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Sandia National Laboratories

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ENERGY ASSURANCE FOR SOLAR-POWERED OPERATIONS: The US DOE Regional Test Center (RTC) Program

DEFENSE TECHCONNECT 2018

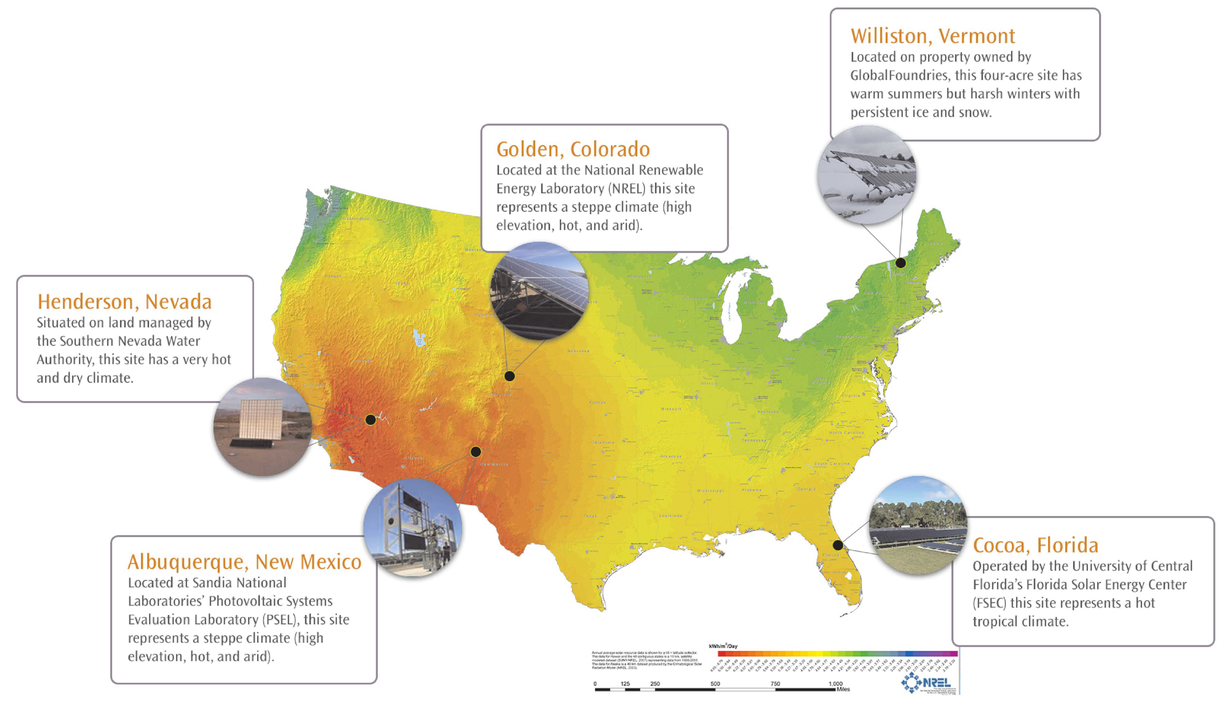
ENERGY, EFFICIENCY AND RESILIENCE

OVERVIEW

The US DOE Regional Test Center (RTC) program, which is managed by Sandia National Laboratories in partnership with the National Renewable Energy Laboratory, operates a network of field laboratories across the US.

Each site:

- Provides a platform for measuring and validating the performance of photovoltaic (PV) systems and components
- Has common infrastructure and world-class instrumentation and executes the same operating protocols
- Reflects the deep expertise, high credibility and technical excellence of the National Labs
- Represents a range of distinct operating climates, from desert to tropical to subarctic



RTC GOALS ALIGN WITH MILITARY GOALS

The RTCs provide a unique constellation of services that bring a critical dimension to solar reliability

I. PRODUCT RELIABILITY/ ENERGY ASSURANCE

- Pre-deployment analysis of solar technologies for harsh operating environments
- Post-deployment high-fidelity monitoring to ensure reliability of mission-critical photovoltaic systems
- Early-warning mechanism for system and component failures; enables quick follow-up diagnostic analysis and cross-site investigation
- Assistance with critical parameters for module and component selection (manufacturing quality; balance-of-materials considerations; shipping & handling)

II. ENERGY SECURITY

- National-laboratory expertise can support solar-energy-generation goals for mission-critical operations, including the design of climate-optimized PV systems
- Focus on US manufacturers for energy and supply-chain security;

III. RESEARCH PLATFORM

- Technically robust and exacting RTC sites can be leveraged for research to support military needs in different climates and operating environments

IV. WORKFORCE TRAINING

- Educational platform and technical showcase that gives military personnel and contractors hands-on exposure to cutting-edge products and O&M protocols

V. REPLICABLE PLATFORM

- Can be built/replicated anywhere in the world, either as a permanent or mobile RTC

WHY MULTI-CLIMATE FIELD VALIDATION MATTERS

Accelerated testing under controlled conditions is one gauge of photovoltaic performance but field studies are essential to understanding how technologies and systems actually perform (and degrade) over time under drastically different—and sometimes highly variable—operating conditions.

Field evaluations are especially important, given the rapid pace of change throughout the solar industry. As more efficient modules hit the market and prices continue to drop, can long-term quality be assured? The RTCs collect data critical to understanding climate-related vulnerabilities and reliability issues.

Demonstrate Performance of Product: **"IT WORKS"**

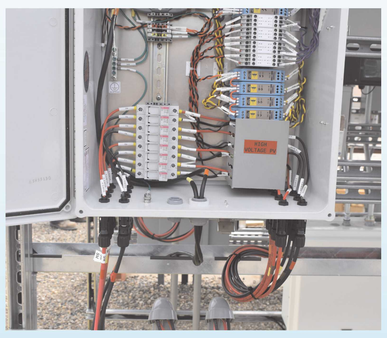
Demonstrate Long-Term Field Performance: **"IT LASTS"**

Demonstrate Long-Term Field Performance: **"IT LASTS HERE"**

HIGH-FIDELITY DATA COLLECTION

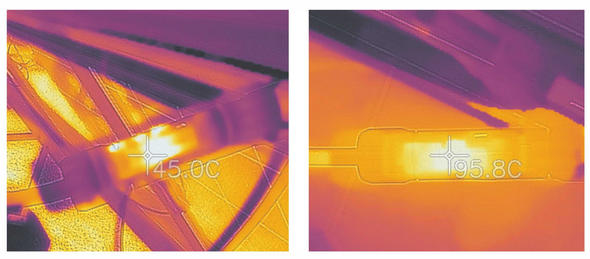
The RTC team has developed a high-resolution, high-frequency data monitoring system for validating the performance of new PV technologies. The following instrumentation is representative of each site.

- String-level DC current and voltage, accuracy of 0.1%.
- Solar cell temperatures
- POA irradiance
- Global horizontal, global diffuse and direct normal irradiance
- Spectral sensor
- PV reference cell – EETS
- Wind speed and direction, barometric pressure, rain and snow gauges; temperature and humidity
- Soiling monitors
- Custom data: tracking monitors, albedometers, AC data
- Data collected at ~ 5 seconds; averaged at one-minute intervals



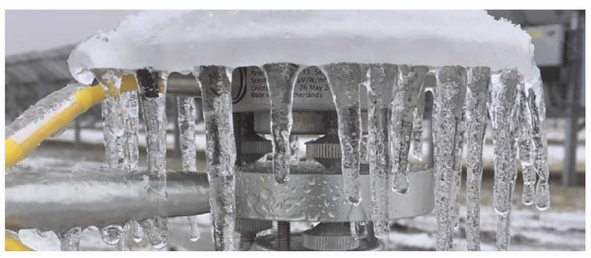
PLATFORM FOR TECHNICAL ASSESSMENT AND VALIDATION

ENERGY YIELDS/PERFORMANCE



RELIABILITY/PRODUCT

SOILING RATES



CLIMATE-SPECIFIC STRESS

SYSTEM OPTIMIZATION

POOR INSTALLATION PRACTICES

SNOW LOSSES

EMERGING TECHNOLOGIES

U.S. DEPARTMENT OF ENERGY
NNSA National Nuclear Security Administration

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