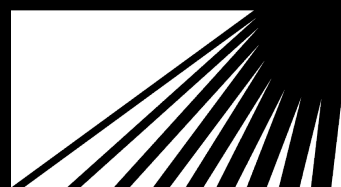


# 2013 PV Module Reliability Workshop

## Feb 26- 27, 2013, Golden, CO



**SunShot**

U.S. Department of Energy

# Overview

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- The **SunShot** Initiative
- Systems Integration / Technology Validation Activities
- 2013 PV Module Reliability Workshop

# SunShot Initiative

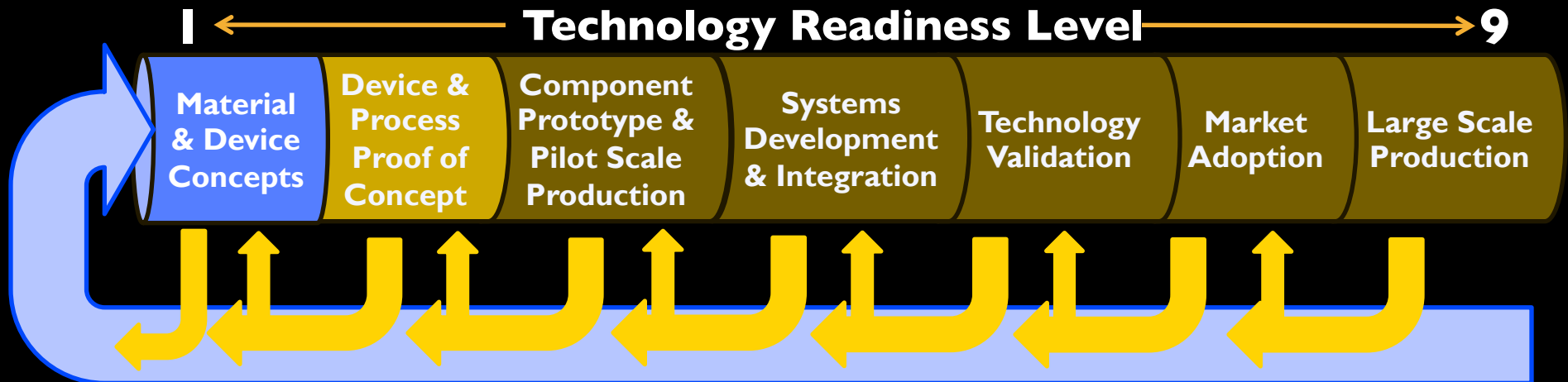


*“The SunShot Initiative will spur American innovations to reduce life costs of solar energy and re-establish U.S. global leadership in this growing industry.”*

U.S. Energy Secretary Steven Chu

- DOE’s **SunShot** Initiative aims to make solar electricity cost-competitive with conventional forms of energy before 2020.
- What is SunShot?
  - Subsidy-free solar electricity
  - 75% cost reduction by end of the decade
  - 5-6 cents/kWh at utility-scale
  - Global Competitiveness
- Coordination among DOE Solar Program, Office of Science, and ARPA-E.

# SunShot Program Framework



Basic Energy Sciences

MURI .....

Next Gen PV .....

Program to Advance  
Cell Efficiency (PACE)

SunShot Fellowships  
.....

SunShot Incubator

PV Supply Chain  
.....

Balance of Systems-Hardware  
.....

PV Manufacturing Initiative I  
.....

Solar ADEPT  
.....

SEGIS  
.....

CSP SunShot FOA  
.....

Thermal Storage: HEATS

High  
Penetration  
.....

Incubator –  
Soft Costs  
.....

PVMI II: SUNPATH

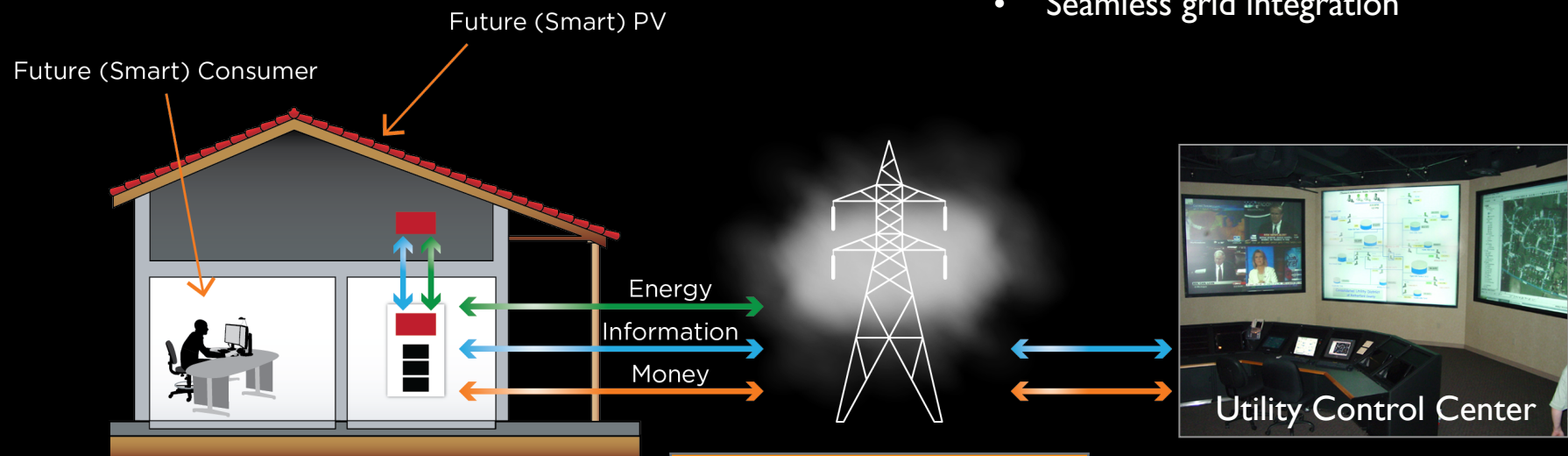
Rooftop Solar  
Challenge  
.....

Non-Hardware  
BOS  
.....

# Plug-and-Play Vision

## Vision: PV as an Appliance

- No permitting required
- Easy installation
- Seamless grid integration



### Future (Smart) Home

- Smart outlet
- Smart circuit
- Smart breaker panel
- Smart appliances
- Home area network (HAN)

### Future (Smart) Grid

- Distributed generation
- Two-way power flow
- Communication and control
- Rich energy information and transactions
- Microgrid

### Future (Smart) City

- Integrated grid and city planning

# Active Funding Solicitations

- Solar Manufacturing Technology (SolarMat) - \$15M
- Diversity in Science and Technology Advances National Clean Energy in Solar (DISTANCE-Solar) - \$3M
- Grid Engineering for Accelerated Renewable Energy Deployment (GEARED) - \$12M
- Solar Utility Networks: Replicable Innovations in Solar Energy (SUNRISE) - \$10M
- Physics of Reliability: Evaluating Design Insights for Component Technologies in Solar (PREDICTS) - \$5M
- Foundational Program to Advance Cell Efficiency II (FPACE II) - \$12M
- SunShot Incubator Program (Round 8) - \$12M
- Rooftop Solar Challenge II (RSC II) - \$12M
- CSP Heat Integration for Baseload Renewable Energy Development - \$20M
- Notice of Opportunity for Technical Assistance: Regional Test Centers
- <http://www1.eere.energy.gov/solar/sunshot/financial.html>

# SunShot - Systems Integration

## Goals

- **BOS Costs:** Reducing the costs of power electronics and balance of system hardware
- **Bankability:** Reducing the risk associated with the use of new technologies
- **Grid Integration:** Establishing a timely process for integrating high penetrations of solar technologies into the grid in a safe, reliable, and cost-effective manner while providing value to the system owner and the utility grid.
- **Solar Resource:** Dramatically reduce the uncertainty in solar system performance due to solar radiation measurements, and provide grid operators and others the information necessary to cost-effectively and reliably integrate solar technologies into the grid.

### Grid Integration

- Distributed Generation
- Transmission
- High Penetration Solar Deployment
- SEGIS-AC

### Balance of Systems

- BOS-X

### Technology Validation

- Testing & Evaluation
- Reliability
- Analysis
- Codes and Standards

### Solar Resource

- Forecasting
- Mapping
- Radiometry
- NOAA & Wind Collaborative

SI



# SunShot – Technology Validation

## **Mission / Vision:**

- To reduce the cost of PV by improving confidence in the expected performance, reliability, and safety of PV components and systems.
- Understanding of performance and reliability leads to reduction of risk and will lead to a greater investment in the technology.

## **Activities:**

- Test & Evaluation
- Reliability & Safety
- Regional Test Centers (RTC's)
- Modeling & Analysis
- Codes & Standards



# Lifetime Prediction of PV Modules

- Reliability engineer: How do I test to determine the number of years for the warranty?
- PV customer: How do I choose the PV module that will last longer?
- PV investor: How do I know that I'm making a safe investment of \$1 billion (if the modules fail after 10 yr, the warranty will be worthless because the company will be gone)?
- Insurance company: How do I determine rates for insuring PV installations?
- PV Manufacturer: How do I differentiate my product from other products?

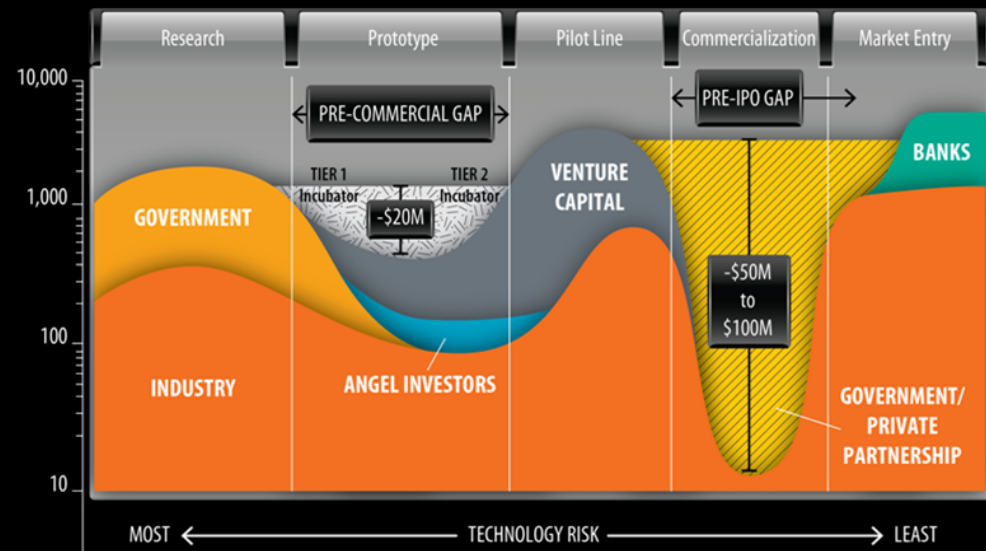
# PV Regional Test Centers

## ■ Background / Vision:

- Accelerate adoption of renewable energy generation sources by helping U.S. PV manufacturers overcome the commercialization “Valley of Death”
- Provide technical basis for bankability of PV systems
  - Test beds for large-scale systems in multiple climates, using a comprehensive validation approach to compare performance and initial reliability against predictions

## ■ Locations:

- Albuquerque (Sandia)
- Denver (SolarTAC – NREL)
- Orlando (UCF – FSEC)



# 2013 PV Module Reliability Workshop

- Objective: Share information among participants leading to the improvement of PV module reliability which:
  - Reduces the cost of solar electricity
  - Promotes investor confidence in the technology
  - Critical goals for moving PV technologies deeper into the electricity marketplace.
- Active participation provides benefit to all: everyone shares a little and takes home a lot.

# 2012 PVMRW Agenda

## Sessions:

- **Monday**
  - **US Technical Advisory Group meeting, IEC TC 82**
- **Tuesday**
  - **Group 2: Thermal and Mechanical Fatigue**
  - **Group 4: Diodes, Shading, and Reverse Bias**
- **Wednesday**
  - **Group 3: Humidity, Temperature, and Voltage**
  - **Group 5: UV, Temperature, and Humidity**
- **Thursday and Friday**
  - International PV Module QA Task Force, Thin Film Task Group, Kick Off Meeting

## Special Thanks to:

- Sarah Kurtz, *Chair*

# PREDICTS

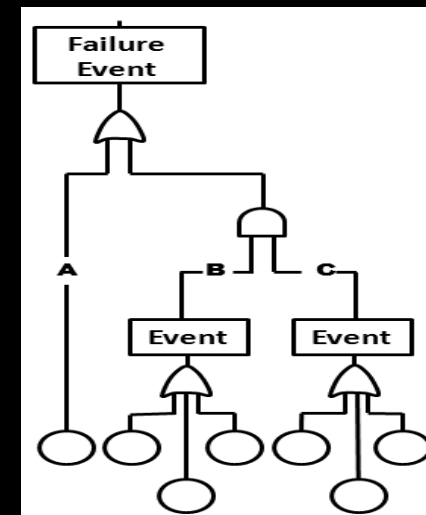
## Physics of Reliability: Evaluating Design Insights for Component Technologies in Solar

### Topic 1: CSP and PV Components Reliability Models

- Physics-Based Predictive Models for the Degradation and Failure of CSP and PV Components or Sub-systems

### Topic 2: Microinverter and Microconverter Reliability Standards

- Creation and Implementation of Industry Standard Tests for Microinverter and Microconverter Reliability



#### Key Dates

Webinar	March 6
Concept Papers Due (Mandatory)	March 22
Full Apps Due	April 29
Reply to Reviewer Comments	June 4

#### Funding Information

Max. Award Duration
3 years
Total DOE Funding Anticipated
\$5,000,000 (2-4 awards)
Cost-share Minimum
20%



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