



Updated Philippines Wind Re-Analysis

E. Ian Baring-Gould

Philippines Wind Stakeholder Meeting ADB Manila, Philippines

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.

Original Philippines Wind Resource Assessment

Completed in 2001, the original wind map was conducted at 50m, 1km resolution, annual average wind speed and power density only.

Used NREL Proprietary Re-Analysis Models



Wind Resource Assessment Considerations

Important wind characteristics:

- Wind shear, spatial and temporal variations, terrain influences
- Seasonal and diurnal wind patterns
- Wind direction and speed frequencies
- Turbulence and complex terrain influences
- Extreme weather events

New wind resource tools:

- Greatly improved wind modeling
- Computational based world wide wind data sets are available
- Validation of regional modeled wind speeds with tower based measurement sites
- Better understanding of wind changes with height
- For some locations, virtual measurement can be obtained which can help spur wind development



Best areas 7.5-8.2 m/s Capacity factors 40-45%



High Resolution Wind Mapping

The "Changing" wind of North Dakota



1987

20 km resolution 30 m height No ground cover Minimal terrain data

2000

1 km resolution 50 m height Basic ground cover Good terrain data

2010

200 m resolution Multiple heights (80m) Good ground cover Excellent terrain data

With the new and expanded availability of data, increasing computational power and better prediction models, the ability to conduct national wind assessments has increased almost exponentially

This allows developers and policy makers to better assess potential

Changes in Turbine Technology

Rapidly changing turbine technology focused on taller turbine towers and larger turbine rotors (longer blades) are changing the landscape of wind development.



US Wind Resource



Changes in Viable Wind Deployment



Class III turbine, 117m rotor on a 140m tower

Planned Results:

1km resolution

- Surface type, elevation, surface roughness
- Annual and monthly wind speed, wind power density, Weibull k values, temperature, and air density at 30 m, 50 m, 80 m, 100 m, 140m, and 200m heights

2.5 km (or finer) resolution

 24 hourly values of wind speed, wind power density, Weibull k, temperature, air density, wind rose and speed frequency distributions by month and annual average again at 30 m, 50 m, 80 m, 100 m, 140m, and 200m heights

Annual Average Gross Capacity Factor (1km grid at 80m & 100m)

- IEC Class I turbine power curve
- IEC Class II turbine power curve
- IEC Class III turbine power curve

Time Series Meteorological

- Typical Meteorological Year of wind speed, direction, temperature, and pressure at heights of 80 m and 100 m
- The data shall be generated for one representative location for every 10 km by 10 km grid cell with the representative location that is within 20% of the highest wind resource in the 10 km cell.
- Land and ocean areas shall be treated separately.
- Expected products:
- Wind speed and turbine capacity maps
- Data provided into Geospatial Toolkit (GsT)
- Detailed data made widely available

USAID/ADB/NREL Mapping RFP

Five companies expressed interest

- GL Garrad Hassan
- AWS Truepower
- 3 Tier
- UCAR/NCAR Resource Group
- MeteoGroup USA

General procedure

- Using WRF to do high level re-analysis (to ~2.5km)
- Different models to look at topography, surface roughness and shear

General Timeline

- Draft data due in 2 months
- Final data due in 6 months
- Gross capacity factor in 6 months
- Hourly time series of wind and other meteorological data 6 months
- Final project report in 7 months

Ground truth data...any data is better than no data..

NDA's can be signed with any organization and can specify the level of engagement, data use, if the data is shared with NREL only or shared with contractor, "returned" after use etc.

NREL conducts NDA's with developers, government agencies, wind resource companies and consultants all of the time.

Non-Disclosure Agreement (NDA) Enhancing Short Term Wind Energy Forecasting for Improved Utility Operations DOE Funding Opportunity Announcement Award To protect certain Protected Data and Proprietary Information.

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- Wind speed, standard deviation, and wind direction at multiple heights, temperature and pressure
- Boom orientations of the wind speed sensors for shadow calcs.
- Site metadata (lat, long, elevation, site description) map location
 Love: 10-min time-series raw logger data
 Really need: 6 hour average time series and statistics
- All of the above with a strong focus on wind shear, directional shear and diurnal profiles – all by month
- Turbulence intensity based on 10m data; annually and seasonally by direction and wind speed
- Wind rose with speed frequency, annually and monthly

Questions

What questions do you have?

My Questions:

- How useful will this be as described?
- What additional information would be helpful?
- How should we make the detailed data available?
- What tower based data would be available and under what conditions?





E. Ian Baring-Gould

Technology Deployment Manager

National Wind Technology Center & Deployment and Industrial Partnerships

303-384-7021

Ian.baring-gould@nrel.gov

www.nrel.gov