Why Solar? The obvious...

energy.gov/sunshot

US Market Growth

4.7 GW of PV in 2013

10X more installed than in 2009
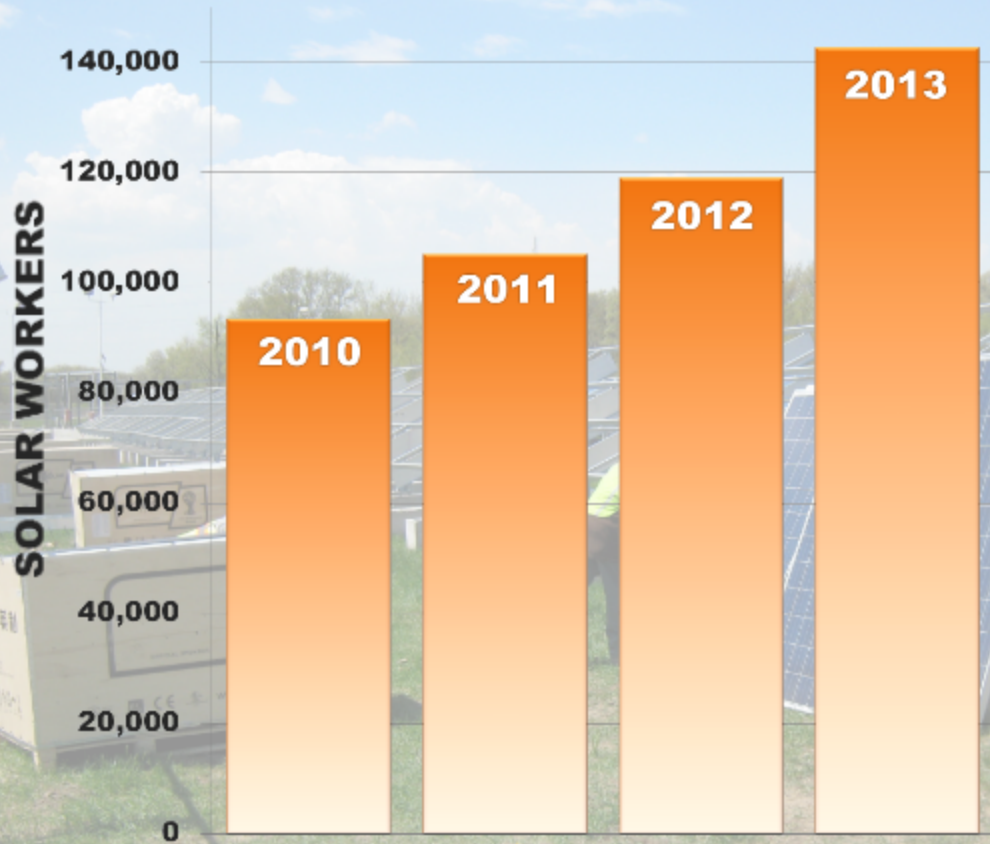
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So what is SunShot Targeting?

Price

SunShot Initiative

~6¢/kWh without subsidy

75% cost reduction by the end of the decade

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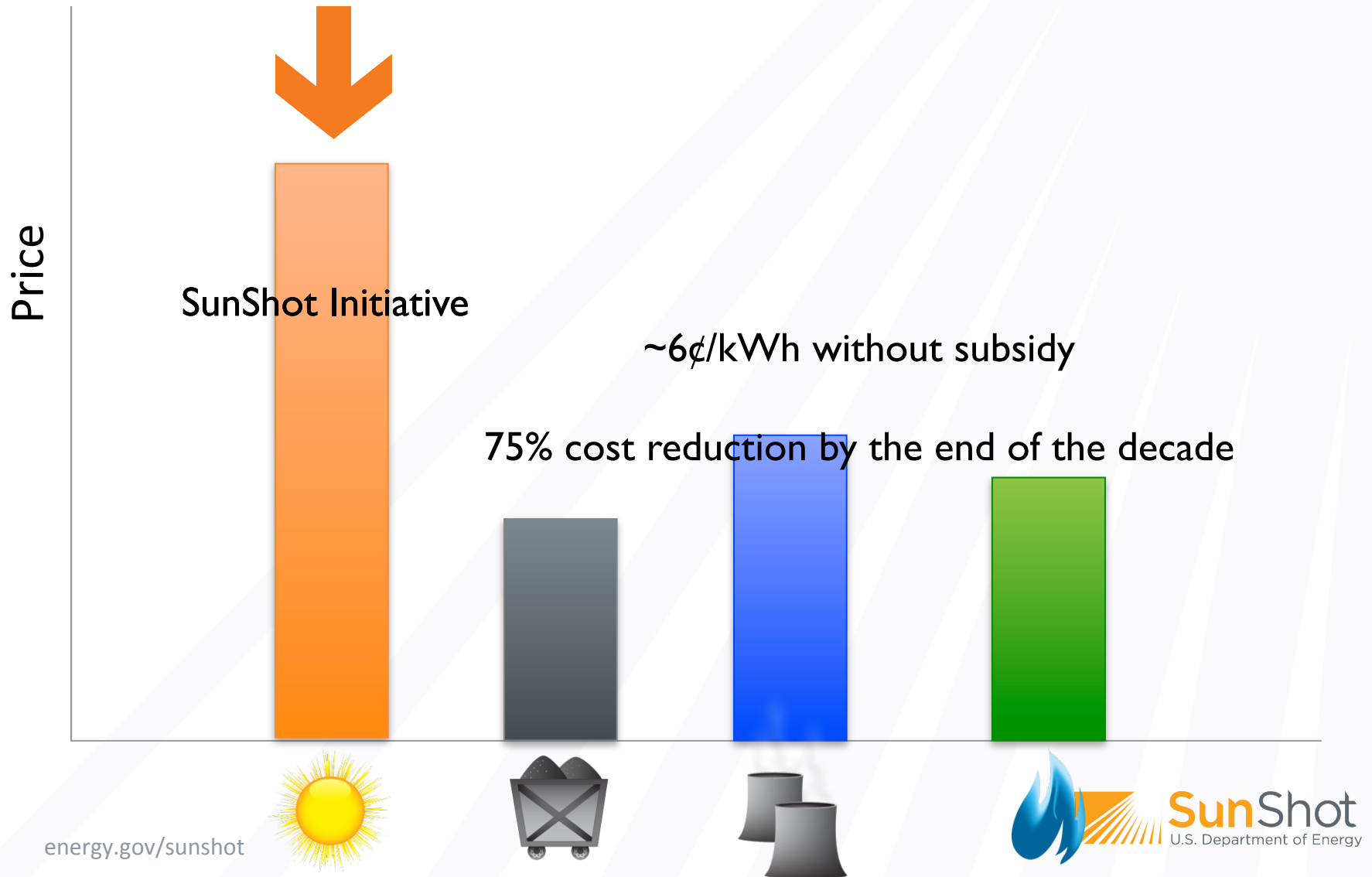
How will we get there?

- Leaders
- Innovators
- Entrepreneurs
- Change

- Failing Fast
- Networks
- Facing Challenges
- Data

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PV System Pathway to SunShot
Residential

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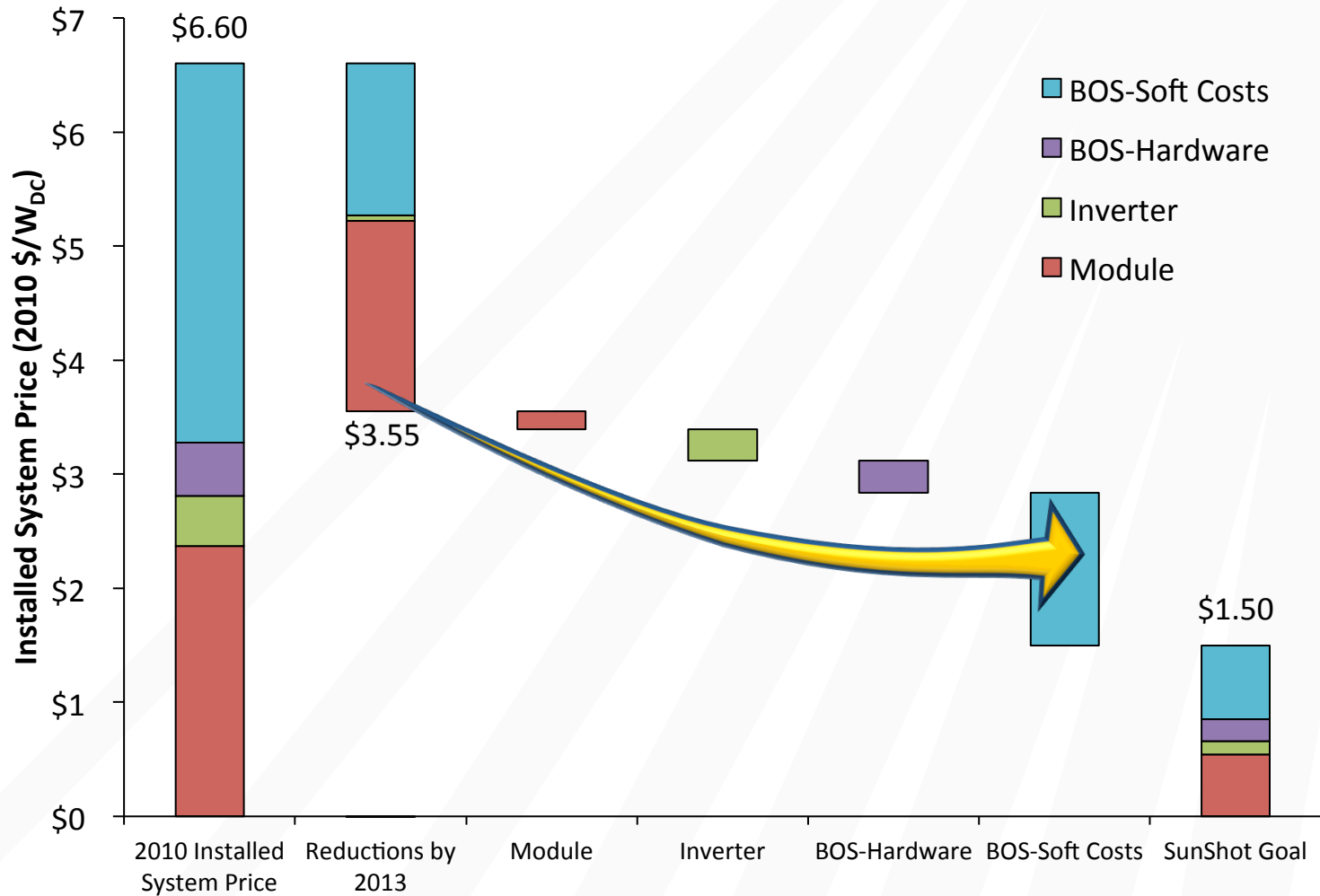
Supporting a Startup Culture

[1]A human institution designed to create a new product of service under conditions of extreme uncertainty.

- – Anyone creating this new product or service is an entrepreneur

Neglecting or ignoring innovation creates risk

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Energy Systems Integration
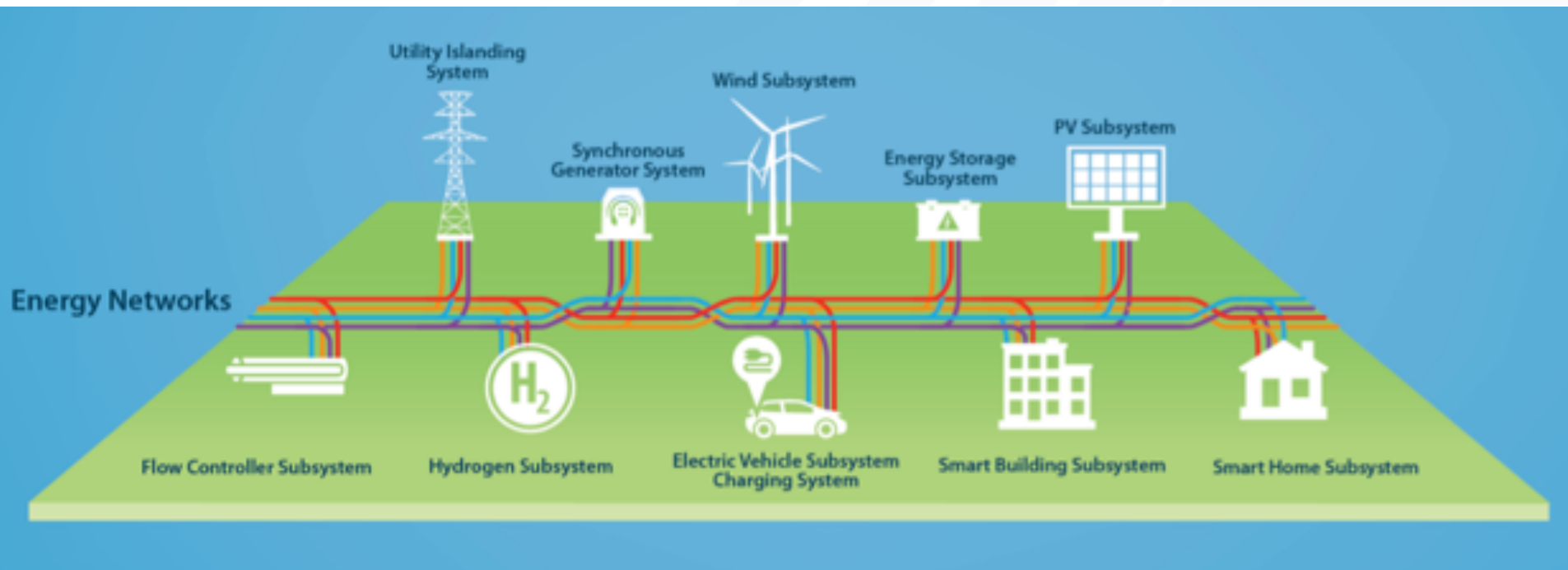
Grid Infrastructure and Workforce: Aging

How Duke's Workforce Is Aging

Born 1980 to 1995 Millennial	Born 1965 to 1979 Gen X	Born pre-1946 to 1964 Veterans & Baby Boomers
21%	37%	42%
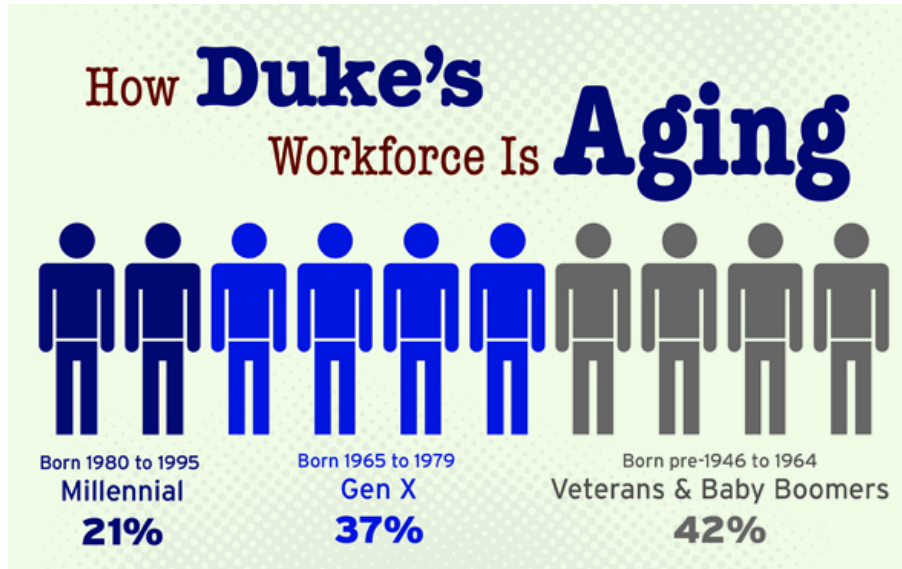
Duke Energy, December 19, 2012

MARKET FAILURE: Colleges are not training graduates for available career opportunities in **power systems**
(rather than microelectronics)

Distributed Energy Resources:
New Skills for Power System Engineers

Training a network of Power System Engineering innovators and entrepreneurs to help the power sector deploy high penetrations of Distributed Energy

– Distributed Energy Resource(DER) technologies like **solar** and electric vehicles have enormous transformative potential for the grid

– To enable utilities to innovate and adapt , Power Systems Engineers and utility professionals need training and new skills to integrate DER Technologies

Distributed technologies

Expertise
Analysis
Data

GEARED

Status Quo

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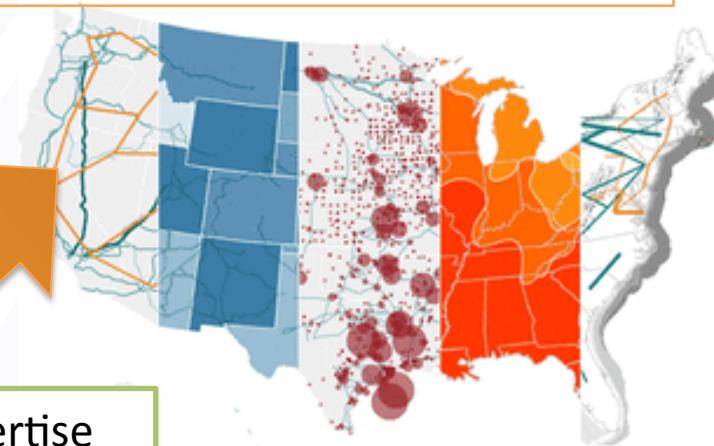
RTC Locations

4 installations

DENVER, CO

1 installation

LAS VEGAS, NV

ALBUQUERQUE, NM

4 installations

1 installation

WILLISTON, VT

ORLANDO, FL

4 installations

SNL manages NM, NV, FL and VT
NREL manages CO

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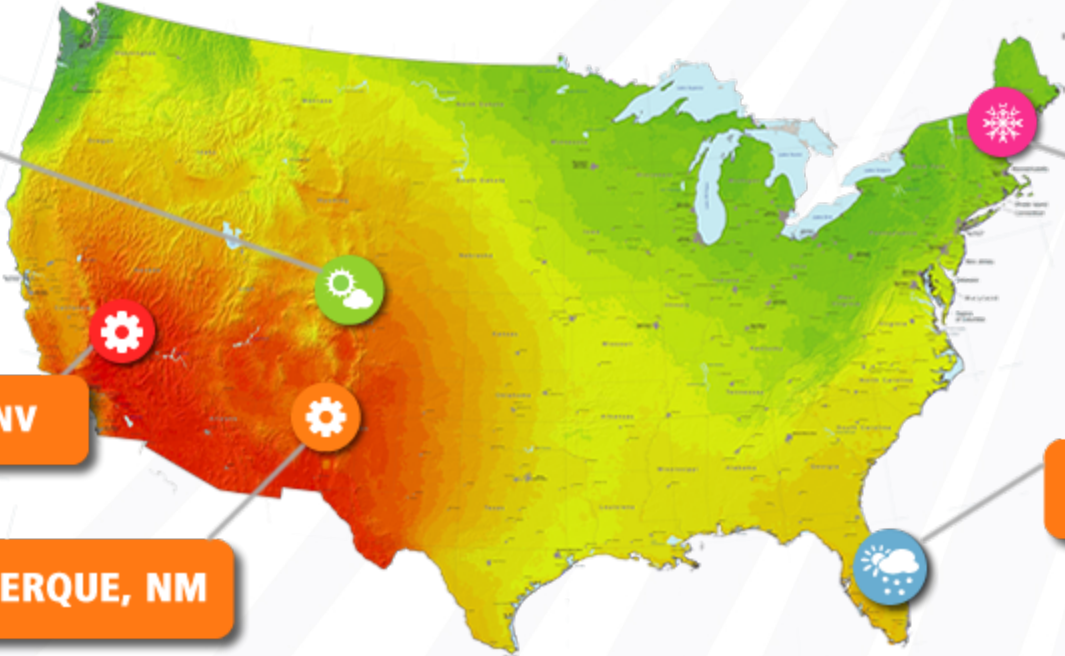
Visualization Demo - Anatolia Cloud Passage NREL
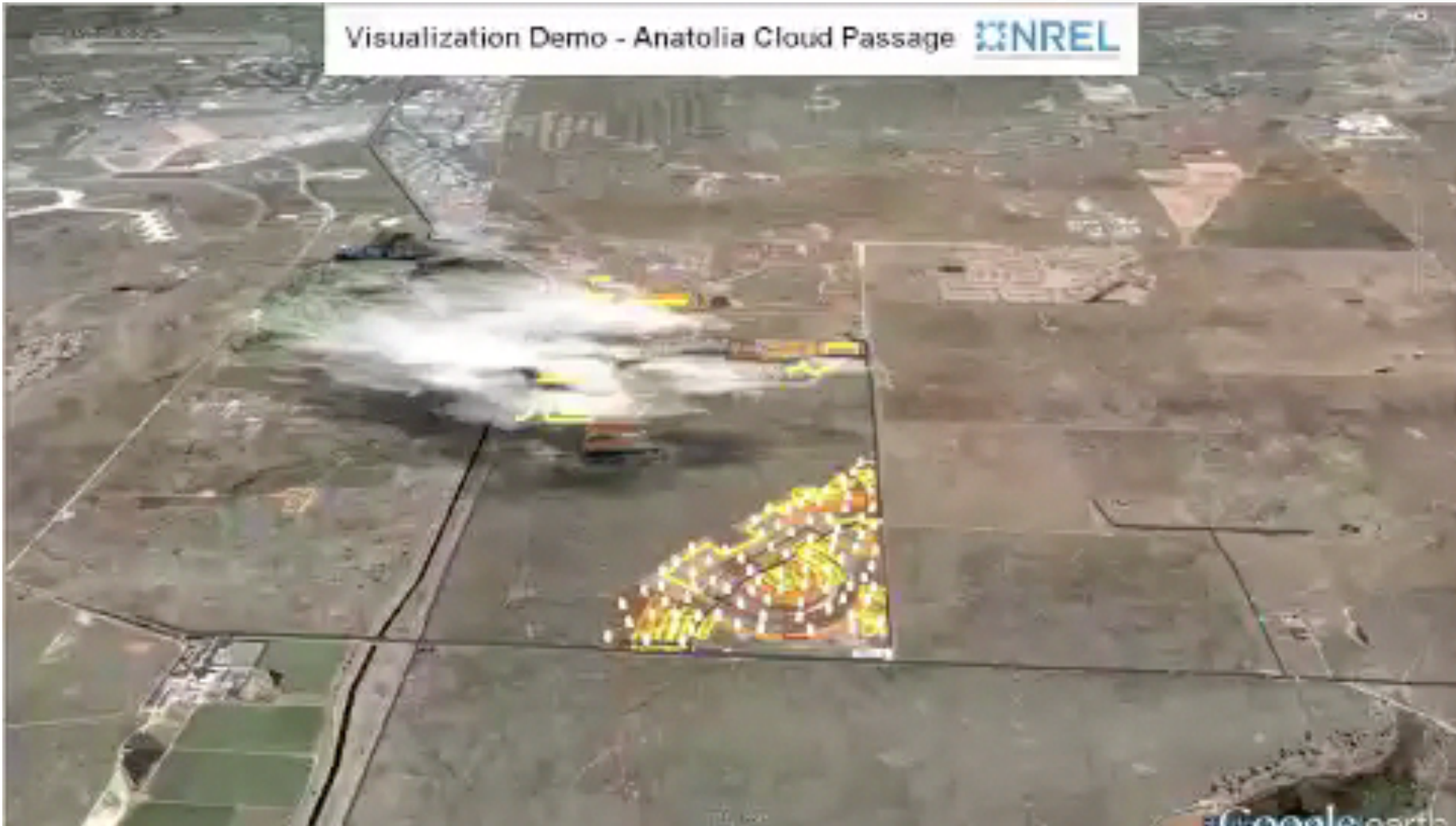
SunShot Program Structure

energy.gov/sunshot

Soft Costs are Persistent

LET'S GET TO WORK ON SOLAR SOFT COSTS

The rising non-hardware "soft costs" of solar energy remain the biggest barrier to more solar deployment in the U.S.

HARDWARE COSTS

↓60%
Since the beginning of 2010, the average cost of solar panels has dropped more than 60 percent.

SOFT COSTS

64%
Of the total price
Soft costs aren't decreasing as quickly as hardware costs. They now comprise up to 64 percent of the total price of residential solar energy systems.

Soft Costs =
$$$, effort and Time

People, processes, action...or created by a **lack of information**.

Gathering information or completing a process make up an increasing share of the costs incurred when solar is deployed.

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Soft Costs Dominating Overall Costs

Financing   Permitting   Customer Acquisition   Installation   Maintenance

Up to ~~50%~~ **64%** of the cost of a solar installation

Source: Second Annual Benchmarking…", Friedman et al., in preparation.

Slashing Red Tape and Driving Local Innovation

ROOFTOP SOLAR CHALLENGE

ROUND 1
(2012-2013)
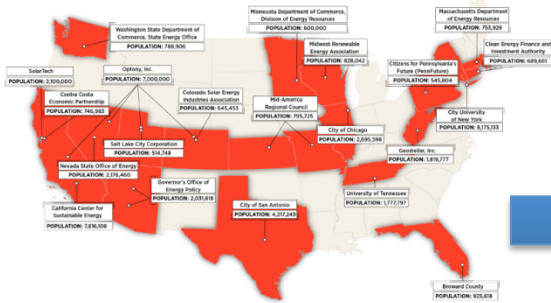
22 Awards
~50M Americans
19 States + Puerto Rico
$12M

Performance-based
Local-level innovation
Teams quantitatively tracked and scored via market maturity scorecard
Year-end results:
Fees reduced
Online permitting spreading
Statewide standards emerging
Innovative digital solutions unveiled

ROUND 2
(2013-2015)

8 Awards
~150M Americans
27 States + DC
$12M

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Local Results, National Impact

PV Installed in RSC locales:

Residential: 225 MW

Commercial: 357 MW

38K Residential Systems

=

3K Commercial Systems

Average Business Days Saved Per Install = 5.1

Average Business Days Saved Per Install = 4.1
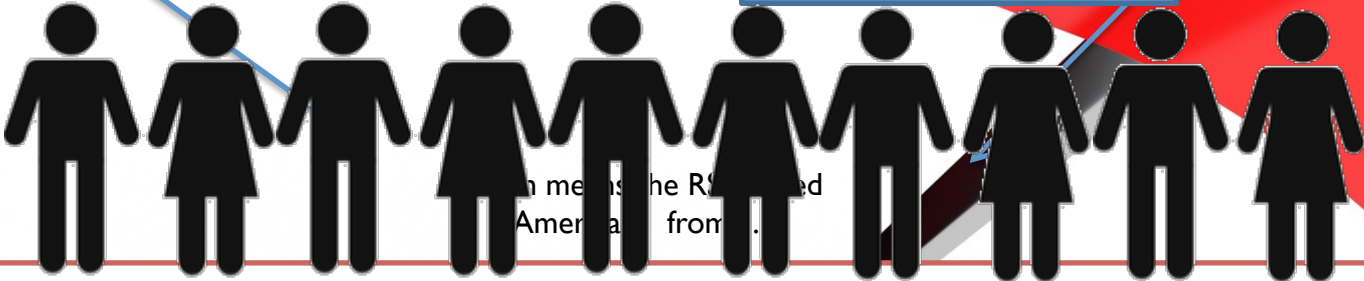
OVER 10 LIFETIMES SAVED

Round Two Highlights

- **REGIONAL COLLABORATIONS**
  – New England (CESA), Pacific Northwest (WADOC)

- **DIGITAL TOOL EXPANSION**
  – Optony Solar Roadmap, SMART NY platform (CUNY), Florida (Broward)

- **DATA COLLECTION ENGINES**
  – CA Interconnection Portal (CCSE)

- **NASCENT SOLAR MARKET PARTICIPANTS**
  – Iowa, New Hampshire & Rhode Island (CESA), Ohio and Indiana (MARC)

8 Awards
~150M Americans
27 States + DC
$12M

Meet the **Teams** and Find Additional **Resources** at
http://www.eere.energy.gov/solarchallenge/

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Access the latest resources, a calendar of events, and information on technical assistance at:
www.solaroutreach.org

SOLAR OUTREACH PARTNERSHIP

SOLAR POWERING YOUR COMMUNITY: A GUIDE FOR LOCAL GOVERNMENTS
Second Edition
JANUARY 2011

SOLAR AMERICA COMMUNITIES

SOLAR ENERGY MYTHS
7 MISCONCEPTIONS ABOUT SOLAR PV

ASK THE EXPERT: SOLAR ACCESS

Ask the Expert Video Podcast Series presented by the SunShot Solar Outreach Partnership.

SolarOPs has reached over 4,000 individuals, in all 50 states, representing more than 1,200 local governments through partnership workshops, e-learning activities, and technical assistance

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Solar Technology Diffusion Research

Under the SEEDS program, DOE supports projects that advance and apply cutting-edge strategies for accelerating solar adoption.

|	Yale	NREL	Sandia National Laboratories	THE UNIVERSITY OF TEXAS AT AUSTIN
Foundational Scientific Advances	tracing **social networks** that spread solar	evolution of **motivations** beyond early adopters	**agent-based modeling** of innovation diffusion	**micro-level data** and analysis of energy consumers
Real-world Market Applications	spreading **community solar** through CT	four **pilot experiments** in CA, AZ, NY & NJ	testing economic + **social incentives** in San Diego	new **incentive structures** piloted with TX utilities
Research and **Market** Partners	Yale, NYU, SmartPower, **CT Clean Energy Finance and Investment Authority**	Portland State U, U of A, LBNL, CU-Boulder, MichState , UMich, Social and Environmental Research Inst., **Clean Power Finance**	UPenn-Wharton, Vanderbilt, NREL , **California Center for Sustainable Energy**	**Austin Energy, Frontier Associates**

20

Big Data Lowers Solar Soft Costs

- Sun Number Scores - engaging consumers
- Roof top data processed to qualify buildings
- Lowering the cost of customer acquisition

Streamlined Permitting, Inspection

- Web-Based permitting

- Track you permits in real time

- Eliminate trips to permitting office
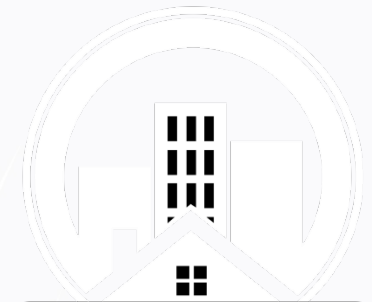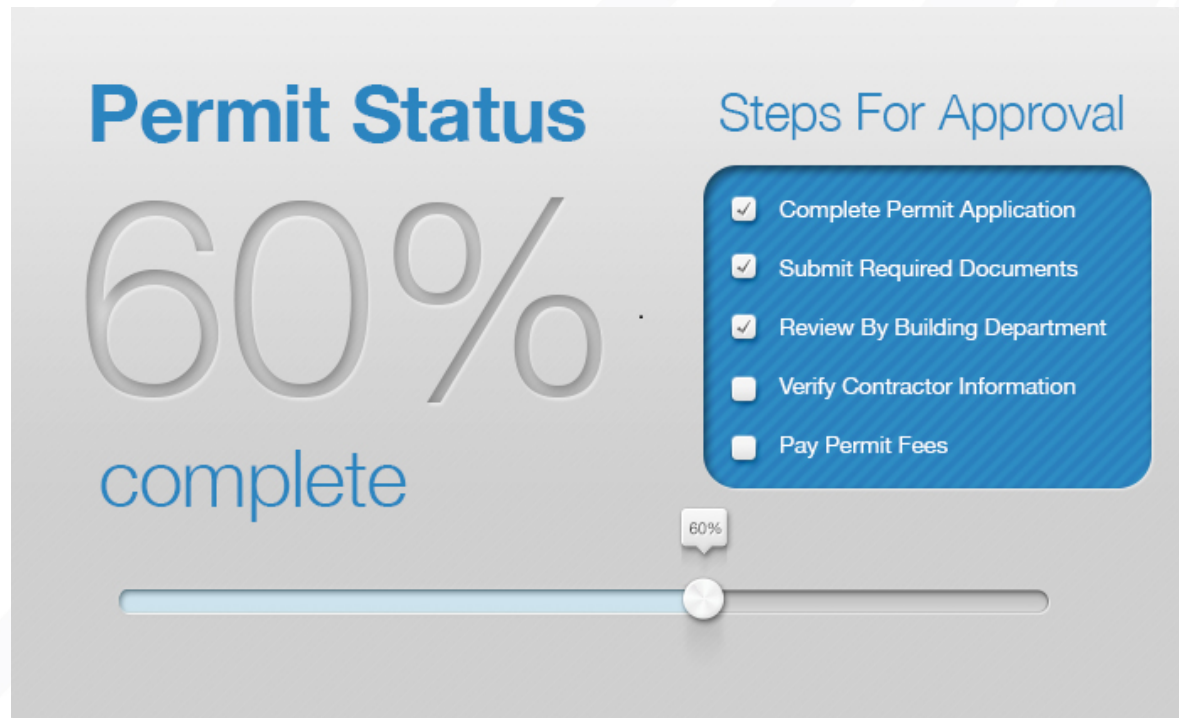
Innovative Solar Business Models

3-7 kW
Residential Rooftop

Rooftop solar is an option for **less than ¼** of the residential market*

Residential roof space suitable for solar:
(structural constraints, roof area, shading)
Numbers do not consider home ownership, renters, financial situation

22%
77%

= Warm
= Cool

27%
73%

Shared and community solar models can:
— Remove the siting requirement
— **Expand the market** for solar
— Take advantage of **economies of scale**
— Provide **opportunities for innovation**

*NREL Study. *Rooftop Photovoltaics Market Penetration Scenarios*. 2008.

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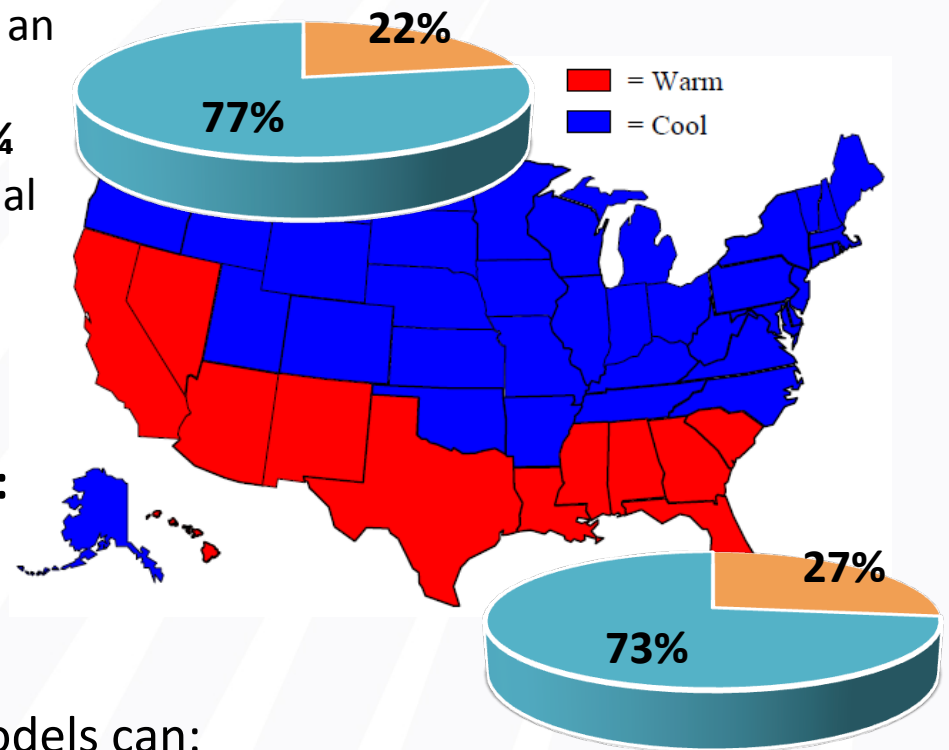
Resources and Further Reading
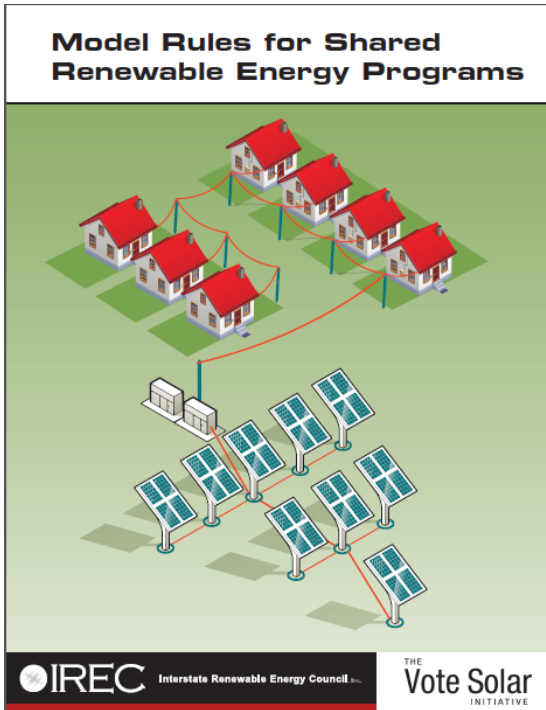
Interstate Renewable
Energy Council
http://www.irecusa.org
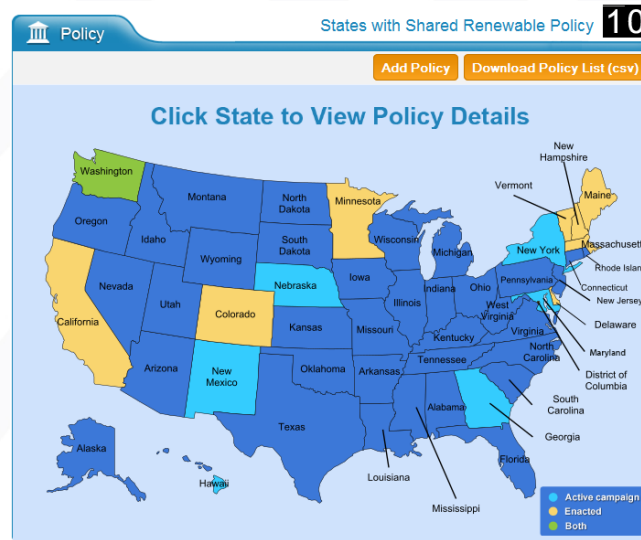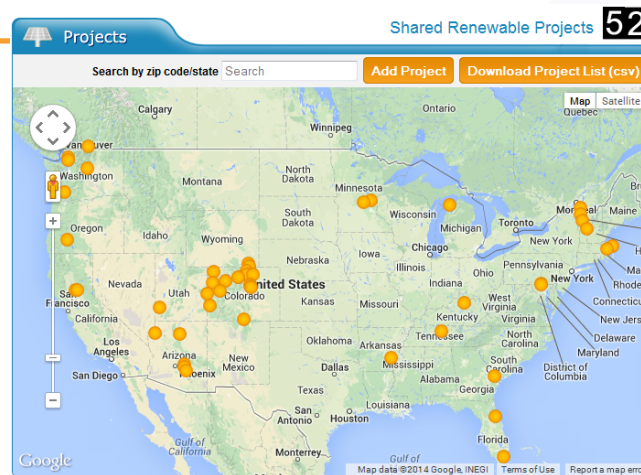
Shared Renewables HQ
www.sharedrenewables.org
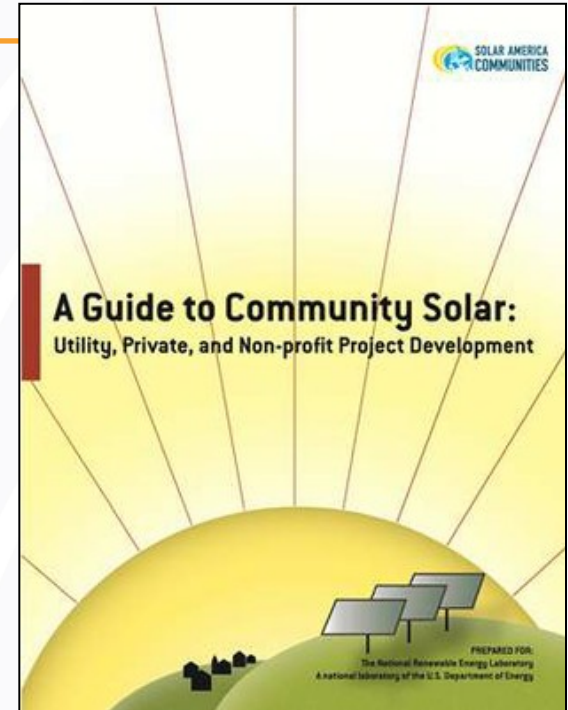
SunShot Initiative
Solar Energy Resource Center
**http://www1.eere.energy.gov/
solar/sunshot/resources.html**

Crowd-Funded Solar

- Non-homeowners can go solar for $25
- Crowdfunding lowers the cost of capital

Images are used for demonstration purposes only

This image is used for demonstration purposes only
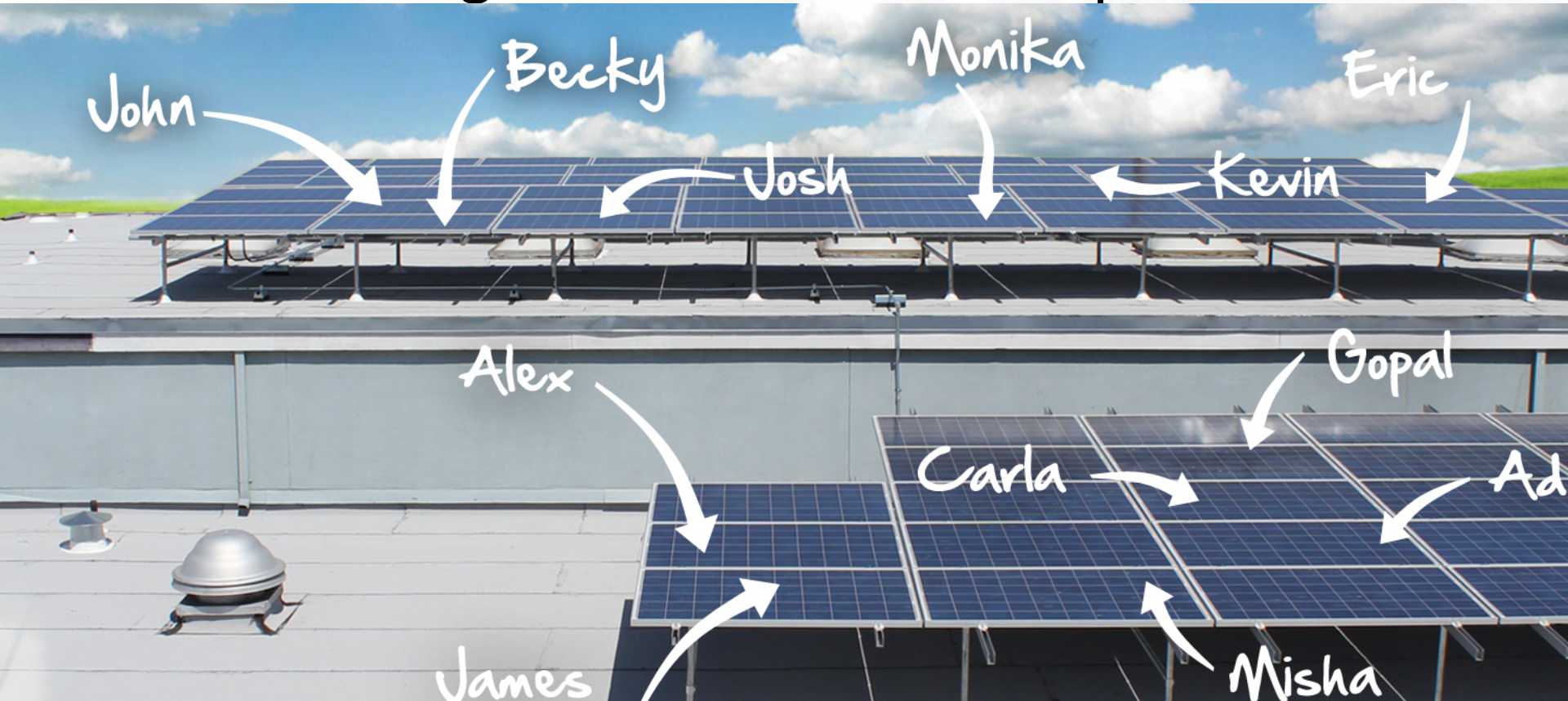
Thank You

Elaine Ulrich
Program Manager
SunShot Initiative

U.S. DEPARTMENT OF ENERGY

Faster, Cheaper, Easier

Provide information and tools that support people and processes that expand adoption of solar technologies.

- Facilitate communication and dissemination of best practices & lessons learned from areas where adoption is well developed (i.e. increasing/high penetration areas) in coordination with SunShot technology offices

- Use established information and knowledge to drive down the cost of increasing and widespread deployment of solar technologies as those technologies advance,

- Support new programs and processes that ensure solar technology deployment becomes easier and cheaper through technological innovation and system change.

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Tools we currently employ

- **Support Communities, Organizations, Companies, Innovators**

- **Provide Open Access to Data and Information Resources**

- **Provide Access to Experts**

- **Train Leaders in the field**

- **Create Reference Materials to support a wide range of professionals**

- **Supply Analysis, Case Studies, Guides, Methodologies and Best Practices**

- **Support Innovation in data collection, management, dissemination and analysis**

- **Encourage Software Development and Automation**

- **Support Networks that share the resources listed above**

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Current Programs

- Soft- BOS
- Rooftop Solar Challenge II
- Solar Outreach Partnership
- SITN
- GEARED

- SUNRISE
- SEEDS
- Incubator- S (Soft Costs)
- LPDP – Labs
- SunShot Prize

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Business and Policy Environment:
- PUCs, Regulators , State and Local Jurisdictions, Legislative Environment, Utility Rebates Metering and Rates

Rooftop solar Challenge, Solar OPs, Soft BOS, Solar Market Pathways, Solar Designation, LPDP, SunShot Prize

Solar ABCs, SAPC, Training, Klise/ Hoen, Interagency

Solar Designation, AEVA, Interagency (HUD, BLM, USFS, USDA)

SITN, SUNRISE, Incubator, Catalyst, LPDP tools

SEEDS, LPDP, Informatics, Catalyst

PV, CSP, SI Primary + SC Analysis (LPDP, Soft BOS)

Auxiliary Network to Solar
- Finance
- Real Estate
- Codes, Standards & Certifications
- Insurance
- Permitting Authorities
- Legal Community
- IRS, SEC

Solar Primary Network :
- Installers,
- Project Developers
- Power providers
- Utility owners
- Business and Software Toolsand Solution Developers

Consumer Markets
- Residential Consumers – SFH
- Multifamily housing, condo, row houses, coops
- Small commercial
- Large commercial
- Big Box, supermarkets
- Big structures with load (warehouses)

- Big structures without load
- MUSH
- Non-Profits and

- Churches
- Low-Income Consumers
- Small Industrial and agriculture (Dairies, Vineyards)
- Stadiums and Convention Centers
- Airports
- Public Lands
- Tribal Lands
- Farms
- Critical Facilities
- Distributed Wholesale
- DOD
- Large Industrial
- Parking

Data and Information Assets

Research and Development

Testing and Validation

Analysis

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National Laboratory Projects

Technical Assistance
Advanced Financing Mechanisms
Policy Analysis
Soft Cost Modeling and Analysis
Solar Regulatory Roadmap
IEA Task 12 and Water Usage

Utility-Scale Long Term Monitoring

O&M Analysis to Mitigate Risk
Glint/Glare Hazard Analysis Tool
Real Estate PV Valuation w/ LBNL
PV Impacts on Common Home Structural Design

NREL: Advanced Financing Mechanisms

Goals

Expand availability of capital

Lower cost of capital

Reduce transaction cost, time to access capital

DOE Awarded Actions

Solar Access to Public Capital (SAPC):

- Standard Documents
- Mock Ratings Filing
- 150 Members and Growing

Open Solar Performance and Reliability Clearinghouse (oSPARC database)

Analysis of opportunities and barriers

Facilitate capital market investment and retail (community) bank lending

Success Stories: Incubator Awardees

As part of the latest round of Incubator funding,

- **Clean Power Research** is developing a software platform that aims to lower the costs associated with connecting distributed electricity generation to the grid.

- **EnergySage** is growing and enhancing their Marketplace's online store that helps make the process of buying and installing solar photovoltaic (PV) systems quick and simple.

- **kWh Analytics** is building big data information tools to help investors understand risk in the new solar asset class, while **Folsom Labs** is working on cloud-based modeling of arrays to help evaluate how new technologies impact PV systems.