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FGW TC PP – resolution for
technical guideline
TG 2 Rev. 17

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Berlin, 25th of June 2020

FGW Technical Committee for Power Performance (TC PP) – resolution of 25th of June 2020

The Technical Committee for Power Performance (TC PP) votes for an alteration of the Annex B „Rated power adaptation“ of the revision 17 of the Technical Guidelines Part 2 (TG 2)

The Annex B „Rated power adaptation“ was added to the revision 17 of the TG 2 with resolution of the TC PP from 9th of September 2019.

Annex B with all alterations can be found on the following pages.

On behalf of FGW TC PP

Bente Klose

Geschäftsführender Vorstand: Prof. Dr.-Ing. habil. Detlef Schulz / Jens Rauch

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USt-ID: DE203774047 Steuernummer: 19/293/16463

Annex B Rated power adaptation

B.1 GENERAL INFORMATION

Modern pitch-regulated wind turbines can be operated with different rated power levels, without requiring a change in operating parameters. So for example, only the rated power is increased or reduced without a change in the operating characteristic curve in part-load range (wind speed range up to reaching rated power).

Annex B describes a procedure for adapting the measurement data of the measured power curve to a modified rated power and is also only valid for this purpose. Here, the procedure takes into account that not only does a change of the rated power influence the rated power section of the measured power curve, but also the section known as the “knee” or “shoulder” before reaching the rated power (see Figure B–1).

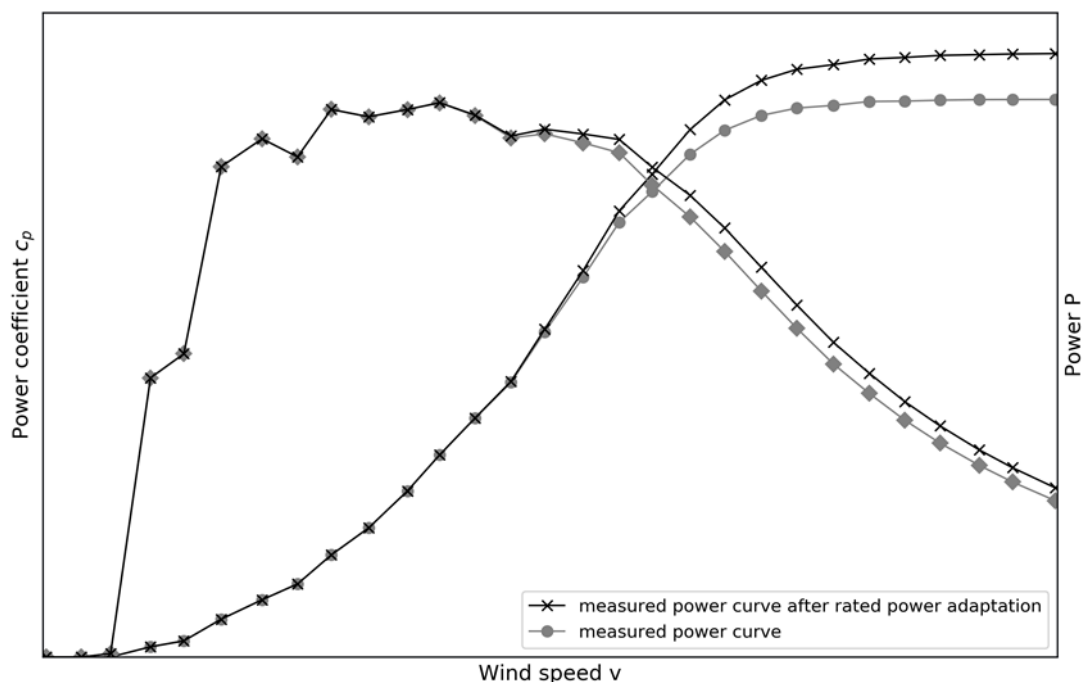


Figure B–1: Measured power curve before and after* rated power adaptation; *is the result of the process defined in Annex B

B.2 PROCEDURE FOR RATED POWER ADAPTATION

The procedure for rated power adaptation is based on the procedure suggested in the current version of IEC 61400-12-1 [1] for normalisation of the measurement data of the power curve to the turbulence intensity¹. Here, fundamental concepts, such as determining the zero turbulence power curve are dealt with and adjusted to the requirements of the procedure where required. Unless stated otherwise, the procedures and guideline values stated in Annex M of IEC 61400-12-1 [1] apply.

The fundamental concept of rated power adaptation is the determination of two zero turbulence power curves for the measured power curve with and without a modified rated power. Using this, for each 10 min interval, a simulated power is determined based on the measured

¹ [1], Annex M, page 229 onwards.

wind speed and turbulence intensity. In the result the difference from the simulated power with and without modified rated power can be applied to the actual measured power.

Therefore based on equation M.2² the following applies:

$$\overline{P_{P_{adapted}}(v)} = \overline{P(v)} + \overline{P_{Sim,P_{adapted}}(v)} - \overline{P_{Sim,P}(v)} \quad \text{(B-1)}$$

where

$\overline{P(v)}$ is the 10 min average of the measured power output

$\overline{P_{Sim,P}(v)}$ is the simulated 10 min average of measured power output according to the given condition 1²: Equation (M.1)² applied for the measured wind speed distribution (measured average wind speed and measured turbulence intensity); application of the zero turbulence power curve **without** rated power adaptation;

$\overline{P_{Sim,P_{adapted}}(v)}$ is the simulated 10 min average of measured power output according to the given condition 1²: Equation (M.1)² applied for the measured wind speed distribution (measured average wind speed and measured turbulence intensity); application of the zero turbulence power curve **with** rated power adaptation.

B.3 DETERMINATION OF THE ZERO TURBULENCE POWER CURVES

The zero turbulence power curve for the case without rated power adaptation (see Figure B–2) is determined according to chapter M.3³ as part of normalising the measurement values to a turbulence intensity of 10 %.

To determine the zero turbulence power curve with rated power adaptation, the interim result of the zero turbulence power curve without rated power adaptation according to Figure M.4⁴ and M.5⁵ is used, with ~~only~~ the rated power P_{rated} (maximal bin-averaged power) being adapted ~~is adapted by the difference between~~ ~~to~~ the target rated power and the specific rated power of the measured wind turbine. ~~The~~ cut-in wind speed v_{cut-in} as well as the maximum power coefficient $c_{p,max}$ ~~are being~~ used unchanged. Based on the adapted rated power and the assumed cubic increase of power with the wind speed below the rated power, this results in an adapted rated wind speed v_{rated} . With the thus modified corrected initial zero turbulence power curve, the procedure is carried out according to figure M.6⁶ and M.7⁶, to obtain the zero turbulence power curve for the case of the rated power adaptation. It is to consider, that \hat{P} in M.6 must be determined on the basis of the corrected initial zero turbulence power curve without rated power adaptation.

² [1], Annex M, page 230

³ [1], Annex M, page 231 onwards

⁴ [1], Annex M, page 234

⁵ [1], Annex M, page 235

⁶ [1], Annex M, page 236

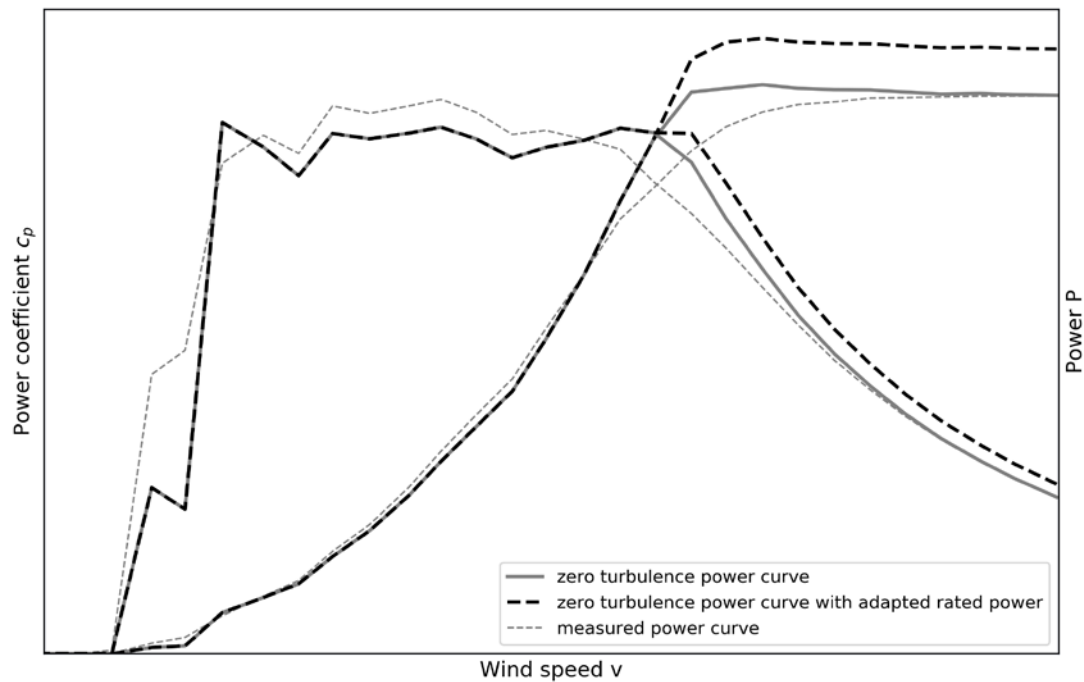


Figure B-2: Zero turbulence power curves with* and without** modified rated power with the aid of which $P_{P_{adapted}}(v)$ is determined; *Basis for $P_{sim,P_{adapted}}(v)$; **Basis for $P_{sim,P}(v)$

Referenced standards and guidelines:

- [1] DIN EN 61400-12-1 (VDE 0127-12-1): 2017-12; Wind energy generation systems - Part 12-1: Power performance measurements of electricity producing wind turbines (IEC 61400-12-1:2017).

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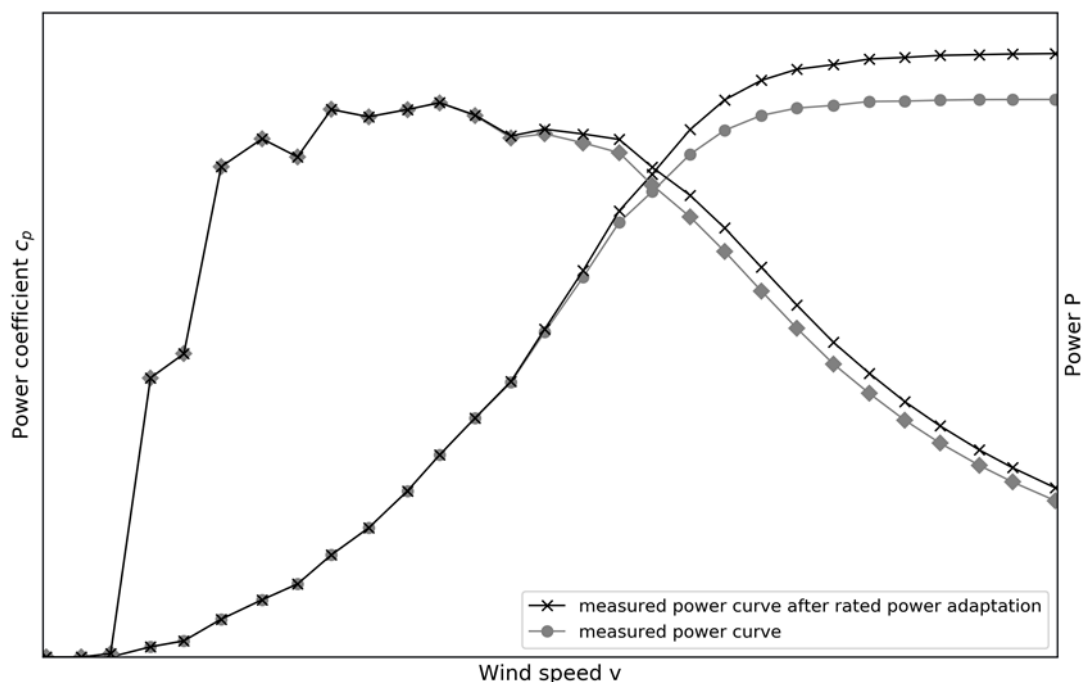


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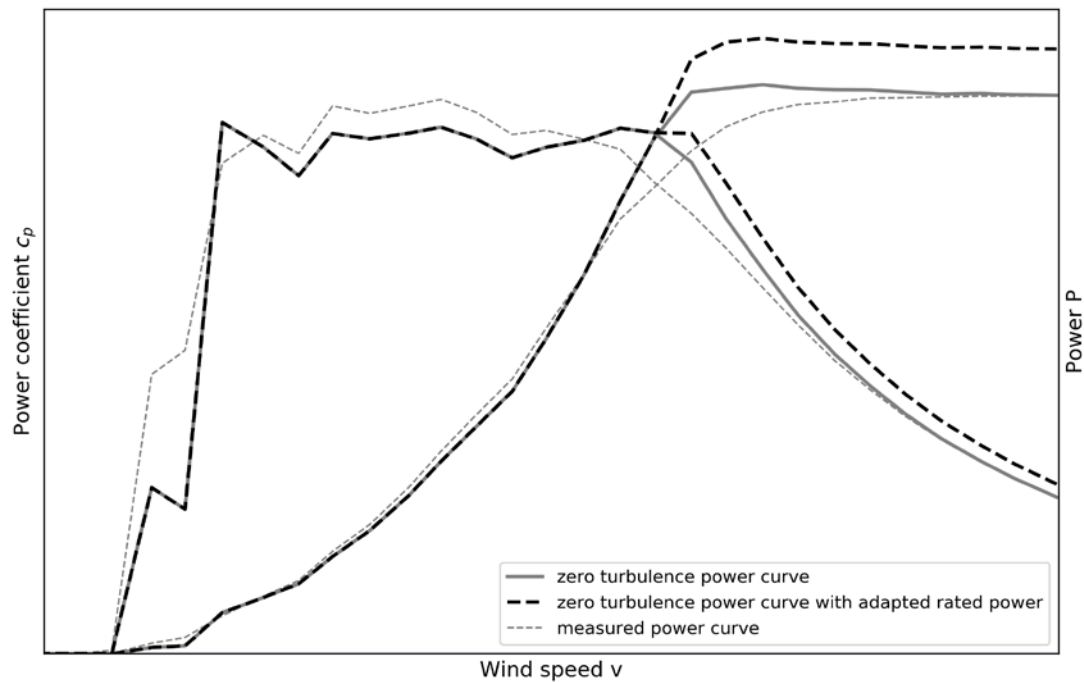


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