

Power Curve Working Group Meeting Minutes

Impact of 'non-standard' inflow

8th Meeting Minutes, Monday 6th October 2014, Vaisala, Colorado, United States

Attending: Peter Stuart (RES), Peter Clive (SGURR ENERGY), Vera Bulaevskaya (LLNL), Axel Albers (WIND GUARD), Jørgen Højstrup (WIND-SOLUTIONS), Rozenn Wagner (DTU), Barry Logue (VAISALA), Ioannis Antoniou (SIEMENS), Alan Derrick (RES), Arlinda Huskey (NREL), Axel Albers (WINDGUARD), Rebeca Riebra Lamata (DONG ENERGY), Peter Gregg (GE), Justin Wolfe (EON), Erik Hale (EDF-RE), Andy Clifton (NREL), Alex Head (PREVAILING ANALYSIS), Dan Bernadett (AWSTRUEPOWER), Ellie Weyer (AWSTRUEPOWER), Matthieu Boquet (LEOSPHERE), Arlinda Huskey (NREL), Ioannis Antoniou (SIEMENS), Rodolphe Lebosq (ENERCON), Jochen Cleve (SIEMENS), Troels Friis Pedersen (DTU), Taylor Geer (DNVGL), Alexandre Kapetanovic (RES-AMERICAS), Brian Healer (RES-AMERICAS), Eric Wenger (RES-AMERICAS), Dale Apgar (GE), Jon Engelsman (VESTAS), Ellie Weyer (AWS TRUE POWER) & Lilia Lavrov (GE).

Motivation:

1. To provide an opportunity for the PCWG to engage with working group members in the US.
2. To provide an opportunity for the PCWG and the IEC Power Curve technical committee to exchange ideas.

Key Outcomes:

- The members present agreed that the PCWG should continue its activities for 2015. A roadmap will be prepared detailing the planned objectives and activities for 2015.
- The IEC 61400-12-1 committee and PCWG should aim to hold a further joint meeting in 2015 (timed with an existing 61400-12-1 meeting to minimise travel). The 2015 joint meeting will most likely be in June and be held at a European venue. The PCWG will also aim to hold one of its 2015 meetings in the US (possibly timed with the AWEA Resource Assessment workshop in New Orleans).
- A manufacturer PCWG member will investigate supplying climate/site specific power curves for forthcoming the round robin.
- PCWG to add action to 2015 roadmap to develop data specification for climate/site specific power curves. This should detail both the input data required by a manufacturer to generate a site specific power curve and the output data required by a developer/consultant in order to do their analysis.
- PCWG to explore establishing a named liaison between the PCWG and the IEC 61400-15 (Resource Assessment) standard committee.
- PCWG to explore preparing a document that would outline the benefits of manufacturers supplying power deviation matrices on an informative basis.
- PCWG to conduct round robin on application of power deviation method.
- PCWG members to explore release of additional datasets to the PCWG.
- PCWG to explore adding IEC uncertainty calculation to PCWG open source tool.

Presentations Overview

The following presentations were delivered:

1. "PCWG Status Update", Peter Stuart (RES)
2. "Use of Manufacture specific inputs to refine energy yield predictions", Taylor Geer (DNVGL)
3. "Update on the IEC 61400-15 Resource Assessment Standard", Jason Fields, (NREL).
4. "The influence of inflow angle on the power curve", Jørgen Højstrup (Wind Solutions)
5. "Turbulence Intensity measurements offshore for power curve verification and wind resource assessment", Rebeca Rivera Lamata & Daniel Pollack (Dong Energy)
6. "Power Curve Modeling in Complex Terrain Using Statistical Models", Vera Bulaevskaya (Lawrence Livermore National Laboratory).
7. "Environmental Influences on Turbine Performance, Recent Results", Dale Apgar (GE)
8. "Update on the IEC 61400-12-1 Standard" , Troels Friis Pedersen (DTU)

Minutes of Discussion

Interaction of the PCWG with the IEC Technical Committees

The group discussed the interaction of the PCWG with the IEC 61400-12-1 (Power Performance) and IEC 61400-15 (Resource Assessment) technical committees. One member of both the PCWG and the IEC 61400-12-1 expressed that the groups had at times been out of step, for example the naming clash of "Type A/B corrections" with "Type A/B uncertainties". A consultant and member of the IEC 61400-12-1 committee said that the PCWG had provided an important platform for 'test-driving' the methods in the standard through its round robin exercises. The consultant added that the PCWG was perhaps a more appropriate forum for such activities and that the current work of the PCWG could be regarded as a 'tool box' for understanding what the standard means. The same consultant also questioned if the interaction was back to front in that the standard should in theory focus on documenting accepted/mature practice rather than creating new methodologies. Some members of the group disagreed in part and stated that there are times when it would be appropriate for new methods to emerge during the development of a standard. One researcher commented that there is a question about what is meant by something being 'mature enough' for inclusion of the standard.

One developer commented that they believed the PCWG has a clearly distinct purpose from the standard committees. The same developer added that it was extremely useful to have a relatively informal group to trial innovations and that he believed that there was room for a non-standards driven group in the wind industry.

The potential for a formal liaison between the PCWG and the IEC standards committees was discussed. It was agreed that the IEC 61400-15 committee and the PCWG would explore establishing a formal liaison.

2015 Roadmap for PCWG

The group agreed that the PCWG should extend its activities for a further year. Several group members said that it was extremely important for the group to publish a 'road map' for its planned activities in 2015. It was agreed that the roadmap for 2015 would be circulated as soon as possible.

Some members of the group made suggestions for possible items to be included on the road map. One manufacturer proposed an evaluation of the uncertainty methods in the IEC 61400-12-1 standard and a possible round robin. The same manufacturer also proposed that the group should consider LiDAR performance in complex terrain, although some group members expressed that they felt that this was not appropriate and was already being considered by IEA Task 32. A different manufacturer suggested that the group investigate climate/site specific power curves and in particular work to define the input data required by a manufacturer in order to generate site specific power curves and the output data required by developers/consultants in order to perform their analysis.

It was agreed that any further suggestions for the roadmap should be emailed to pcwg@res-ltd.com. It was also agreed that there would be the opportunities for further suggestions to be made after the draft roadmap is circulated.

Climate/Site Specific Power Curves

The group discussed the supply and application of site specific power curves (also referred to as climate specific power curves). A PCWG member said that the PCWG planned a further round robin related to site specific power curves.

A manufacturer stated that they could provide whatever climate specific power curves their customers require. Several developers responded that site specific power curves were in practice very difficult to obtain from manufacturers. One developer commented that most sites would require several site specific power curves in order for the full range of relevant conditions to be covered. It was agreed that the manufacturer who made the original comment (i.e. that they could provide whatever climate specific power curves their customers require) would explore the possibility of their company supplying the site specific power curves for the upcoming round robin.

A manufacturer reiterated the suggestion that the PCWG should work to define the 'data interface' for site specific power curves i.e. the data required by a manufacturer in order to generate site specific power curves and the output format required by developers/consultants in order to perform their analysis.

One offshore developer made the comment that in their experience it was even more difficult to obtain site specific power curves for newer machines i.e. that site specific power curves are mainly provided for established machines which are well understood by their manufacturer.

Power Curve Deviation Matrices

The group discussed the use of power curve deviation matrices (percentage power deviation as a function of turbulence intensity and wind speed). One consultant commented that a machine specific power curve deviation matrix was the primary input they needed to improve their analysis. One developer said that the power curve deviation matrix could be made available by a manufacturer on a purely informative basis and would therefore not form part of the warranty. The group agreed to explore a round robin exercise on the application of the power curve deviation matrix method.