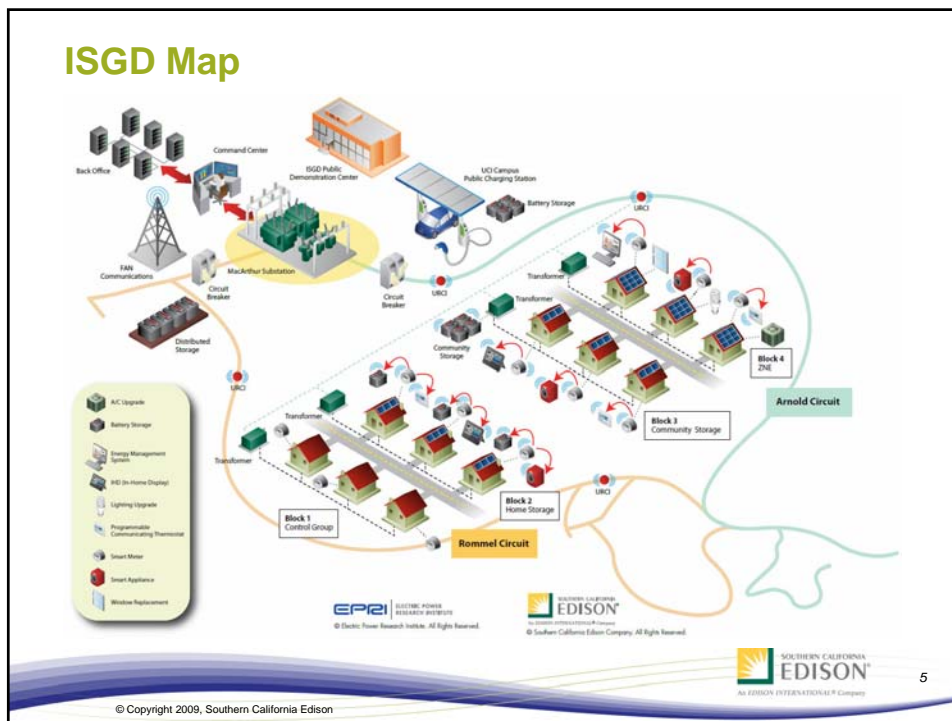
## ISGD Partners

- Sub-Recipients:
  - GE: Software, Telecom Engineering & Field Equipment
  - USC-ISI: Telecom & Cyber-security Engineering
- Vendors:
  - Boeing: Software, System Integration & Cyber-security
  - GE: Software, Telecom Engineering & Field Equipment
  - EPRI: Measurement & Reporting
  - Itron: Technical Support
  - SunPower: Solar Shades & Residential PV
  - UC Irvine: Measurement & Reporting
  - Cal Poly Pomona: Workforce Impact
  - CSU Los Angeles: Workforce Impact
  - A123 Systems: Lithium-ion Battery Technology



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### TSP – SCE is Prime Recipient

<b>Awards:</b>	<b>Tehachapi Wind Energy Storage Project (TSP)</b>
<b>Area of Interest:</b>	<b>Grid-Scale Energy Storage Demonstrations</b>
<b>Objectives:</b>	<b>Deploy and evaluate an 32 MWh utility-scale lithium-ion battery technology to improve grid performance and aid in the integration of wind generation into the electric supply.</b>
<b>Project Size (\$):</b>	<b>\$57.3 million</b>
<b>DOE \$ Request:</b>	<b>\$25 million</b>
<b>Partner Cost Share:</b>	<b>\$6.3 million</b>
<b>SCE Contribution:</b>	<b>\$26 million (\$2.4 million contingency)</b>
<b>PIER Funding Requested:</b>	<b>\$1 million (for direct labor and contractual)</b>

## TSP Objectives

**TSP will test the largest ever grid-applied Lithium-ion Energy Storage System (8MW-4hr or 32MWhr) coupled with a Smart Inverter.**

### TSP will enable SCE to:

- Demonstrate the performance of a Lithium-ion Storage System for 13 specific operational uses, both individually and stacked
- Share data and results with CAISO, DOE, and other interested parties
- Test and demonstrate Smart Inverter with LISS
- Assess range and life-cycle of LISS
- Potentially resolve key issues with wind-integration and/or with remote generating sources
- Expand expertise in energy storage technologies and operations

### Measurement & Verification Plan:

- Define and test 13 operational uses
  - Develop test plan for each operational use and for combining uses
  - Execute test plan
- Collect and analyze system performance data
  - Analyze performance vs. baseline
  - Quantify benefits/organize by DOE category

### 13 Use Cases:

#### Transmission Uses

1. Support with voltage/grid stabilization
2. Decrease transmission losses
3. Diminish congestion
4. Increase system reliability by load shed deferral
5. Defer transmission investment
6. Optimize size and cost of renewable energy-related transmission

#### System Uses

7. Provide system capacity/resource adequacy
8. Integrate renewable energy (smoothing)
9. Shift wind generation output

#### ISO Market Uses

10. Frequency regulation
11. Spin/non-spin replacement reserves
12. Capacity for ramping, reductions in ramping needs
13. Energy price arbitrage



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## TSP Partners

- Sub-Recipient:
  - A123 Systems: Lithium-ion Battery Technology
- Vendors:
  - Cal Poly Pomona: Measurement and Valuation
  - Quanta Engineering: Analytical Support and Modeling
- TSP Advisory Group:
  - CAISO
  - PG&E
  - Sempra Energy
  - Idaho Power
  - WECC
  - UWIG



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## Facility with Battery & Inverter System

Racks of batteries will be installed inside a new climate controlled facility at Monolith substation.



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## WES – SCE is a Cost Share Contributor

<b>Prime Recipient:</b>	<b>Waukesha Electric Systems (WES)</b>
<b>Area of Award:</b>	<b>Smart Grid Regional Demonstrations</b>
<b>Objectives:</b>	<b>A prototype superconducting transformer with fault current limiting capabilities, which is expected to reduce the cost and size of substation equipment.</b>
<b>Project Size (\$):</b>	<b>\$21.7 million</b>
<b>DOE \$ Request:</b>	<b>\$10.7 million</b>
<b>Partner Contribution:</b>	<b>\$10.2 million</b>
<b>SCE Contribution:</b>	<b>\$0.8 million</b>
<b>PIER Funding Requested :</b>	<b>\$755,874 (for labor, equipment, and materials)</b>

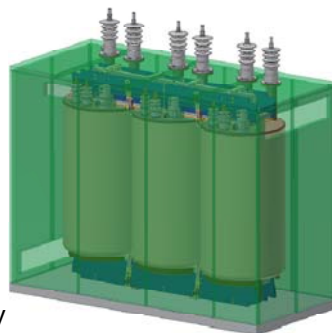


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## Fault Current Limiting Superconducting Transformer

- This sub-project involves a superconducting transformer that Waukesha Electric Systems (WES) is developing under its SGD award as the prime recipient;
- The transformer coils will be cryogenically cooled to eliminate line loss due to overheating;
- ISGD is a test bed to demonstrate this new technology;
- Inherent low impedance giving higher duty cycle at the bus; and
- Inherent fault current minimization cyclability that may affect equipment duty at the substation.



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## FCL Superconducting Transformer Project Team

- Waukesha Electric Systems
- SuperPower
- Texas Center for Superconductivity at the University of Houston
- Oak Ridge National Laboratories
- Southern California Edison



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## Expected Outcomes

- Irvine Smart Grid Demonstration:
  - Quantification of Smart Grid costs and benefits in terms of overall energy consumption, operational efficiencies, and societal/environmental benefits
  - Validation of SCE's Smart Grid vision to provide measured results that are scaleable to other regions of the country
  - Verification of the viability of Smart Grid energy technology in an integrated environment
- Tehachapi Wind Energy Storage Project:
  - Evaluate wide range of applications for lithium-ion batteries that will spur broader demand for the technology, bringing production to a scale that will make this form of large energy storage more affordable
  - Facilitate integration of intermittent renewable resources, and encourage job growth in the energy sector
- Waukesha Electric Systems:
  - Installation and long-term performance test of the fault current limiting superconducting transformer on the Southern California Edison grid
  - Demonstrate the commercial viability of replacing conventional copper wound transformers to Smart Grid capable fault current limiting superconducting transformers



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## Lessons Learned

- Main challenge of SCE as a state-regulated utility is layering all of DOE's regulations, such as:
  - Tax implications of award
  - Davis-Bacon Act compliance
  - Property ownership/disposition
  - Property encumbrance
- Proactively structure the application to accommodate federal and state mandates.
- What could the CEC do differently to better provide funding assistance opportunities:
  - The DOE awards involve a significant amount of paperwork, reporting and compliance requirements. The CEC should consider adopting DOE compliance and reporting requirements to satisfy CEC needs to minimize the burden placed on awardees.



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## Next Steps

- Final PIER funding documentation requires a signed definitized agreement with the DOE;
- SCE is currently finalizing negotiations with DOE and expects to definitize ISGD and TSP by the end of July;
- Waukesha Electric Systems (WES) is in the process of definitizing their award as well; and
- SCE will provide the definitized award for WES as well as the contract between SCE and WES.

## ADVANCED TECHNOLOGY

Transmission & Distribution Business Unit

For more information on SCE's Smart Grid strategy, news, and updates, go to: [www.sce.com/smartgrid](http://www.sce.com/smartgrid)

For information on careers with Advanced Technology, please email Lee Cordner at [Lee.Cordner@sce.com](mailto:Lee.Cordner@sce.com)