SunShot Initiative:
Lower cost via proven PV module reliability

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SunShot Goal: 5 - 6¢/kWh without subsidy. A 75% cost reduction by 2020.
SunShot Initiative – Solar Grid Parity by 2020

68% progress towards 2020 goals
SunShot Initiative – Solar Grid Parity by 2020

2010

2014

2020

MAJOR PROGRESS

PRIORITY AREAS

16GW of solar
4.75GW of PV in 2013
13x growth rate from 2009
PV Residential-Scale System Pathway to SunShot

- **2010 Installed System Price ($/W_{dc}$)**
  - BOS-SOFTWARE: $3.32
  - BOS-HARDWARE: $0.47
  - INVERTER: $0.44
  - MODULE: $2.37

- **2014 Installed System Price ($/W_{dc}$)**
  - BOS-SOFTWARE: $1.56
  - BOS-HARDWARE: $0.58
  - INVERTER: $0.32
  - MODULE: $0.67

- **2020 Goal Installed System Price ($/W_{dc}$)**
  - BOS-SOFTWARE: $0.65
  - BOS-HARDWARE: $0.19
  - INVERTER: $0.12
  - MODULE: $0.54

*Source: energy.gov/sunshot*
Photovoltaics R&D
Dr. Rebecca Jones-Albertus, Program Manager

- Improving Reliability & Durability
- Increasing Efficiency
- Lowering Material & Process Costs
- Lower Solar Electricity Cost
Reliability/durability/lifetime

SOLAR: powering your life through the decades.
Reliability/durability/lifetime at the National Labs

Increasing Prediction Accuracy and Confidence in PV System Performance

Characterizing Emerging Photovoltaic Technologies

PV Reliability: Prognostics and Health Management

Regional Test Centers

Quantifying Risk Through Bankability Reports/Standards

Emerging Technology Characterization

IEC PV Standards Activities

Advanced Measurement and Analysis of PV De-rate Factors

Predicting Service Life for PV Modules

Solar System Modeling Algorithms and Tools for Characterizing and Reducing Uncertainty

Mitigating Industry-Wide Risks through Data Collection and Assessment

FY 2014: $18.8 million
Regional Test Centers

Vision:
- Accelerate adoption of solar energy generation sources by helping U.S. PV manufacturers overcome the challenges on the path to commercialization
- Provide technical basis for bankability of PV systems
  - Installation size:
    - Module-level testing: 10-50kW per site
    - System-level testing: 50–300 kW per site
- Validate in multiple climates, to compare performance and initial reliability against predictions
The challenge: degradation rates

PV module degradation rates, pre- and post-year 2000 installation

Decline curve analysis: oil and gas wells

Exponential: $r_0 \exp(-\lambda(t - t_0)) \quad \beta = 0$
Harmonic: $r_0 \left[\exp(-\lambda(t - t_0))\right]^{-1} \quad \beta = 1$
Hyperbolic: $r_0 \left[1 + \lambda \beta(t - t_0)\right]^{-1/\beta} \quad \beta \in [0,1]$

Oil and gas industry falls back on linearity, too...

Linear degradation
Linear degradation?
Linear degradation?
Impact on LCOE

- 0.5%/year
- 1%/year
- 12.4¢/kWh
- 13.4¢/kWh
Join our team!

Take on the SunShot challenge to make solar energy cost-competitive with traditional energy sources by 2020.

- Photovoltaics
- Systems Integration
- Tech to Market
- CSP
- Soft Costs

energy.gov/sunshot