REexplorer
MAPPING OUR ENERGY FUTURE

www.re-explorer.org

Data for Renewable Energy Planning, Policy, and Investment

Reliable, robust, and validated data are critical for informed planning, policy development, and investment in the clean energy sector. The Renewable Energy (RE) Explorer was developed to support data-driven renewable energy analysis that can inform key renewable energy decisions globally. This document presents the types of geospatial and other data at the core of renewable energy analysis and decision making. Individual data sets used to inform decisions vary in relation to spatial and temporal resolution, quality, and overall usefulness. *From Data to Decisions,* a complementary geospatial data and analysis decision guide, provides an in-depth view of these and other considerations to enable data-driven planning, policymaking, and investment.

Data support a wide variety of renewable energy analyses and decisions, including technical and economic potential assessment, renewable energy zone analysis, grid integration, risk and resiliency identification, electrification, and distributed solar photovoltaic potential. This fact sheet provides information on the types of data that are important for renewable energy decision making using the *RE Data Explorer* or similar types of geospatial analysis tools.

Key Data Definitions for Renewable Energy Decisions

Geospatial data describe the relative position of something on the earth's surface. Examples include the location of roads, cities, protected lands, and transmission infrastructure.

Temporal data describe the time characteristics of data. For example, at a given place on the earth's surface, there will be different amounts of solar irradiance (or sunshine) during different hours of the day.

Renewable energy data are characterized temporally and spatially.

Analyses for Renewable Energy Decision Making

The data outlined in this fact sheet feed into various analytical approaches that can inform renewable energy decisions, including:

- **Mapping and visualization** can play a role in early stages of analysis through data exploration as well as later stages through visualization of analytical outcomes.
- **Generator performance modeling** illustrates the amount of energy that could be produced by a renewable energy system given the resource potential and system configuration.
- **Technical potential analysis** shows the achievable energy capacity and generation of a particular technology given resource potential, system performance, topographic limitations, environmental attributes, and land-use constraints.
- **Supply curve modeling** blends technical potential, interconnection cost, energy cost, and regional competition to provide a geographically discrete, national estimate of renewable energy supply and cost.
- **Economic potential analysis** defines the subset of the available resource technical potential where the cost required to generate electricity is below the revenue available in terms of displaced energy and displaced capacity.
- **Capacity expansion modeling** analyzes long-term electricity system capacity expansion, including power generation technologies and transmission infrastructure.
- **Production cost modeling** optimizes energy supply and demand resources in relation to demand over a specified period of time.

These analyses depend on the availability, quality, and resolution of data. More information is available in a report, *From Data to Decisions – A Guide to Geospatial RE Planning*, which provides detailed information on how data link to specific analyses and key decision areas.

Data Quality

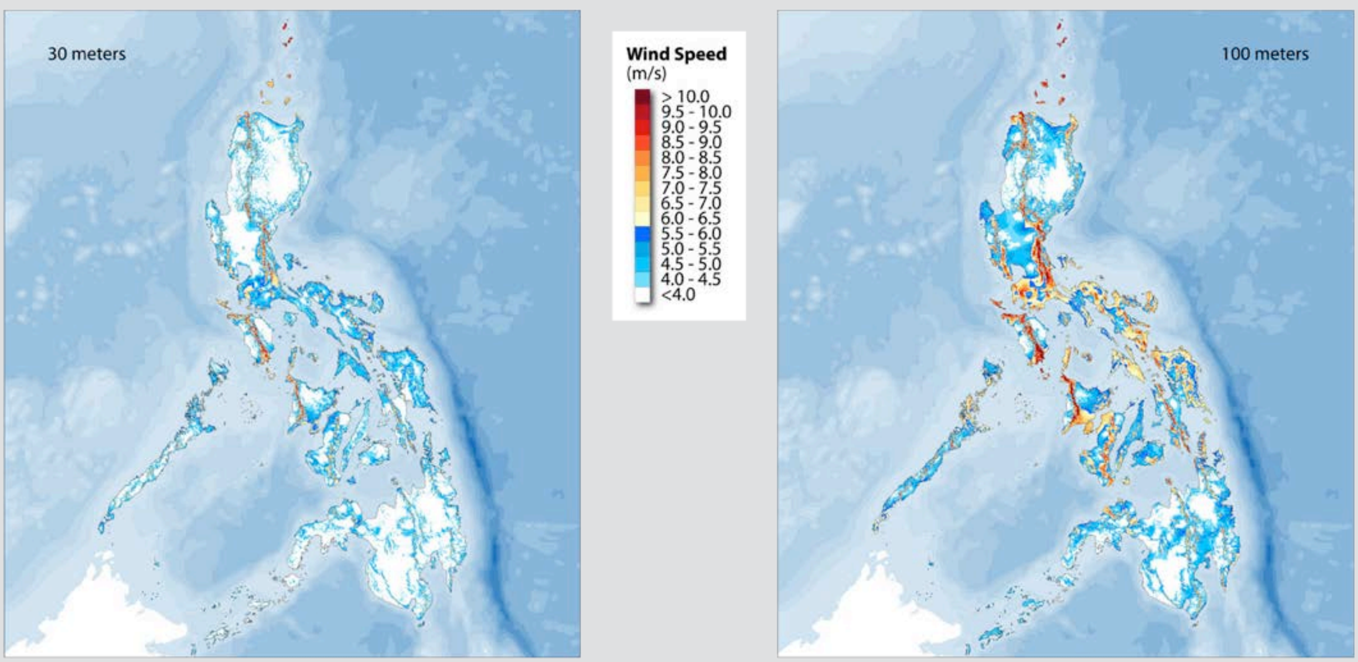
Data quality can vary widely for any given data set. If the data vary spatially, the distance between data points can affect the quality of the data. Similarly, if the data vary by time, the frequency of the data (e.g., 15 minutes, hourly, monthly, yearly) will affect the quality of the data. The year of the demographic data and the specificity of electricity infrastructure data sets will also contribute to the overall usefulness of the data. The quality of the data will have a direct impact on the type of analysis it can be used for.

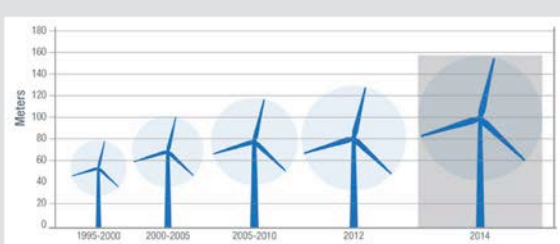
The RE Data Explorer: Mapping Our Renewable Energy Future

The RE Data Explorer, developed by the National Renewable Energy Laboratory, is an innovative web-based platform that allows users to assess and visualize renewable energy potential. The RE Data Explorer informs prospecting, integrated planning, and policymaking to enable clean energy scale-up. Access the RE Data Explorer through the RE Explorer web portal at *www.re-explorer.org*.

Hub-Height Data to Inform Wind Development

Fifteen to twenty years ago, utility-scale wind turbines typically had hub heights between 30 and 60 m. Today, wind turbine hub heights are typically between 80 and 100 m and can even be as high as 120 m. As illustrated in the figure, wind data for 30 m and 100 m over the same region can have very different results. In this map of the Philippines, decision makers considering utility-scale applications would be misled if they were pursuing exercises to set wind goals or discussing opportunities with developers using 30-m wind data. The 100-m data illustrate a much more robust wind resource for utility-scale development highlighted by increased land opportunities with higher wind speeds that are suitable for development.





These images show the difference in available resources in the Philippines when comparing 30-m hub-height data to 100-m hub-height data. The increase in warmer color tones (yellows, oranges, and reds) depicts more areas with wind speeds over 6.5 m/s in the map on the right.

Examples of key data sets to inform renewable energy decisions include:

Renewable energy resource data. Renewable energy resource data sets provide information on the availability of a particular renewable energy source, such as the quantity of feedstocks or the characteristics of solar energy, for a particular location. Renewable energy resource availability differs in relation to location and, for variable resources (e.g., solar and wind), in relation to time.

- Wind (e.g., wind speeds, power density, ground measurements)
- Solar (e.g., irradiance, ground measurements)
- Biomass (e.g., crop or forestry residue)
- Hydro
- Geothermal
- Marine hydrokinetic.

Administrative. Census data, including population density and local boundaries, can be useful for understanding if renewable energy resources are situated within, near, or far from population centers.

- Population density or distribution
- Boundaries (e.g., province, district).

Environmental. Topographic limitations, environmental attributes, and land-use constraints can affect the achievable energy capacity and generation of a particular technology.

- Designated protected areas
- Land cover or land use
- Elevation
- Water bodies (e.g., rivers, lakes).

Infrastructure. The location of non-electricity-related infrastructure, such as roads, can affect the achievable energy capacity and generation of a particular technology.

Grid. Data sets that depict transmission infrastructure and other grid attributes can help decision makers understand the relationship between resources and the infrastructure that will transport those resources.

- Electricity transmission and/or distribution lines
- Electricity substations
- Power plants (e.g., location, type, operational status)
- Other energy infrastructure (e.g., natural gas pipelines).

Development. Renewable energy decisions can align with key development goals.

- Electrification rates
- Poverty rates
- Vulnerable communities (e.g., indigenous populations, populations relying on subsistence farming)
- Economically important and/or sensitive fisheries (marine or freshwater)
- Cropland type and productivity
- Land ownership
- Any other data set that can help inform the identification of tradeoffs and synergies between renewable energy development and other national development goals.

Natural hazards. Extreme weather events and other natural hazards can affect achievable energy generation and feed into resilience planning and decisions.

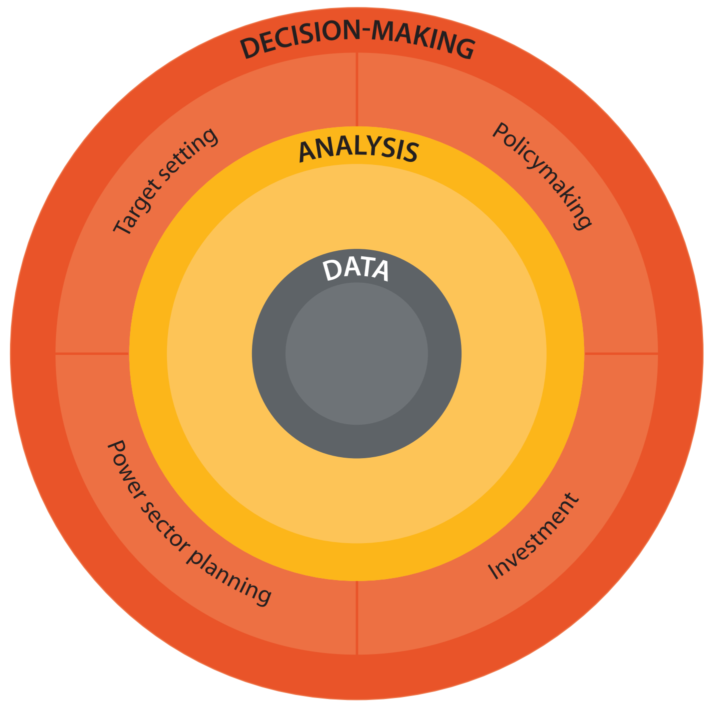
- Fault lines
- Tsunami frequency
- Landslide frequency
- Fire risk
- Earthquake frequency
- Drought events
- Flood risk
- Heatwave risk
- Tornado risk.

Energy demand and costs. Energy demand and cost measurements inform economic potential, which is one measure of renewable capacity and generation potential.

- Electricity and/or heating demand (e.g., by end-use sector, primary fuel)
- Electricity and/or heating price (e.g., marginal generation or wholesale energy market price, retail rates, projected energy price)
- Building inventory (e.g., building count, building type/area, occupancy rates, roof area, roof suitability)
- Critical loads
- Technology cost (e.g., levelized cost of energy, construction cost, operations and maintenance cost, fixed operating cost, variable operating cost, fixed charge rate, transmission costs)
- Incentives (e.g., net-metering policy, feed-in tariff policy)
- Any other data set that allows for the characterization of energy usage/demand in a given region.

If you are interested in assessing availability of geospatial data to support decisions in your country or jurisdiction, an RE Explorer data gap assessment tool is freely available on the *RE Explorer website*.

The RE Explorer portal, *re-explorer.org*, houses the RE Data Explorer tools and provides training materials and information on data-driven decision making and on the RE Data Explorer tools.



Data-analysis-decisions nexus: Data are at the core of renewable energy decision making. With the right data, stakeholders can conduct analysis that supports various decision making, including target setting, policymaking, power sector planning, and investment.

NREL NATIONAL RENEWABLE ENERGY LABORATORY | USAID FROM THE AMERICAN PEOPLE

The *RE Explorer* provides renewable energy data, analytical tools, guidance resources, and technical assistance to developers, policymakers, and decision makers in developing countries. RE Explorer and the RE Data Explorer are developed by the *National Renewable Energy Laboratory* and supported by the U.S. Agency for International Development.

NREL/FS-6A20-68899 | August 2017

For more information:

Jennifer Leisch
USAID Office of Global Climate Change
Tel: +1-303-913-0103
Email: jleisch@usaid.gov

Sadie Cox
National Renewable Energy Laboratory
Tel: +1-303-384-7391
Email: sadie.cox@nrel.gov