NASA's Prediction of Worldwide Energy Resource (POWER) Web Services

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Introduction:

The Prediction of Worldwide Energy Resource (POWER) home page at http://power.larc.nasa.gov is the central web portal providing user-friendly access to solar radiation and meteorology data useful for renewable energy technologies. The POWER project team is developing the commercial potential of NASA's cloud, radiation, and meteorology data by working closely with partners from government, commercial industry, educational, and non-profit organizations. To this end, POWER is developing and improving web based portals that accomplish the dissemination of this information to industry and research sectors with parameters and formats specifically targeted to needs within the energy, buildings, and agriculture industries. POWER is building upon the success and lessons learned by the Surface meteorology and Solar Energy Project (SSE-http://eosweb.larc.nasa.gov/sse), which is now a core component of the POWER project. Currently useful in a variety of applications, future versions of these data have the potential to significantly advance the global adoption of renewable energy technologies, facilitate the design of sustainable buildings, and the development of more efficient agricultural practices.

Surface meteorology and Solar Energy:

Since its initial release in 1997, the SSE archive has undergone multiple revisions. Each new release is a result of incorporating improved data sets into the data processing scheme, expanding the temporal coverage of the data parameters, improving and refining data processing techniques, and new parameters based upon suggestions from industry partners and requests by the public. Currently, release 6 of SSE contains over 200 parameters based on surface solar radiation derived from satellite observations and meteorology from NASA Goddard's Earth Observing System assimilation models. Daily and monthly parameters averaged from 22 years of data (1983 - 2005) are available on a global 1-degree latitude/longitude grid. These parameters are used to optimize both traditional and renewable energy systems for power production and/or increase energy efficiency of optimized building electricity and heating/cooling systems.

Sustainable Buildings:

The building engineering/architecture sector requires the direct normal radiation and diffuse radiation on various time scales in order to better optimize building orientation, passive and active solar heating devices, and the size of heating, ventilation, air-conditioning, and refrigeration systems. A new sustainable buildings prototype has been developed to test delivery of parameters tailored to the data requirements of this sector.

Agroclimatology:

Data parameters include daily values of surface solar radiation, near surface air temperatures, and precipitation all of which are critical inputs to most agricultural decision support tools. An important characteristic of the POWER data is that it is global and spans the time period from 1983 to within several days of current time. Data from the Agroclimatology archive are now being used to augment climate change hydrological studies in Bolivia by the World Bank and to support the evaluation of over 5000 maize crop lines at various locations by researches at ARS, USDA.

Decision Support Tools:

A particularly noteworthy application of the SSE data parameters is through the Renewable Energy Technology Screen (RETScreen) International project (http://www.retscreen.net/) developed by Natural Resources Canada. RETScreen is a Decision Support Tool that allows engineers, technicians and architects to evaluate the energy production and savings, costs, emission reductions, financial viability and risk for various types of Renewable-energy and Energy-efficient Technologies (RETs) most of which are specifically designed for use in building systems. The SSE data are an important component of the environmental data underlying RETScreen. The RETScreen tool is available via the

web allowing for a complete global integration of SSE parameters. RETScreen also provides a CD version of their software containing basic meteorological and solar energy parameter from every registered city in the world. Over half of those cities worldwide have incomplete or no reliable data measurements and SSE data were supplied to the users for those areas.

The Hybrid Optimization Model for Electric Renewables (HOMER), developed at the National Renewable Energy Laboratory (NREL), uses the POWER web portal. Data requests delivered via the web are directly ingested into the HOMER tool. HOMER is a computer model that evaluates design options for both off-grid and grid-connected power systems for remote, standalone, and distributed generation applications.

A pilot program at Battelle uses POWER near real-time data to enhance energy utility load forecasting. Model runs with and without the POWER data input have demonstrated to reduce the mean absolute percent error (MAPE).

Near Real-time Data:
Within the POWER project, the temporal span of radiation and meteorological parameters is being extended beyond the 22-year period to near real-time. More than 27 years of data are currently available. Year-by-year daily, monthly and annual averages of many parameters, which may provide details of interannual variability, are obtainable. Radiation parameters are available within seven days and meteorology parameters are available within three days before the present time.

Summary:
Satellite based products have been shown to be accurate enough to provide reliable solar resource data over regions where surface measurements are sparse or nonexistent. Insolation and many other environmental parameters (e.g. cloud amount, air pressure, average/minimum/maximum air temperature, relative humidity, dew point temperature, earth skin temperature, wind speed) of interest to the above-mentioned industries are made available on a worldwide basis through the POWER web portal. The latest developments of the POWER project will be presented.

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