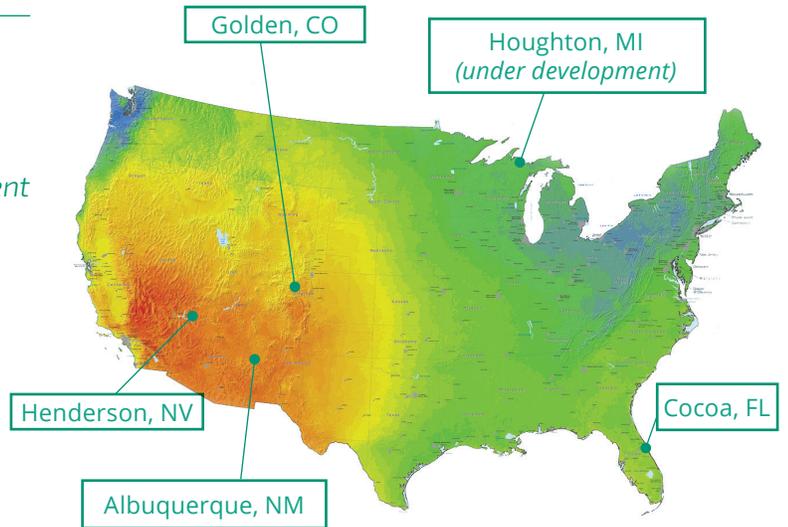




THE US DOE REGIONAL TEST CENTER PROGRAM

Founded in 2012, the Regional Test Center (RTC) program supports a state-of-the-art technical platform for evaluating the performance and reliability of emerging PV technologies across multiple climates. Established by the U.S. Department of Energy Solar Energy Technologies Office, the program allows for the rigorous evaluation of proprietary technologies under realistic field conditions, enabling the cross-climate comparison of solar technologies. To that end, each RTC has a common infrastructure, including world-class meteorological instrumentation, high-resolution monitoring equipment, and operating protocols to ensure data quality.



The Regional Test Centers span multiple climates, providing a valuable test bed for emerging solar technologies.

OVERVIEW

Sandia National Laboratories (Sandia) manages three of the four sites (New Mexico, Florida, and Nevada) while the National Renewable Energy Laboratory (NREL) oversees local management of the Colorado RTC. Together, the four sites represent a range of climate conditions and have the electrical and technical infrastructures to accommodate an assortment of technologies and system configurations for long-term performance and reliability studies.

The success of the RTC program, with its focus on multi-climate performance evaluation, reflects the standards of excellence and exacting validation approach developed by Sandia and NREL, as well as a growing recognition that climate must be carefully considered when developing and deploying new solar technologies. In addition, the RTCs are known to collect high-resolution meteorological data important to the accuracy of PV performance models.

SIX-PRONGED VALUE PROPOSITION

The RTCs contribute to innovation and growth in the solar market in multiple ways:

1. Product Validation

The RTCs provide the data and analysis to demonstrate how new products perform over time and in different climates. Compa-



Left: Solar panels at the FL RTC are tested under tropical conditions. Right: Different panel types at the NV RTC are tested under high desert heat.

nies apply for an RTC study, and if accepted, partner with the National Labs on the design and execution of a study that best aligns with the partner’s technical objectives. These studies help accelerate the commercialization of innovative and more efficient solar products, lowering costs and expanding markets. All data are protected by a non-disclosure agreement and shared only with the industry partner, unless the partner decides otherwise.

2. Technological Innovation

Access to the technical excellence, engineering capabilities, and credibility of the National Labs benefits industry by providing technical support to drive innovation.



Left: Multiple module types at the NM RTC.

Right: Concentrated photovoltaic dual-axis tracker, one of three, at the NV RTC.

3. Photovoltaics R&D

In addition to supporting industry studies, the RTCs are a catalyst for research, fostering partnerships between the National Labs, universities, and private companies to address both mainstream and emerging research challenges of broader interest.

4. Multi-Climate Performance Data

Data available to the public includes performance data from each RTC's reference PV array, synchronized to onsite meteorological data (see <https://pv-dashboard.sandia.gov>). The data helps improve performance models, bringing greater accuracy to leveled-cost-of-electricity projections.

5. Training and Education

With its world-class infrastructure, exacting protocols and diversity of technologies, the RTCs provide a platform for state-of-the-art solar-training and education, with curricula that reflect collaborations between the local host institution and Sandia.

6. Early-Warning Mechanism for Reliability Issues

Automated data reports alert the National Labs to system or data failure; follow-up diagnostic analysis allows faults to be uncovered and corrected, ensuring data integrity. Long-term and cross-site investigations can identify widespread problems affecting the reliability of PV systems and components. The RTCs also generate data on degradation rates, which are important to lifetime performance.

COMMON TECHNICAL PLATFORM

Each RTC has a common grid-tied electrical infrastructure, world-class meteorological instrumentation, high-resolution monitoring equipment, and a common set of operating protocols to ensure data quality across the program.

Irradiance instrumentation

- Global horizontal irradiance (GHI)
- Diffuse horizontal irradiance (DHI)
- Direct normal irradiance (DNI)
- Plane-of-Array (POA)

Meteorological instrumentation

- Precipitation gauge
- Wind speed and direction
- Barometric pressure
- Relative humidity and temperature

Reference PV System

In addition, each site has a 6kW baseline PV system, equipped with a high-fidelity monitoring system that includes string-level DC voltage and current measurements, local POA irradiance, a POA reference cell, and back-of-module temperature sensors. Baseline arrays provide a common reference to which emerging PV technologies can be compared.

Data Collection

Data is collected at a frequency of ≥ 5 seconds, averaged per minute and transferred to Sandia, where it is analyzed daily. All irradiance sensors are cleaned twice a week and calibrated every two years.

VALUE TO INDUSTRY

The RTC program is a singular resource that gives solar companies access to multi-climate research facilities, high-fidelity performance data and the technical excellence of the National Labs. This unique pairing of industry with Laboratory expertise helps drive both product innovation and the commercialization of new high-efficiency solar products. Specifically, the RTCs provide:

- A multi-site technical platform for accurately comparing product performance under varying conditions of temperature, humidity and irradiance
- Grid-tied infrastructure that can accommodate a diversity of technologies and installations of multiple types and sizes
- Access to National Lab expertise and the Labs' broad engineering capabilities
- A validation approach that ensures complete confidentiality: data collected on behalf of industry is shared only with that partner
- Analysis in the form of performance reports authored by trusted experts at the National Labs creates credibility and trust that can increase investor confidence in specific technologies and their broad deployment.

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