

*Sandia National Laboratories and the Electric Power Research Institute (EPRI) are pleased to host the*

## **2013 Inverter Reliability Workshop**



Photo courtesy of Semptra Energy

**Dates:** 8:00 AM to 5:00 PM on Tuesday, April 30, 2013  
8:00 AM to 1:00 PM on Wednesday, May 1, 2013

**Location:** The Biltmore Hotel, 2151 Laurelwood Road, Santa Clara, CA

*Inverter reliability drives project life cycle costs and plant performance. This workshop will focus on current reliability issues and develop a roadmap to define the gaps and the path forward for inverter reliability.*

## **Agenda : Day 1: April 30**

### **Registration and Breakfast 8:00am**

### **Welcome & Introduction: Why Are We Here? 8:30am**

An overview of the workshop will be presented, along with intended outcomes, goals and next steps. In addition, meeting participants will introduce themselves.

- Welcome/Introductions (10 min) – Charlie Hanley, Sandia National Laboratories
- Charge for the Survey (30 min)- Jennifer Granata, Sandia National Laboratories

### **Inverter Reliability: State of the Industry 9:10am**

A cross section of industry stakeholders will discuss various aspects of inverter reliability.

- O&M Aspects of Inverter Reliability (20 min) – Dan Sweeney, Advanced Energy, Inc.
- Systems Impacts on Reliability (20 min) – Mike Schenck, First Solar
- Component Level Reliability (20 min) – Janet Ma, Schneider Electric
- Thermal management (20 min) – Kenneth Armijo, Sandia National Laboratories

### **Break 10:30am**

### **Next Generation and Cross-Industry 11:00am**

An overview of module-scale conversion reliability aspects, potential impacts of next-generation inverter technologies, and reliability from the viewpoint of a different industry

- Module-Scale Conversion (20 min) – Timothy Peshek, Case Western University
- Next Generation Inverter Technologies (20 min) – Sig Gonzalez, SNL
- Cross-Industry Reliability: Automotive Power Module Perspective (20 min) – Zhenxian Liang, Oak Ridge NL

### **Lunch (included) 12:00pm**

### **Breakout Session #1 1:00pm**

Intended outcomes of the breakout sessions: Identify primary failure modes, gaps, and potential for condition-based monitoring

#### **A: O&M Aspects of Reliability/System impacts on reliability**

Topics: Brainstorm on the impacts of system designs on inverter reliability and vice versa. What information is missing in the industry? What failures are arising that were not designed for or tested for?

Moderator: Jennifer Granata

Short talk: *Opportunity*



### **B: Component Level Reliability**

Topics: Reliability of Capacitors, Power switches, Boards, Connectors. Identify the primary gaps/issues in each area, primary failure modes being addressed, and failure modes not yet being addressed (why?)

Moderator: Bob Kaplar

Short talk: Jack Flicker, SNL

### **C: Next Generation Inverter Technologies**

Topics: Have failure modes been identified for next gen technologies? What type of testing is being applied? What type of testing could be applied (is qualification testing being implemented or needed)?

Moderators: Sig Gonzalez, Jay Johnson

Short talk: Jay Johnson, Mike Ropp *\*tentative\**

## **Break**

**2:30pm**

## **Breakout Session #2**

**3:00pm**

Intended outcomes of the breakout sessions: Identify primary failure modes, gaps, and potential for condition-based monitoring.

### **D: Module-Scale Conversion**

Topics: Inverter/converter lifetime, failure modes, testing of components versus in a system (module), test to failure

Moderators: Bob Kaplar

Short talk: Scott McCalmont, Tigo; Paul Parker, SolarBridge

### **E: Thermal Management**

Topics: Design effects, fans, liquid cooling, effects of solar gain

Moderators: Rob Sorensen

Short talk: *Opportunity*

### **F: Performance / Reliability/Cost Trade-space**

Topics: What constitutes a failure? Acceptable failure rates, Repair / replacement strategy, Allowable reduction in output power prior to repair, Scheduled vs. unscheduled maintenance, Contracted O&M

Moderators: Tom Key

Short talk: *Opportunity*

## **Break**

**4:30pm**

## **Day 1 Wrap-Up/Adjourn**

**4:45 – 5:00pm**

## **Agenda: Day 2: May 1**

**Registration and Breakfast** **8:00am**

**Standards and Reports** **8:30pm**

- Update on IEC Qualification Standards (15 min) – Greg Ball, DNV Engineering
- Report out on the Breakout Sessions (30 min) - Moderators
- Survey Results (15 min) – Jennifer Granata, Sandia National Laboratories

**Break** **9:30 am**

**Technology Roadmap** **10:00 am**

- Based on the results of the breakout sessions, we will brainstorm on the development of a technology roadmap for inverter reliability (1:15 min)
- Recommended Future Actions (30 min)

**Wrap-Up & Closing Remarks** **11:45 am**

The workshop hosts will recap key meeting takeaways and next steps.

**Adjourn/Lunch** **Noon**