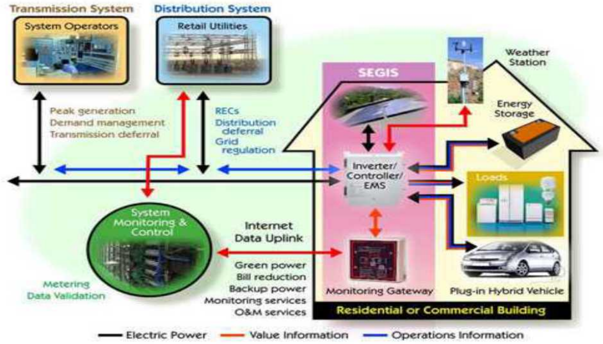
SAND2016-7492C

solar.sandia.gov



NMSU REU Students Visit – Overview of Sandia and Solar R&D

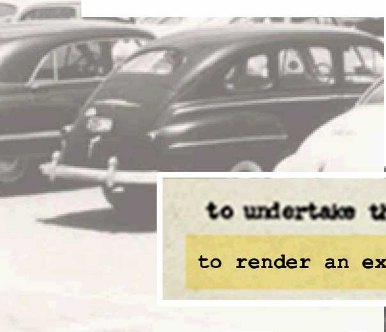
July 2016


WELCOME

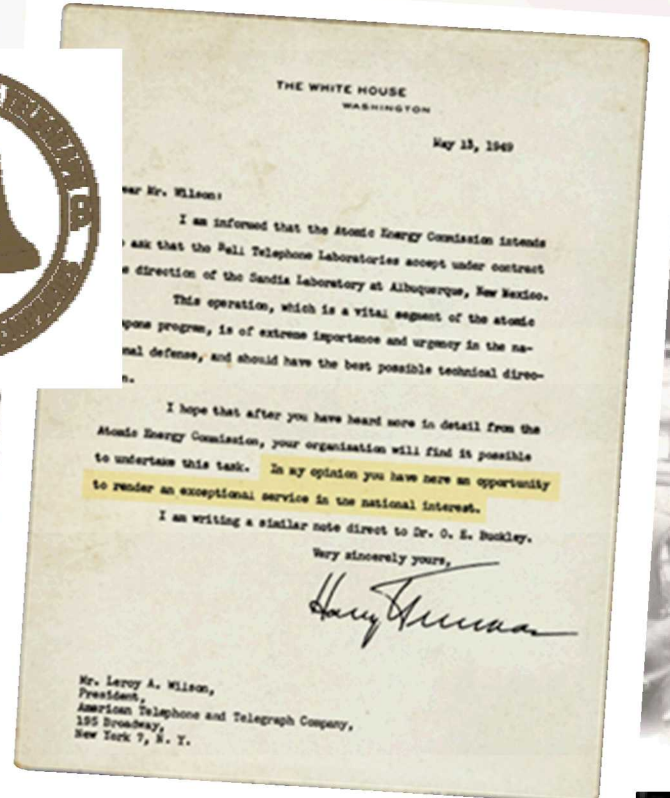
Sandia's History

Exceptional service in the national interest

- July 1945: Los
  creates Z Divi
- Nonnuclear c
  engineering
- November 1,
  Sandia Labora
  established



to undertake this task. In my opinion you have here an opportunity to render an exceptional service in the national interest.



THE WHITE HOUSE
WASHINGTON

May 13, 1949

Dear Mr. Wilson:

I am informed that the Atomic Energy Commission intends to ask that the Bell Telephone Laboratories accept under contract the direction of the Sandia Laboratory at Albuquerque, New Mexico.

This operation, which is a vital segment of the atomic weapons program, is of extreme importance and urgency in the national defense, and should have the best possible technical direction.

I hope that after you have heard more in detail from the Atomic Energy Commission, your organization will find it possible to undertake this task. In my opinion you have here an opportunity to render an exceptional service in the national interest.

I am writing a similar note direct to Dr. O. E. Buckley.

Very sincerely yours,

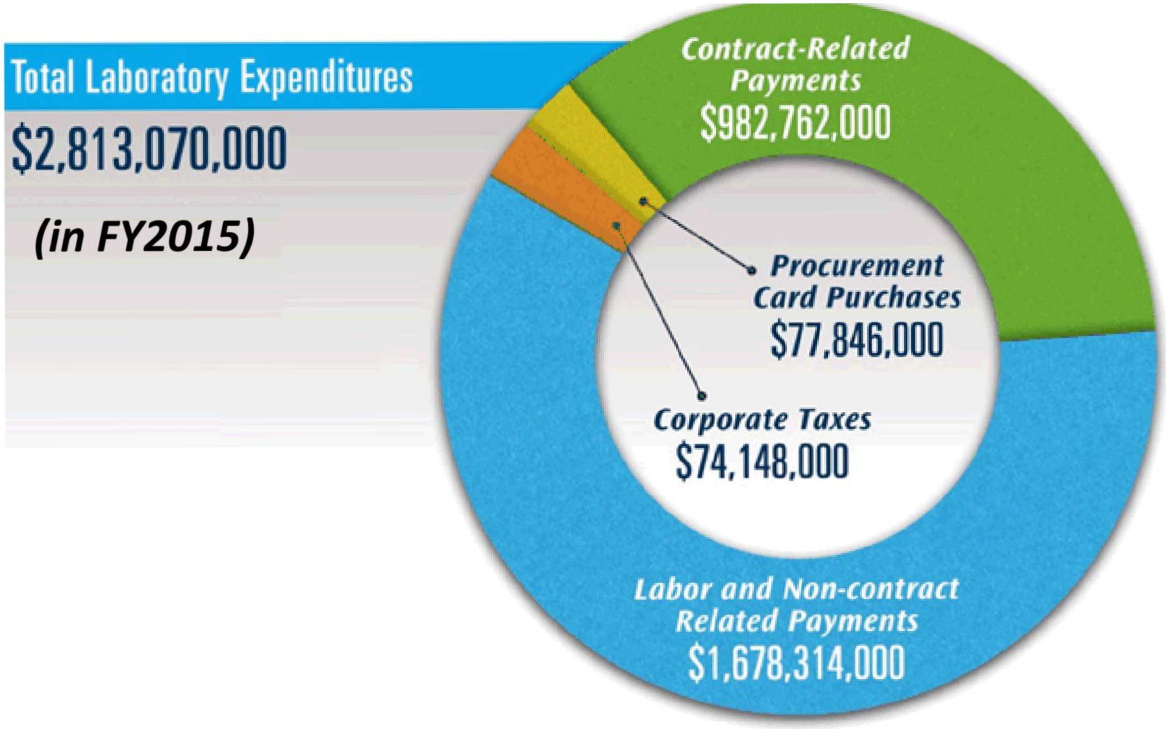
Harry Truman

Mr. Leroy A. Wilson,
President,
American Telephone and Telegraph Company,
195 Broadway,
New York 7, N. Y.

Key Sandia Figures

- Total Sandia workforce: 12,611
- Regular employees: 10,643
- Advanced degrees: 5,898 (55%)

Data as of
December 14, 2015



Sandia Sites

Albuquerque, New Mexico

Livermore, California

Kauai, Hawaii

Waste Isolation Pilot Plant,
Carlsbad, New Mexico

Pantex Plant,
Amarillo, Texas

Tonopah,
Nevada

Sandia Addresses National Security Challenges

Sandia National Laboratories

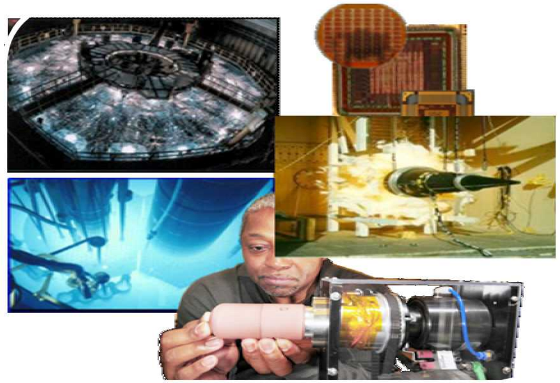
1950s	1960s	1970s	1980s	1990s	2000s	2010s
Nuclear weapons	Development engineering	Multiprogram laboratory	Missile defense work	Post–Cold War transition	START Post 9/11	LEPs Cyber, biosecurity proliferation
Production and manufacturing engineering	Vietnam conflict	Energy crisis	Cold War	Stockpile stewardship	National security	Evolving national security challenges

Sandia National Laboratories Program Management Units (PMUs)

Defense Systems & Assessments

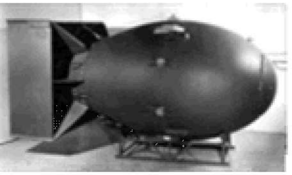
Energy & Climate

International, Homeland, & Nuclear Security



Nuclear Weapons

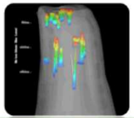
History of Sandia Energy Programs



a nuclear weapons engineering laboratory with deep science and engineering competencies

Energy crisis of the 1970s spawned the beginning of significant energy work

Strategic Petroleum Reserve – geological characterization of salt domes to host oil storage caverns



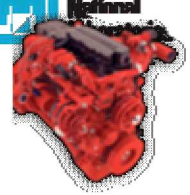
DOE's Tech Transfer Initiative was established by Congress in 1991

METAL HYDRIDE CENTER OF EXCELLENCE

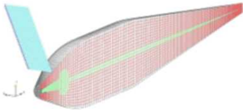
Advent Solar

Energy Policy Act of 2005

Combustion Research Facility (CRF) & Cummins partner on their newest diesel engine



Joint BioEnergy Institute



Water Power Program

1950	1960	1970	1980	1990	2000	2007	2009	2010

Our core NW competencies enabled us to take on additional large national security challenges

Vertical axis wind turbine

NRC cask certification studies & core melt studies

Solar Tower opens

CRF opens to researchers

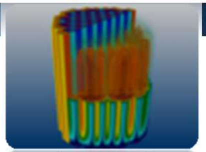
Distributed Energy Technology Laboratory (DETL) to integrate emerging energy technologies into new and existing electricity infrastructures

Power grid reliability study

SunCatcher™ partnership with Stirling Energy Systems

Sunshine to Petrol Pilot Test

Large-scale pool fire tests of liquefied natural gas (LNG) on water



Consortium for Advanced Simulation of Light Water Reactors (CASL)

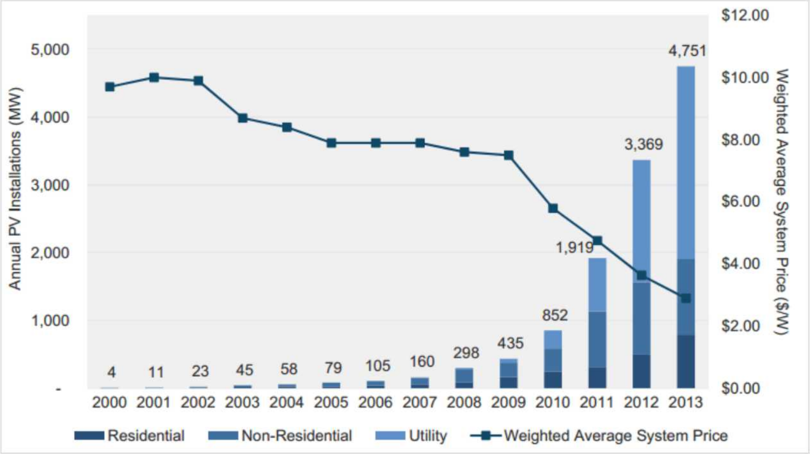
Climate stu
uncertainties
economies

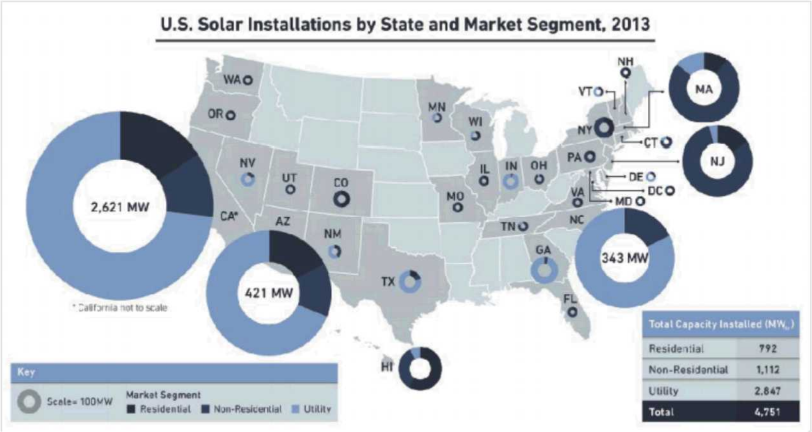
Combustion Research Computation and Visualization (CRCV) opens

PV capacity is growing fast!

- ~30 GW installed today
  - Installed capacity is projected to double every 2 years!
  - Highest growth rate expected in distribution-connected PV

- Dealing with high amounts of PV
  - California
  - Hawaii

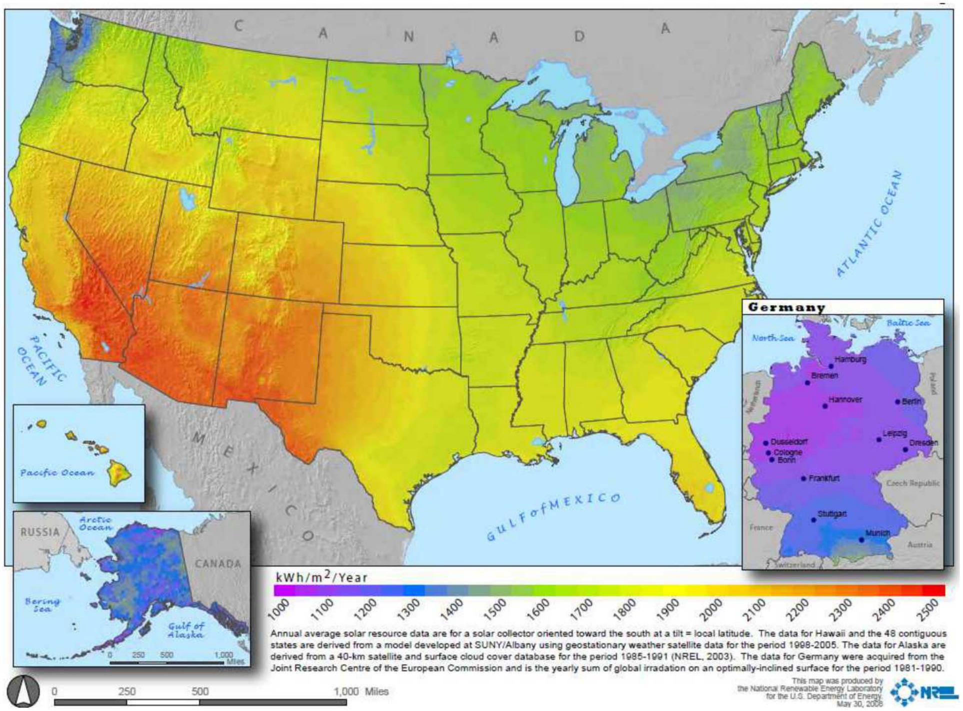


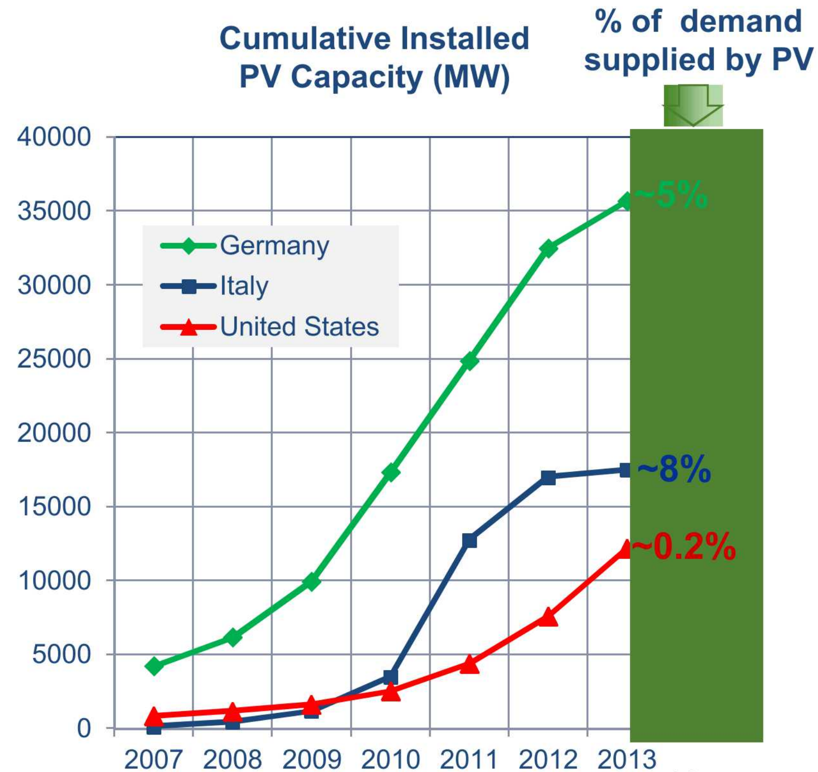


Source: GTM Research, US Solar Market Insight 2013 Year in Review

Huge potential for further growth!

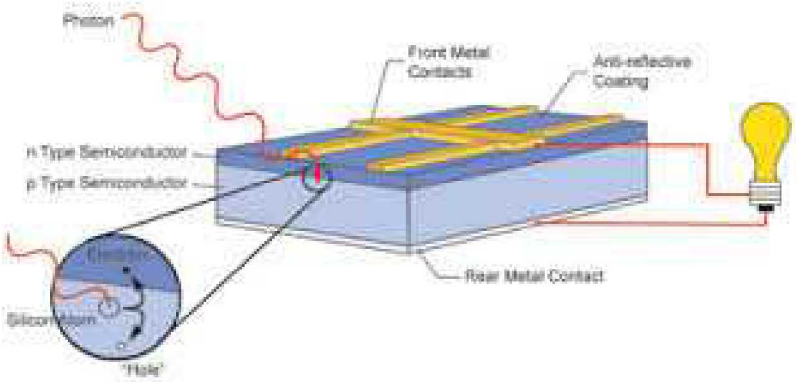
- US lags other countries in terms of installed capacity, but the future potential is much greater
  - How much of this potential can be tapped while maintaining high grid reliability and performance?

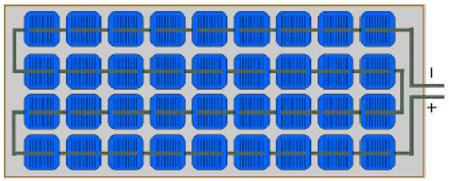




What is a PV?

PV Cells

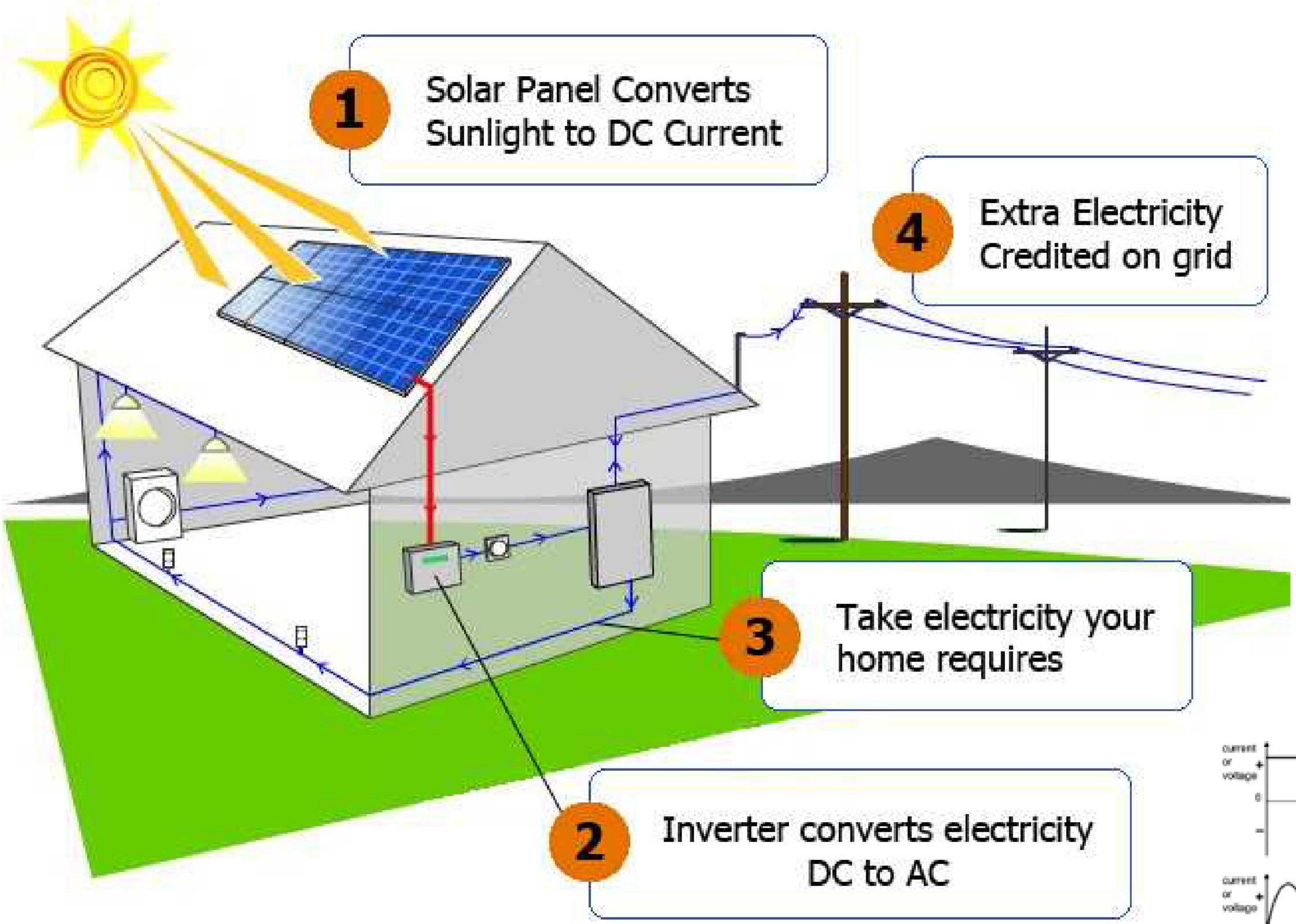


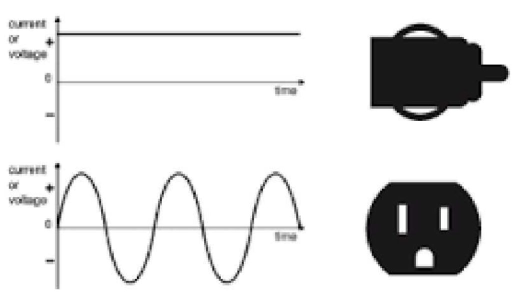


PV Modules

PV System

How does it work?





PV System Size

PV Research at Sandia

Solar Resource	PV System	Power Electronics	Grid Integration

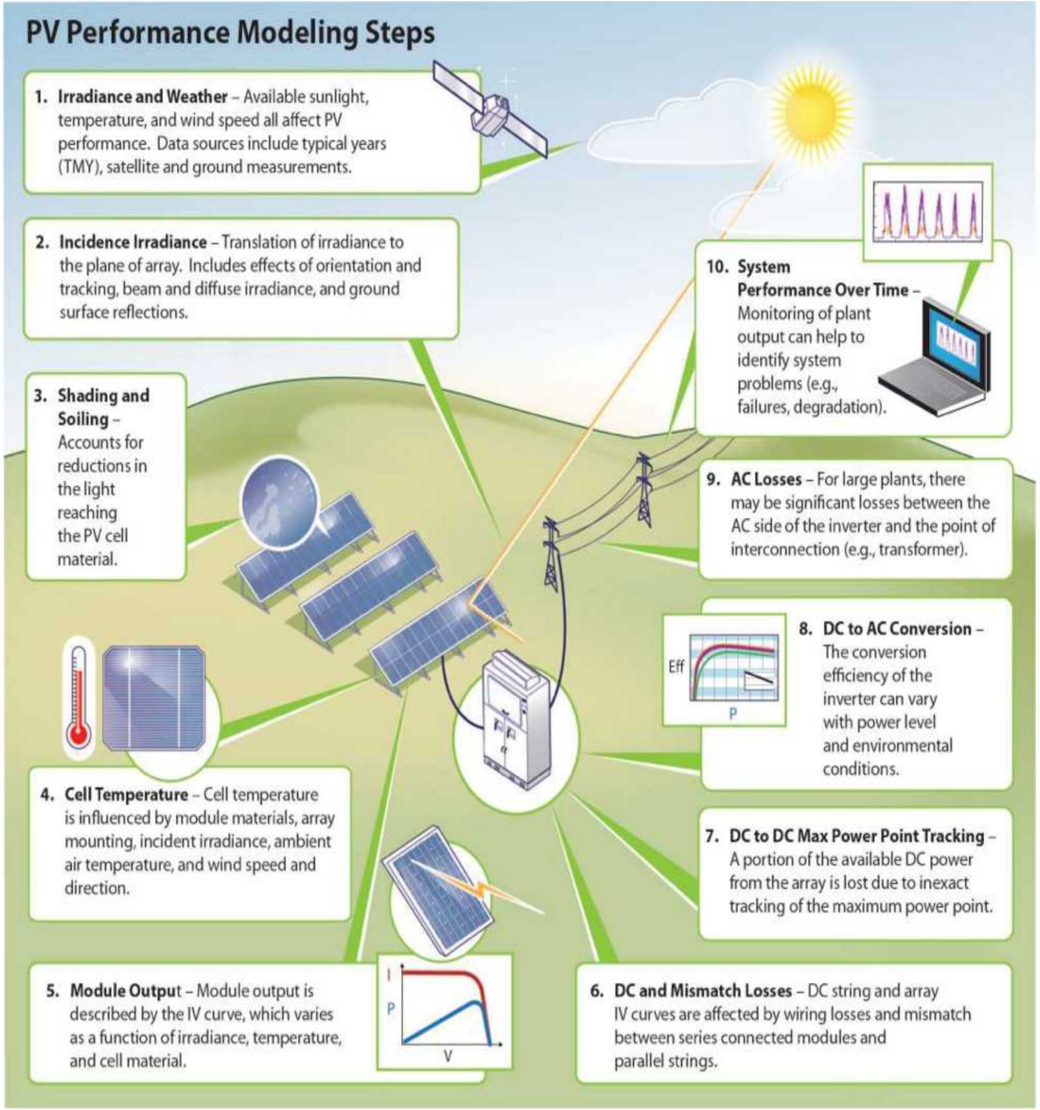
Reliability and Safety

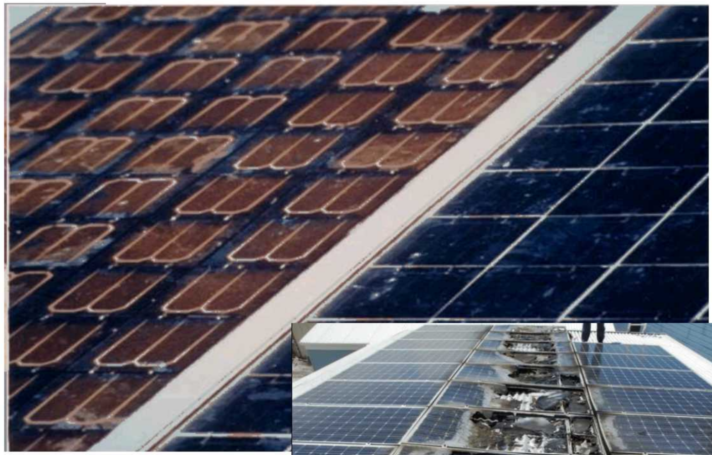
Testing, Modeling, Simulation

Standards for Performance and Safety

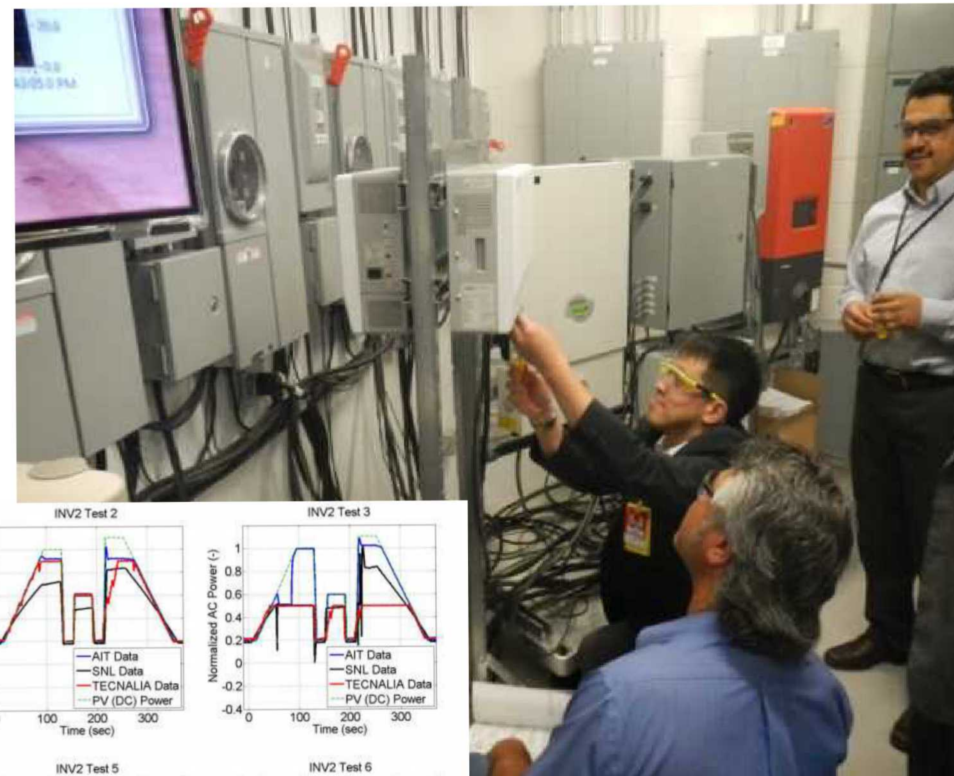
Soft Costs (Financing, Permitting, Installation)

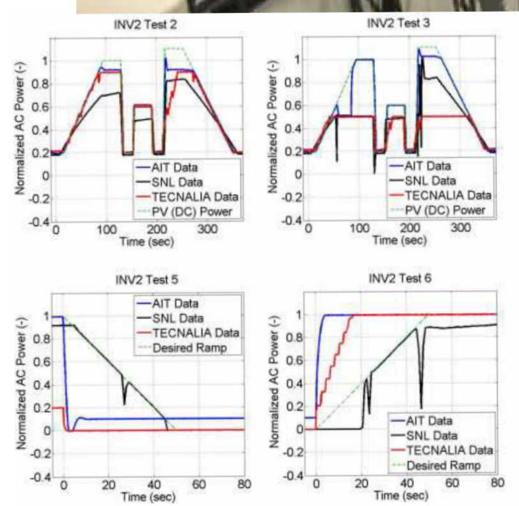
PV System Performance and Reliability





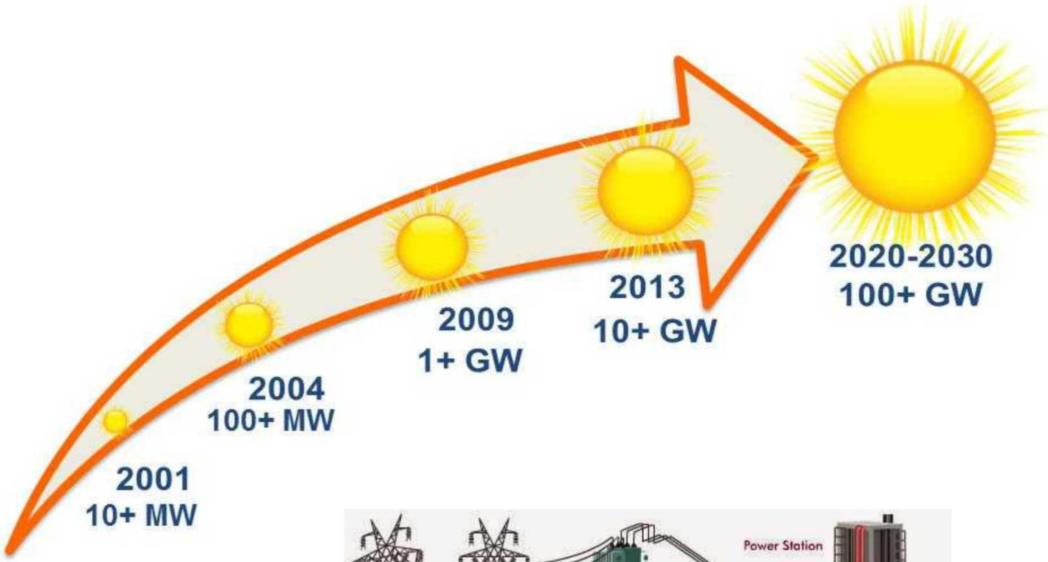
Power Electronics (PV Inverters)

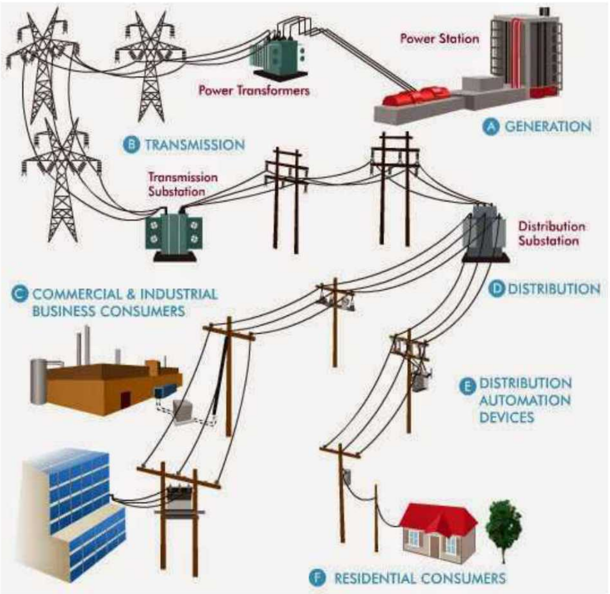


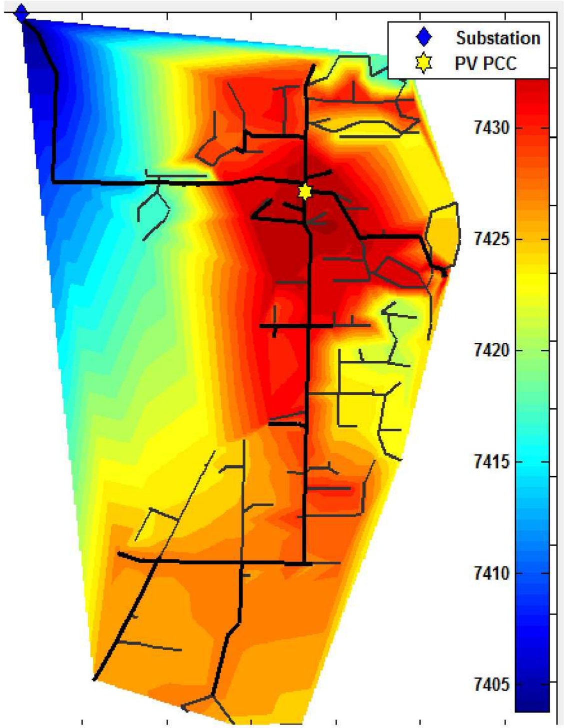


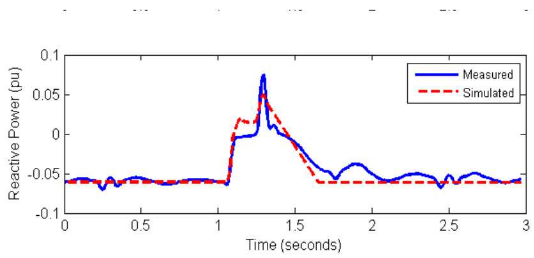
PV Inverters

Systems Integration

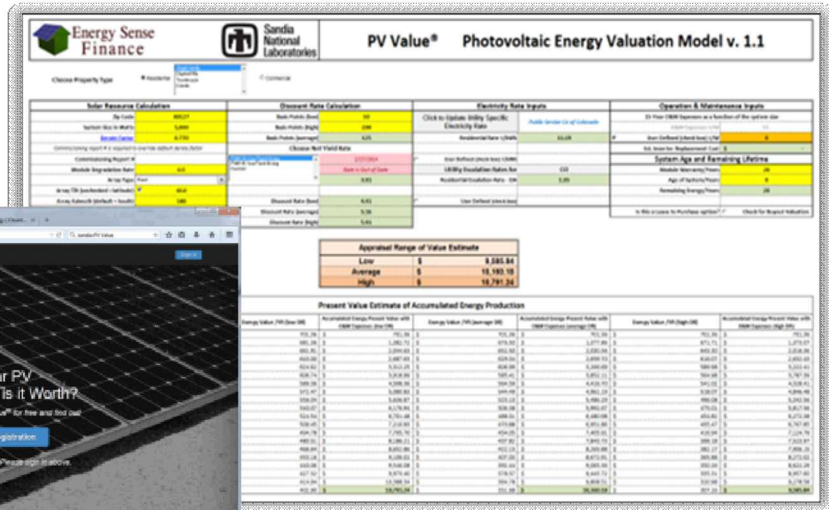




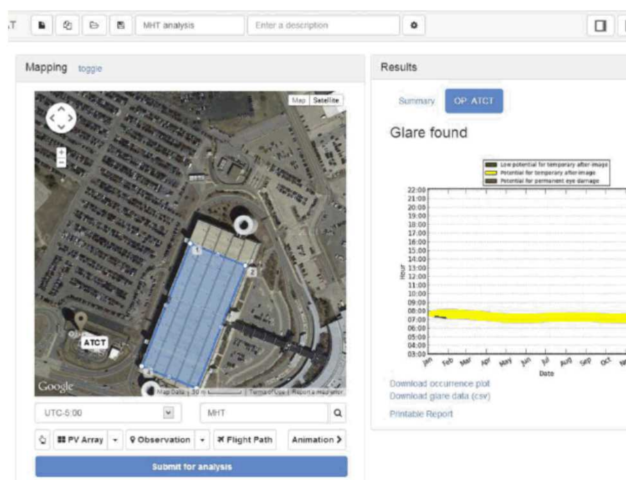


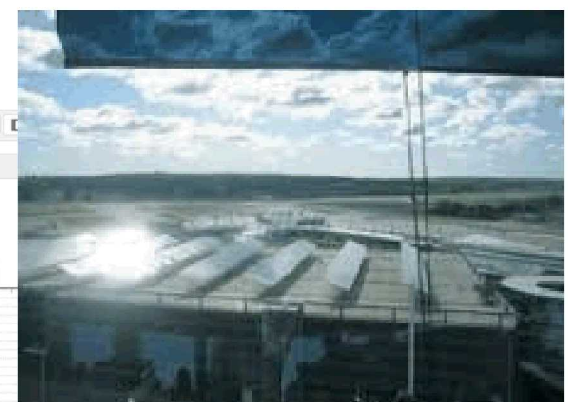


Soft Costs and Balance of Systems



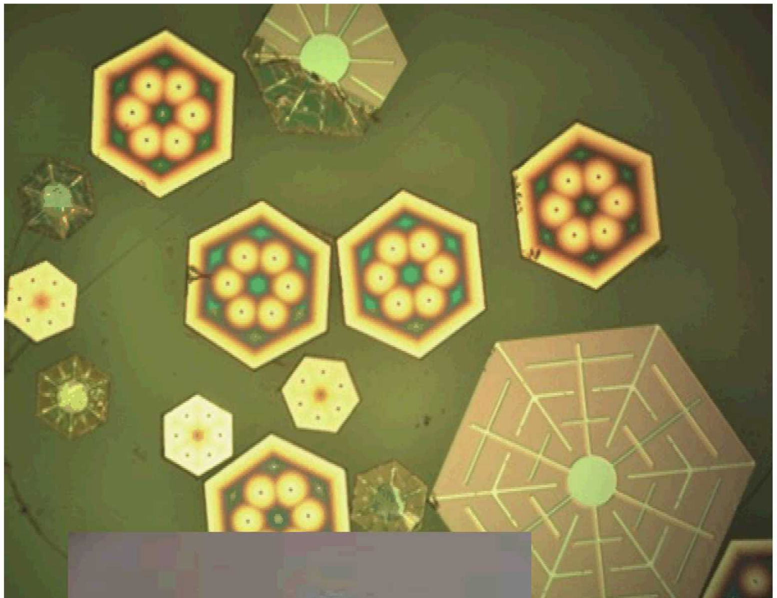
PV & Real Estate Value

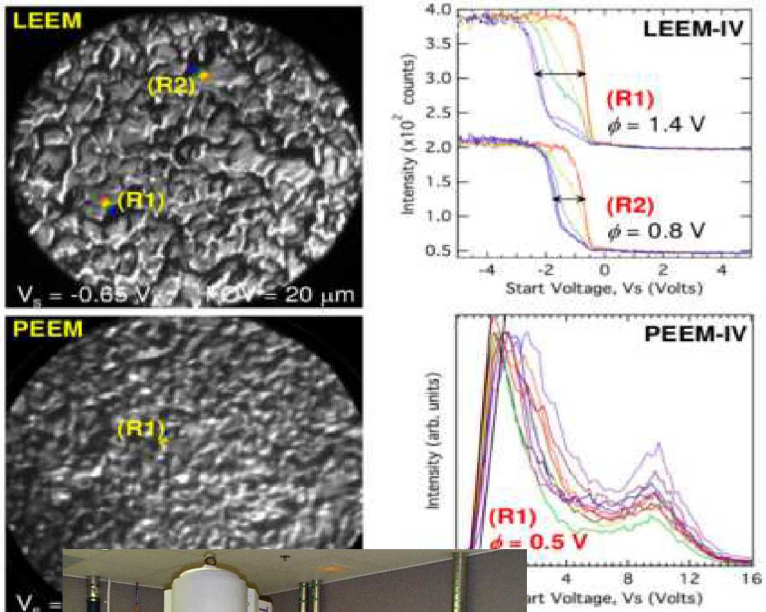




Glint and Glare

PV Cells and Materials R&D



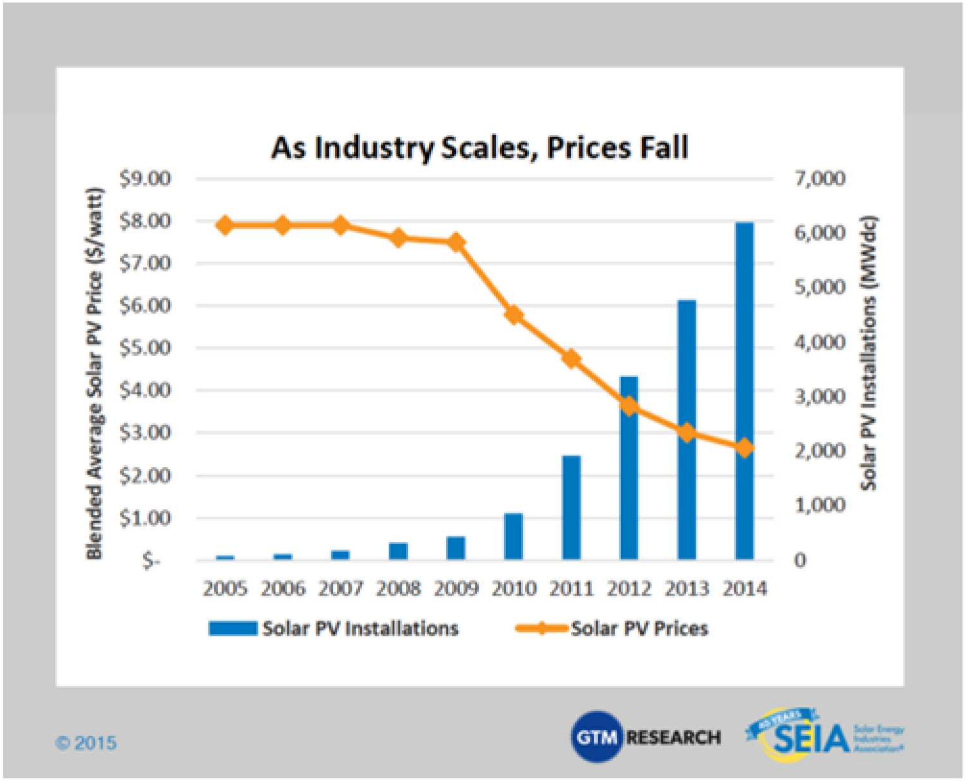


DOE Solar Energy Technology Office SunShot Initiative

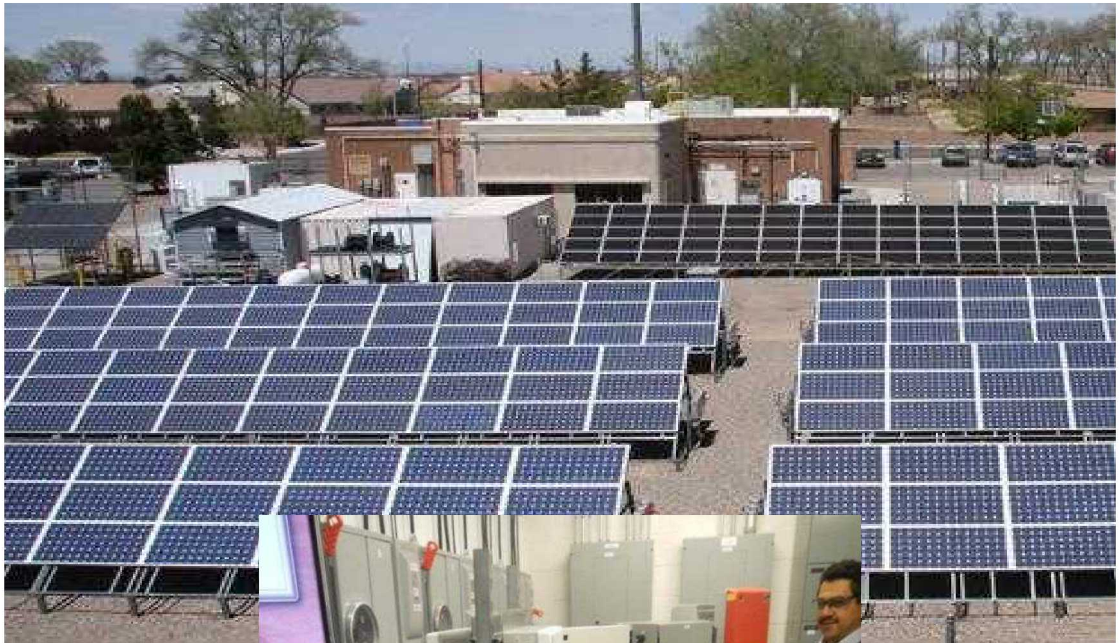
SunShot 2020 Goals

- PV cost is competitive with conventional electricity cost
- The grid is able to accommodate 10X more solar than today

Powered by SunShot
U.S. Department of Energy



Distributed Energy Technologies Laboratory



- Focus on PV inverters, energy storage, microgrids and other distributed energy technologies
- Efficiency, grid compatibility, interoperability, reliability and safety
- In operation since early 1980's, currently pace-constrained
- Constantly reconfiguring and adding new capabilities to support new industry needs

PV Systems Evaluation Laboratory

- Fully configurable test platforms for indoor, outdoor and long-term testing
- Full-scale cell and module performance characterization laboratory
- Controlled side-by-side PV system and component characterization
    - PV Systems, PV modules
    - Components such as cables, connectors, etc.

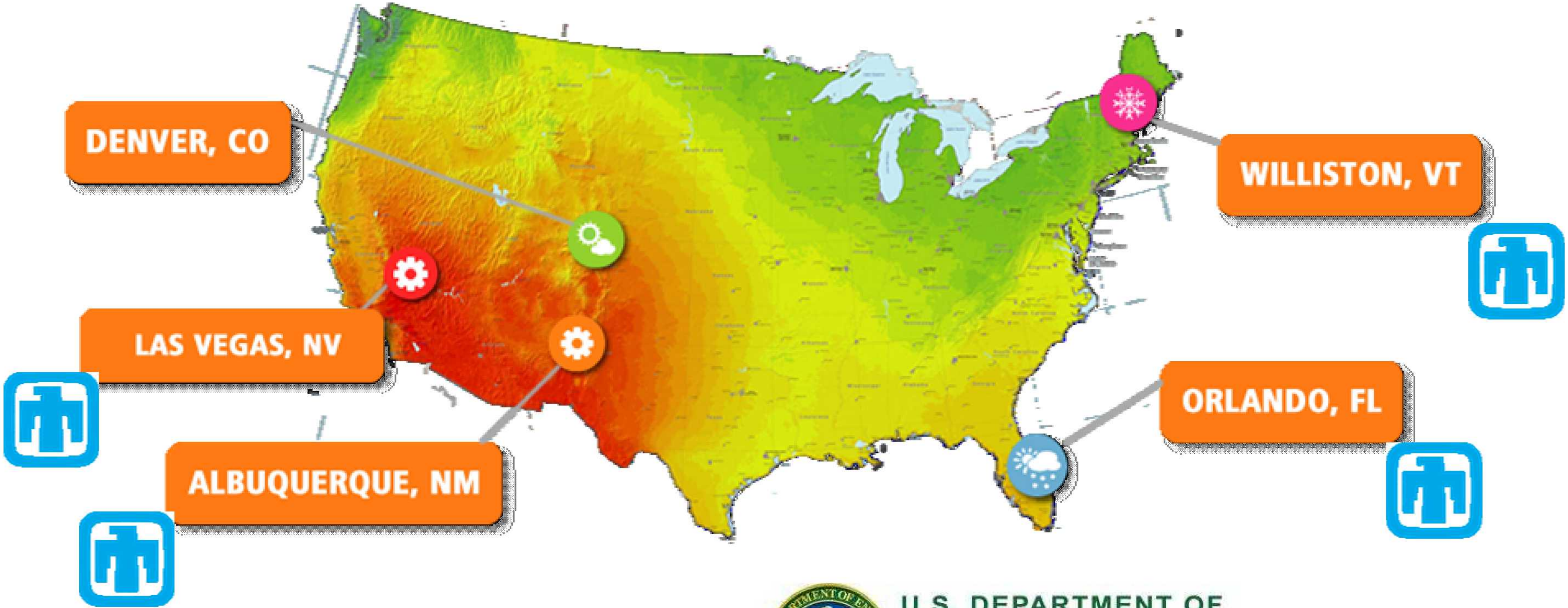
PV Systems Evaluation Laboratory

- PSEL – Hosts small systems, up to ~50 kW ea.
- NSTTF Site – Interconnection infrastructure for large systems, up to ~1 MW

Regional Test Centers (RTCs)

- Public-Private Partnership
- Independent, rigorous PV technology validation in diverse climates
- Supports R&D and bankability

Regional Test Centers
Differentiating PV Quality



U.S. DEPARTMENT OF ENERGY

Questions?

Comments?