PO.0117	From Ba A Er	ankable Opportunity to Oper New Approach for Wind Far ik Koppen, Jim Young, Zivorad Radonjic, Gerwin Brand ARCADIS	rations – ms sen
	Abstract	Objectives	Results

From Global Observations Meteo Stations



To Local Wind Resource Data for Bovina



FReSH Wind has been shown to forecast wind energy availability correctly, in advance and consistently over a year (all seasons). The results for a site in Bovina, Texas (USA) are shown below at a height of 75 metres.

OBSERVED versus PREDICTED

Hourly Wind Direction on 12-26 March 2011



The challenges with wind energy projects are: 1) To provide evidence that the wind resource in a given location is worth an investment (is "bankable"). 2) To obtain the most energy possible out of day-to-day operations in a way that is predictable and therefore "saleable".

"Bankability" has historically been judged by using on-site measurements over at least a year. These measurements can be as simple as a 10-metre high anemometer at the project location converted to the height of the proposed turbine hub. They can also be as complex as measuring wind speed, direction and density at the proposed hub height using one or a series of tall towers. These measurements can be very expensive and time consuming.

"Saleability" can be improved through weather forecasting for the area of a wind farm but most weather models run on a 15×15 kilometre grid spacing and cannot hope to reproduce local details which have to be corrected for statistically using the historical measurement records.

The first objective is to **reduce the lead time and costs** of wind resource assessments in the (pre-) feasibility phase. Or to improve the accuracy compared to a resource assessment based on standard wind atlas files. The second objective is to improve the **accuracy** in the investment and operational phase.

Reducing the margin of error & Improving bankability and saleability!



Hourly Wind Speed on 12-26 March 2011







Mean Wind Direction per Month in 2011

Since each location (even within a wind farm site) is unique, the above approaches will have errors and uncertainties which can degrade both "bankability" and "saleability" making lenders more reluctant and power purchasers pay less for uncertain power.

A new approach which uses a state-of-the-science weather model running on a very fine scale (1 × 1) kilometres or less) can overcome both of these issues by providing a location specific data set of **10**minute average values over a period of 10 years, or more, to improve "bankability" as well as a turbine by turbine power forecast for the next day or two improve "saleability".

Global historic observations per 6 hours

Method - FReSH Wind

Long Term Wind Climate

FReSH Wind uses FReSH in the hindcasting mode. Hindcasting uses analysis fields. Analysis fields are the globally observed real data pre-processed to balance all physical forces into a **3-dimensional grid** of boundary conditions. In this mode the analysis fields from NCEP every 6 hours are used as the boundary conditions and a forecast is made using a full weather model (WRF-NMM). The analysis field boundary conditions nudge the forecast in the direction of the observations. A nested approach is used to go



Mean Wind Speed per Direction January - September 2011



Annual Energy Production

Expected energy production based on predicted wind resource is about 7 to 10% lower than production based on observed wind resource (depending on turbine type).

• Meteo conditions (wind speed, wind direction, temperature, humidity etc.) · Time-dependent surface fields (soil temperature, soil moisture etc

Time-independent surface fields (roughness, elevation)



from a global level to a local level. For each project the accuracy of the generated wind resource data is demonstrated by comparing it to measurements.

Short Term Wind Power Forecast

Once a wind turbine array is in place, hourly energy availability can be forecast, using the same system, for power distribution and availability planning purposes. This forecast can be as simple as an hourly forecast for a farm updated once per day or as complex as an hourly turbine-by-turbine forecast updated as the weather changes.

Conclusions

The results for Bovina show FReSH Wind predicts the local wind resource at hub height with a similar, if not overall better, accuracy than the traditionally used methods. The main advantage of a wind resource assessment by FReSH Wind is that it delivers reliable detailed data for multiple years at multiple positions and multiple heights, while the lead time and cost are considerably reduced compared to measurements.

For more information or to discuss what FReSH Wind can do for you and your projects feel free to contact us: erik.koppen@arcadis.nl



EWEA Wind Power Forecasting Technology Workshop, Rotterdam, 3-4 December 2013

