Image by Billy J. Roberts, NREL

NSRDB: NATIONAL SOLAR RADIATION DATABASE

India Solar Resource Data

Enhanced Data for Accelerated Deployment

As solar energy systems become increasingly prevalent, utility planners and grid system operators will need to understand how high penetrations of variable solar energy will impact the electric grid. To do this appropriately, utility planners will need to model the long-term performance and short-term variability of solar technologies, as well as synchronize the solar generation with the load and other variable generation sources like wind.

This will require high-resolution solar radiation data for long periods of time and a clear understanding of their spatial and temporal correlation. However, collecting high-quality, reliable direct normal irradiance (DNI) and global horizontal irradiance (GHI) data for sufficient periods of time is a challenge. Although surface measurements are the most accurate, obtaining such measurements for regional solar resource assessments is not practical. And even if a site of interest were instrumented now, it would take years to produce a time series long enough for the required analysis.

To address both the lack of spatial coverage and the limited availability of time series data, researchers at the National Renewable Energy Laboratory (NREL) have developed methods to retrieve DNI and GHI data from satellite measurements.

Under a bilateral partnership between the United States and India, the NREL has developed 15-minute and 4-km x 4-km temporal and spatial resolution solar resource data for the period from 2017 to 2019.

Using the Physical Solar Model, Version 3 (PSM V3), NREL—in collaboration with the University of Wisconsin and the National Oceanic and Atmospheric Administration—produced modeled surface solar irradiance based on Meteosat-8 satellite-based cloud information. PSM V3 takes a physics-based radiative transfer approach to model surface solar irradiance using cloud properties processed from raw satellite data and ancillary data, such as aerosol optical depth and precipitable water vapor from the Modern-Era Retrospective Analysis for Research and Applications, Version 2 (MERRA-2). NREL validated the modeled surface solar irradiance using data from 10 high-quality ground measurement stations from the Baseline Surface Radiation Network. The modeled data showed good correlation with the ground measurement data. Because of the satellite viewing geometry, the farthest locations from the Meteosat satellite demonstrated higher uncertainties than locations closer to satellite nadir.

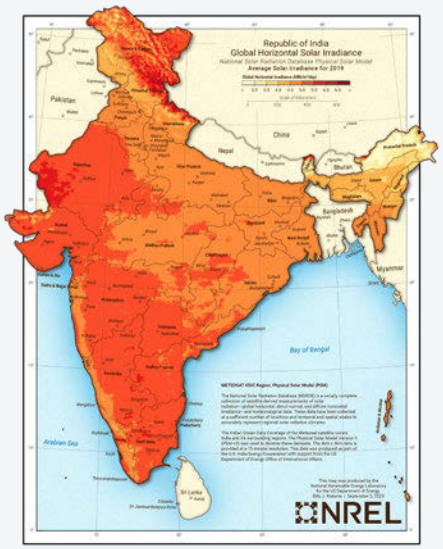

Figure 1. Annual Global Horizontal Irradiance *Figure by Billy J. Roberts, NREL*

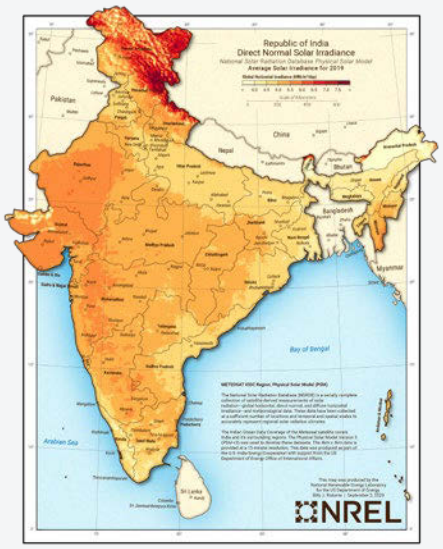

Figure 2. Annual Direct Normal Irradiance *Figure by Billy J. Roberts, NREL*

Accessing the Data

The data set can be accessed directly at nsrdb.nrel.gov. The solar resource data are available for the three solar irradiance components: GHI, DNI, and diffuse horizontal irradiance. Other meteorological parameters, such as temperature, wind speed, and relative humidity, are also available.

The data is available in two formats—GIS summary maps or a time series format. The data can also be accessed programmatically using an application programming interface. For instructions, users can refer to developer.nrel.gov/docs/solar/nsrdb. To directly access performance and financial projection calculations, use NREL's System Advisor Model at sam.nrel.gov.

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NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

NREL/FS-5D00-78025 • October 2020

This work was funded by the U.S. Department of Energy's International Affairs and Office of Energy Efficiency & Renewable Energy International. The data were developed in coordination with India's Bureau of Oceans and International Environmental and Scientific Affairs.