STATEMENT OF WORK

Tall Tower Wind Data
March 19, 2009

1.0 BACKGROUND

Wind speed measurements are critical to validating 100-meter wind resources; developing wind plant power curves for use in integration studies; improving wind power forecasting; validating, calibrating and improving mesoscale models for use in integration studies; and understanding micro-effects in wind plants.

The high resolution state wind maps produced under the aegis of the National Renewable Energy Laboratory (NREL) and others since 1999 have greatly facilitated wind energy development in the United States. By highlighting the areas most likely to have a good wind resource the wind maps have helped focus wind energy development efforts and inform public policy related to wind energy development.

For historical reasons the wind maps developed to date are referenced at 50 meters above ground level (AGL). Back in the late 1990s 50 meters was a common hub height for utility scale wind turbines. Thus the maps provided the most accurate information available at the most useful height. In recent years utility scale wind turbine hub heights have increased to 80-100 meters. Recent wind resource assessment research indicates that the wind resource at 80-100 meters often differs markedly from what simple extrapolation from 50 meters would indicate.

A new set of wind maps is required that show the wind resource at 80-100 meters to enable continued identification of good wind resource areas. This is especially important in areas such the Great Lakes Region where the modest wind resource at 50 meters AGL has, until recently, generally precluded large scale wind energy projects. Wind development in regions such as this can help reduce the new transmission needed to achieve the US Department of Energy's 20% Wind Scenario. These new wind maps in turn require good data at 80 m, 100 m, and above.

Both wind power forecasting and meso-scale modeling for integration studies typically rely on single wind speed location to estimate the power output from wind plants that include many turbines. These 'wind plant power curves' are often terrain dependent and not well understood.

The Subcontractor shall provide tall tower wind time series data sets for use in validating meso-scale models and validating wind farm power curves. The Subcontractor shall provide data sets that focus on on wind speed measurements to help validate 100-meter wind maps in the Great Lakes region and the development of wind plant power curves, but wind measurements that may help the mesoscale modeling process and our understanding or micro-effects shall also be considered.

In order to develop 'wind plant power curves', the Subcontractor shall provide:

- Wind speed data from sites that are within 10 km of the wind plants listed in Appendix 1 and Appendix 2 and cover all or part of the time period specified.
- Temporally correlated, co-located wind plant output and wind speed data.

2.0 OBJECTIVES

Through this effort the Subcontractor shall provide tall tower wind time series data sets for use in validating meso-scale models and validating wind farm power curves.

3.0 TASKS

The Subcontractor shall provide wind data sets that meet the following criteria:

1. The data set must include data taken at a minimum of 70m AGL
2. The data set must include data for at least 9 months
3. The data averaging interval must be 10 minutes or less
4. Minimum sampling interval is 5 seconds (0.2 Hz)
5. The data must contain the actual measurements. It may not include interpolated or fill-in data
6. At a minimum the data must include wind speed, wind speed standard deviation, and wind direction. Wind direction is required for at least one level.
7. Preferred geographic regions (however data from any location in the continental US will be considered):
   a. Great Lakes (especially in or near OH, IN, MI, WI)
   b. Within 10 km of the locations listed in Appendix 1 and Appendix 2

4.0 DELIVERABLES

The Subcontractor shall submit in ASCII format (comma delimited, tab delimited, etc) the following information for each dataset:

1. Wind speed, wind speed standard deviation, and wind direction.
2. Type of measurement (anemometer, SODAR, LIDAR, etc)
3. Period of measurement. Please state whether or not monitoring is ongoing.
4. Location (latitude, longitude, elevation)
5. Topo map (1:24,000 or greater resolution) showing station location
6. Description and/or photos describing the terrain and cover around the site
7. History of the site during monitoring, e.g. Was a wind farm installed part way during monitoring?
8. Tower description and dimensions
9. Photo of the tower
10. Tower configuration information including: sensor height and orientation & length of mounting booms
11. Sensor make & model
12. Sensor calibration history
13. Other data included in the data set (e.g. temperature, pressure, etc.)
14. Sampling interval
15. Averaging interval
16. Whether the wind data falls into wind power class 1-2, 3-4, or 5+ at the highest level
17. How complete the dataset is [%]

Due upon completion of the subcontract.

DELIVERABLE ADDRESSES - The Subcontractor shall clearly label all deliverables with the subcontractor name, NREL subcontract number, NREL Technical Monitor name, date, and the deliverable description (e.g., First Quarterly Report, Draft Final Report). Deliverables shall be sent to the following addresses:

National Renewable Energy Laboratory
Attn: ***, Technical Monitor, M/S ***
1617 Cole Blvd.
Golden, CO 80401
Email Address: ****@nrel.gov

- One (1) master electronic version
- One (1) master printed copy, including graphics, and one copy

National Renewable Energy Laboratory
Attn: ***, M/S ***
1617 Cole Blvd.
Golden, CO 80401

- One (1) printed copy of the data set transmittal letter

Appendix 1. List of wind plants for wind speed data from 2004 onward or the in-service date onward.

Name	Location	Total Cap.	Starting Year
Ponnequin	Weld County, CO	30 MW	1999
Lake Benton	Lincoln County, MN	103 MW	2000
Storm Lake	Buena Vista County, IA	113 MW	2001
Buffalo Ridge	Pipestone County, MN	240 MW	2001
Stateline	Walla Walla County, WA	90 MW	2002
Vansycle	Umatila County, OR	25 MW	2002
Condon	Gillam County, OR	50 MW	2002
Nine Canyon	Benton County, WA	20 MW	2002
Klondike	Sherman County, OR	40 MW	2002
Texas Wind Power Project	Culberson county, TX	35 MW	2003
Indian Mesa	Pecos County, TX	83 MW	2003
King Mountain	Upton County, TX	79 MW	2003
Trent Mesa	Taylor county, TX	150 MW	2003
NM Wind Energy Center	Quay & DeBaca, NM	204 MW	2003
Colorado Green	Prowers County, CO	162 MW	2003
Blue Canyon	Comanche County, OK	74 MW	2004
Brazos Wind Ranch	Borden and Scurry Counties, TX	160 MW	2003
Horse Hollow Wind Energy	Taylor and Nolan Counties, TX	735 MW	2005
Callahan Divide Wind Energy	Taylor County, TX	114 MW	2005
King Mountain Wind Farm	Upton County, TX	278 MW	2001
Woodward Mountain Wind	Pecos County, TX	160 MW	2001
Trent Mesa Wind Project	Taylor and Nolan Counties, TX	150 MW	2001
Desert Sky Wind Farm	Pecos County, TX	160 MW	2002
Indian Mesa Wind Farm	Pecos County, TX	83 MW	2001
Delaware Mountain Wind	Culberson County, TX	30 MW	1999
Texas Wind Power Project	Culberson County, TX	35 MW	1995
Big Spring Wind Power	Howard County, TX	34 MW	1999
Southwest Mesa Wind Farm	Upton County, TX	75 MW	1999
Buffalo Gap I & II	Taylor and Nolan Counties, TX	120 MW	2007
Sweetwater Wind Farm	Nolan County, TX	585 MW	2003
Camp Springs I & II	Scurry County, TX	250 MW	2007
Forest Creek Wind Farm	Glasscock and Sterling Counties, TX	124 MW	2007
Sand Bluff	Glasscock and Sterling Counties, TX	90 MW	2007
Capricorn Ridge Wind Farm	Sterling and Coke Counties, TX	215 MW	2007
Lone Creek Post Oak	Shackelford County, TX	200 MW	2008
Red Canyon	Borden, Garza and Scurry Counties, TX	84 MW	2006
Whirlwind	Floyd County, TX	60 MW	2007
ENEL Snyder Wind Project	Scurry County, TX	63 MW	2007

Appendix 2: List of wind plants for wind speed data from 2007 onward or the in-service date onward.

Name	Location	Total Cap.	Starting Year
Peetz Table	Logan County, CO	400	2001
Cedar Creek	Weld County, CO	300	2008
Fenton Wind Project	Murray/Nobles Counties, MN	205	2007
Chanarambie	Murray County, MN	85	2003
Minn-Dakota	Lincoln County, MN	150	2008
JD Wind	Hansford County, TX	150	2008
Wildorado	Potter, Oldham and Randall Counties, TX	161	2007