Center for Electric & Hydrogen Technologies & Systems

Resource Integration Group

Data, Analysis, and Measurements of Renewable Energy Resources

Renewable resources can vary considerably from one geographic location to another. Consequently, optimal siting of renewable energy systems requires knowledge of the resource characteristics at any given location. Determining these characteristics — magnitude and variability — draws on the combined knowledge of measurement experts, modelers, and analysts.

The Resource Integration Group provides renewable resource data for U.S. and international locations, and includes a Geographic Information System (GIS) Team and a Measurement and Instrumentation Team.

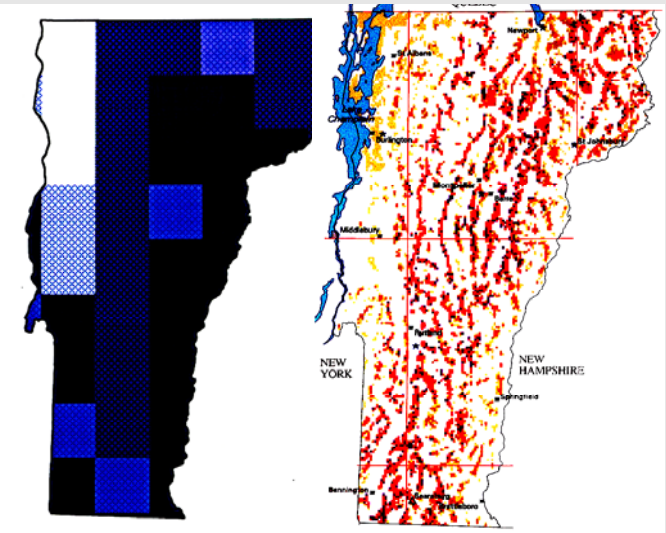
Modeling

Using satellite and ground-based weather information, the Resource Integration Group constantly upgrades and refines its solar resource models. The group uses these models to provide reliable and accurate data and maps on the solar resource anywhere in the world. The data generated by these models is used by industry, government planners, and others to find the most likely locations of favorable renewable energy resources, or to define the resource at specific locations where renewable technologies might be installed to meet a particular need. The data serve as a reliable guide for the user to perform follow-up analysis for siting and sizing renewable energy systems.

Using meteorological data from weather stations around the world, the group has developed models that can provide hour-by-hour solar radiation data at thousands of locations. These data can be used to predict the performance of stand-alone and grid-connected solar systems for any time period (hourly, daily, monthly, etc.), and how well those systems may meet load requirements.

Geographic Information System Capabilities

The GIS team uses geographic information system software to organize, display, and analyze geospatial data important to solar, wind, biomass, and geothermal technologies. They manipulate, analyze, and compare the sets of data in map formats to extract information for optimized technology deployment. For example, to determine whether a particular type of solar technology would pay back on a startup investment, one could use



Wind resource modeling, 1987 and today. Through continual improvement of models and data, the group can now provide high-resolution wind maps as valuable tools for siting wind turbines.

GIS data to compare a region's solar resource with its electrical transmission network, the local cost of electricity, and the characteristics of the load.

The capabilities of GIS are greatly enhanced by NREL's team of experts — who can perform the manipulation and analysis and who can link topographic, demographic, utility, facility, resource, environmental, land use, and other data for a variety of uses, including energy planning and forecasting, policy formulation, and project development assistance.

This team of experts also developed a map server that allows users access to GIS data sets to generate their own maps and to perform their own analysis. Users can access NREL's resource data and GIS capabilities through the Internet at http://www.nrel.gov/gis.

Measurements and Instrumentation

The Solar Radiation Research Laboratory (SRRL) is a unique research facility located on South Table Mountain in Golden, Colorado. The lab continually measures solar radiation and other meteorological data and disseminates the information to government, industry, academia, and international laboratories and agencies. The measured data include global, diffuse, and direct-normal solar radiation, ultraviolet and infrared

radiation, atmospheric aerosols, wind speed and direction, temperature, barometric pressure, relative humidity, and more. These research-quality meteorological data are used for climate change studies, atmospheric research, renewable energy conversion system testing, and more.

The SRRL performs a wide range of measurement functions, including:

- Maintaining a baseline measurement system, an array of more than 70 instruments to collect minute-by-minute radiation and atmospheric data. Among other applications, these data are used by the World Meteorological Organization's World Radiation Data Centre.
- Developing and operating the NREL Metrology Laboratory for calibrating pyranometers, pyrheliometers, and other measurement and test equipment, with calibrations traceable to national and international standards.
- Serving as a U.S. source for maintaining and transferring international radiometer calibration standards to government, industry, and academic laboratories.
- Operating the Optics Laboratory designed to support the outdoor and indoor characterization of photovoltaic devices with broadband and spectral irradiance standards.
- Providing research support for measurement networks such as radiometer calibration techniques for the Atmospheric Radiation Measurement (ARM) program, DOE's global climate change research program.

Additional information, including real-time data displays and access to the SRRL Baseline Measurement System are available at http://www.nrel.gov/srrl.

Combined Capabilities

NREL's Resource Integration Group brings expertise and resources to provide the data and tools necessary to address leading-edge renewable-energy resource issues, both domestically and internationally.

To support system design and project planning and to promote the understanding of renewable resource collection, analysis, and modeling, the Resource Integration Group develops and disseminates data manuals, resource maps, and other data products. Typically, these products provide data on the renewable resource across large regions. But for particular projects or user's special needs, the group also develops customized maps and data sets.

The SRRL employs scores of instruments to measure radiation and atmospheric data. This particular setup measures global and direct-beam irradiance, ultra-violet radiation, atmospheric aerosols, wind speed and direction, ambient temperature, relative humidity, and barometric pressure.

General products immediately available to the public in printed, electronic, or on-line formats include:

- Maps and atlases of solar and wind resources for monthly, seasonal, and annual periods.
- Base maps of biomass and geothermal resource data provided by other research groups.
- Manuals on solar radiation data, solar spectral models, and more.
- Glossaries.
- Primers on solar radiation data and its measurement.

The Resource Integration Group's Renewable Resource Data Center posts some of this information at http://rredc.nrel.gov.

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