

Wind energy generation systems - Part 12-2: Power performance of electricity producing wind turbines based on nacelle anemometry

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN IEC 61400-12-2:2022 sisaldab Euroopa standardi EN IEC 61400-12-2:2022 ingliskeelset teksti.	This Estonian standard EVS-EN IEC 61400-12-2:2022 consists of the English text of the European standard EN IEC 61400-12-2:2022.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 14.10.2022.	Date of Availability of the European standard is 14.10.2022.
Standard on kättesaadav Eesti Standardimis-ja Akrediteerimiskeskusest.	The standard is available from the Estonian Centre for Standardisation and Accreditation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 27.180

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardimis- ja Akrediteerimiskeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardimis-ja Akrediteerimiskeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardimis-ja Akrediteerimiskeskusega: Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation and Accreditation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation and Accreditation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation and Accreditation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

English Version

Wind energy generation systems - Part 12-2: Power
performance of electricity producing wind turbines based on
nacelle anemometry
(IEC 61400-12-2:2022)

Systèmes de génération d'énergie éolienne - Partie 12-2:
Performance de puissance des éoliennes de production
d'électricité fondée sur l'anémométrie de nacelle
(IEC 61400-12-2:2022)

Windenergieanlagen - Teil 12- 2: Leistungsverhalten von
stromerzeugenden Windenergieanlagen auf der Grundlage
der Gondelanemometrie
(IEC 61400-12-2:2022)

This European Standard was approved by CENELEC on 2022-10-10. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 88/823/CDV, future edition 2 of IEC 61400-12-2, prepared by IEC/TC 88 "Wind energy generation systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 61400-12-2:2022.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2023-07-10
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2025-10-10

This document supersedes EN 61400-12-2:2013 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 61400-12-2:2022 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 61400-2 NOTE Harmonized as EN 61400-2

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Wind energy generation systems –
Part 12-2: Power performance of electricity producing wind turbines based on
nacelle anemometry**

**Systèmes de génération d'énergie éolienne –
Partie 12-2: Performance de puissance des éoliennes de production d'électricité
fondée sur l'anémométrie de nacelle**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2022 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Wind energy generation systems –
Part 12-2: Power performance of electricity producing wind turbines based on
nacelle anemometry**

**Systèmes de génération d'énergie éolienne –
Partie 12-2: Performance de puissance des éoliennes de production d'électricité
fondée sur l'anémométrie de nacelle**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 27.180

ISBN 978-2-8322-5594-0

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD	5
INTRODUCTION	7
1 Scope	9
2 Normative references	9
3 Terms and definitions	10
4 Symbols, units and abbreviated terms	14
5 Overview of test method	17
6 Preparation for performance test	19
6.1 General	19
6.2 Wind turbine	19
6.3 Test site	19
6.4 Nacelle wind speed transfer function	20
6.5 Test plan	20
7 Test equipment	20
7.1 Electric power	20
7.2 Wind speed	21
7.3 Wind direction	21
7.4 Air density	21
7.5 Rotor speed	22
7.6 Pitch angle	22
7.7 Wind turbine status	22
7.8 Data acquisition	22
8 Measurement procedure	23
8.1 General	23
8.2 Wind turbine operation	23
8.3 Data system(s) synchronisation	23
8.4 Data collection	24
8.5 Data quality check	24
8.5.1 General	24
8.5.2 Measured signals are in range and available	24
8.5.3 Sensors are operating properly	24
8.5.4 Ensure data acquisition system(s) is/are operating properly	25
8.5.5 Sector self-consistency check	25
8.6 Data rejection	25
8.7 Data correction	26
8.8 Database	26
9 Derived results	27
9.1 Data normalisation – Density correction	27
9.2 Determination of measured power curve	28
9.3 Annual energy production (AEP)	28
9.4 Power coefficient	29
9.5 Uncertainty analysis	30
10 Reporting format	30
Annex A (normative) Nacelle wind speed transfer function validity procedure	38
A.1 General	38

A.2	Measurement procedure:	38
A.3	Terrain class and slope:	38
A.4	Measurement hardware:	38
A.5	Other turbine hardware:	38
A.6	Turbine controls:	39
Annex B	(normative) Evaluation of uncertainty in measurement	40
B.1	General:	40
B.2	The measurands	40
B.3	Uncertainty components	40
B.4	Wind direction uncertainty	42
Annex C	(normative) Theoretical basis for determining the uncertainty of measurement using the method of bins	43
C.1	General:	43
C.2	Propagation of uncertainty through the stages of NTF/NPC measurement	44
C.3	Category A uncertainties	47
C.3.1	General	47
C.3.2	Category A uncertainty in electric power	47
C.4	Category B uncertainties	49
C.4.1	General	49
C.4.2	Category B uncertainties in climatic variations	49
C.5	Expanded uncertainty	49
Annex D	(normative) NPC uncertainty estimates and calculation	51
D.1	Methods and assumptions:	51
D.1.1	General	51
D.1.2	Nacelle power curve uncertainty component estimates	51
D.1.3	Wind direction uncertainty	54
D.1.4	Contribution factors	55
D.2	Uncertainty example calculations	57
D.2.1	Example description	57
D.2.2	Example case – NTF uncertainty	57
D.2.3	Example case – NPC uncertainty	58
Annex E	(normative) Allowable anemometry instrument types	60
E.1	General:	60
E.2	Calibration of sonic anemometers	60
E.2.1	General	60
E.2.2	Step 1: Wind speed calibration (required)	60
E.2.3	Step 2: Wind direction calibration (required)	61
E.2.4	Step 3: Tilting test (recommended)	61
E.3	Recalibration of sonic anemometers	61
E.4	Uncertainty of sonic and propeller anemometers	61
Annex F	(informative) Results and uncertainty considerations	62
F.1	General:	62
F.2	Method for calculation of measurement uncertainty	62
F.3	Method for calculation of sampling uncertainty	66
F.4	Combined measurement and sampling uncertainty	66
Annex G	(informative) Example multi-turbine NTF/NPC uncertainty calculation	67
G.1	Overview:	67
G.2	Outline of procedure:	67

G.3	Example of measurement uncertainty calculation	70
G.4	Example of sampling uncertainty calculation	74
G.5	Combined uncertainty	74
G.6	Discussion of sample size and uncertainty	74
Annex H (informative)	Organisation of test, safety and communication	76
H.1	Overview.....	76
H.2	Responsibility for test	76
H.3	Safety during test.....	76
H.4	Communication	76
H.5	Prior to test.....	76
H.6	During test.....	76
H.7	After test.....	77
Bibliography	78
Figure 1	– Procedural overview.....	18
Figure 2	– Presentation of sample data: nacelle power performance test scatter plots	34
Figure 3	– Presentation of sample data: binned power curve with uncertainty bands.....	34
Figure 4	– Example of sample data: measured power curve and C_p curve	35
Figure G.1	– Impact of multiple turbine testing on measurement uncertainty	74
Figure G.2	– Impact of multiple turbine testing on sampling uncertainty	75
Table 1	– Example of a measured power curve.....	36
Table 2	– Example of estimated annual energy production.....	37
Table B.1	– Uncertainty components in nacelle power curve evaluation	41
Table B.2	– Uncertainty components in nacelle based absolute wind direction	42
Table C.1	– Example cancellation sources	45
Table C.2	– List of category A and B uncertainties for NPC.....	48
Table C.3	– Expanded uncertainties.....	50
Table D.1	– Estimates for uncertainty components from NPC measurement	52
Table D.2	– Estimates for $u_{V5,i}$ for NPC terrain class	54
Table D.3	– Estimates for uncertainty components for wind direction	55
Table D.4	– Estimates for contribution factors for NPC	56
Table G.1	– List of correlated uncertainty components	68
Table G.2	– Sample AEP and uncertainty data from three turbines	70
Table G.3	– Component uncertainty contribution to AEP uncertainty on turbine 1	71
Table G.4	– Combination of uncertainty components across turbines.....	72

INTERNATIONAL ELECTROTECHNICAL COMMISSION

WIND ENERGY GENERATION SYSTEMS –

**Part 12-2: Power performance of electricity producing
wind turbines based on nacelle anemometry**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61400-12-2 has been prepared by IEC technical committee 88: Wind energy generation systems. It is an International Standard.

This second edition of IEC 61400-12-2 is part of a structural revision that cancels and replaces the performance standards IEC 61400-12-1:2017 and IEC 61400-12-2:2013. The structural revision contains no technical changes with respect to IEC 61400-12-1:2017 and IEC 61400-12-2:2013, but the parts that relate to wind measurements, measurement of site calibration and assessment of obstacle and terrain have been extracted into separate standards.

The purpose of the re-structure was to allow the future management and revision of the power performance standards to be carried out more efficiently in terms of time and cost and to provide a more logical division of the wind measurement requirements into a series of separate standards which could be referred to by other use case standards in the IEC 61400 series and subsequently maintained and developed by appropriate experts.

The text of this International Standard is based on the following documents:

Draft	Report on voting
88/823/CDV	88/868/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 61400 series, published under the general title *Wind energy generation systems*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This second edition contains no technical changes with respect to the previous edition but the parts that relate to wind measurements, measurement of nacelle transfer functions and assessment of obstacles and terrain have been extracted into separate standards. The separated standards comprise:

- IEC 61400-50, *Wind measurements – Overview*
- IEC 61400-50-1, *Wind measurement – Application of meteorological mast, nacelle and spinner mounted instruments*
- IEC 61400-50-2, *Wind measurement – Application of ground-mounted remote sensing technology*
- IEC 61400-12, *Power performance measurements of electricity producing wind turbines – Overview*
- IEC 61400-12-1, *Power performance measurement of electricity producing wind turbines*
- IEC 61400-12-2, *Power performance of electricity producing turbines based on nacelle anemometry*
- IEC 61400-12-3, *Power performance – Measurement based site calibration*
- IEC 61400-12-5, *Power performance – Assessment of obstacles and terrain*
- IEC 61400-12-6, *Measurement based nacelle transfer function of electricity producing wind turbines.*

This procedure describes how to characterise a wind turbine's power performance characteristics in terms of a measured power curve and the estimated annual energy production (AEP) based on nacelle-anemometry. In this procedure, the anemometer is located on or near the test turbine's nacelle. In this location, the anemometer is measuring wind speed that is strongly affected by the test turbine's rotor. The procedure provides guidance on determination of measurement uncertainty including assessment of uncertainty sources and recommendations for combining them into uncertainties in reported power and AEP.

The measured power curve is determined by collecting simultaneous measurements of nacelle-measured wind speed and power output for a period that is long enough to establish a statistically significant database over a range of wind speeds and under varying wind and atmospheric conditions. In order to accurately measure the power curve, the nacelle-measured wind speed is adjusted using a transfer function to estimate the free stream wind speed. The procedure to measure such a transfer function is given in IEC 61400-12-6. The AEP is calculated by applying the measured power curve to the reference wind speed frequency distributions, assuming 100 % availability.

A key element of power performance testing is the measurement of wind speed. Even when anemometers are carefully calibrated in a quality wind tunnel, fluctuations in magnitude and direction of the wind vector can cause different anemometers to perform differently in the field. Further, the flow conditions close to a turbine nacelle are complex and variable. Therefore special care should be taken in the selection and installation of the anemometer. These issues are addressed in this document.

This document will benefit those parties involved in the manufacture, installation, planning and permitting, operation, utilisation and regulation of wind turbines. When appropriate, the technically accurate measurement and analysis techniques recommended in this document should be applied by all parties to ensure that continuing development and operation of wind turbines is carried out in an atmosphere of consistent and accurate communication relative to environmental concerns. This document presents measurement and reporting procedures expected to provide accurate results that can be replicated by others.

Meanwhile, a user of this document should be aware of differences that arise from large variations in wind shear and turbulence intensity, and from the chosen criteria for data selection. Therefore, a user should consider the influence of these differences and the data selection criteria in relation to the purpose of the test before contracting power performance measurements.

This document is a preview generated by EVS

WIND ENERGY GENERATION SYSTEMS –

Part 12-2: Power performance of electricity producing wind turbines based on nacelle anemometry

1 Scope

This part of IEC 61400-12 specifies a procedure for verifying the power performance characteristics of a single electricity-producing, horizontal axis wind turbine that is not considered to be a small wind turbine per IEC 61400-2. It is expected that this document be used when the specific operational or contractual specifications do not comply with the requirements set out in IEC 61400-12-1. The procedure can be used for power performance evaluation of specific turbines at specific locations, but equally the methodology can be used to make generic comparisons between different turbine models or different turbine settings.

The purpose of this document is to provide a uniform methodology of measurement, analysis, and reporting of power performance characteristics for individual electricity producing wind turbines utilising nacelle-anemometry methods. This document is intended to be applied only to horizontal axis wind turbines of sufficient size that the nacelle-mounted anemometer does not significantly affect the flow through the turbine's rotor and around the nacelle and hence does not affect the wind turbine's performance. The intent of this document is that the methods presented in this document be utilised when the requirements set out in IEC 61400-12-1 are not feasible. This will ensure that the results are as consistent, accurate, and reproducible as possible within the current state of the art for instrumentation and measurement techniques.

This document describes how to characterise a wind turbine's power performance in terms of a measured power curve and the estimated AEP. Guidance on uncertainty considerations relating to the power performance of the sample of turbines tested relative to the power performance of all turbines in a wind farm is provided. Guidance on the evaluation of the combined uncertainty for the case where multiple turbines are tested is also provided.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60688:2021, *Electrical measuring transducers for converting AC and DC electrical quantities to analogue or digital signals*

IEC 61400-12-1, *Wind energy generation systems – Part 12-1: Power performance measurements of electricity producing wind turbines*

IEC 61400-12-3, *Wind energy generation systems – Part 12-3: Power performance – Measurement based site calibration*

IEC 61400-12-5:2022, *Wind energy generation systems – Part 12-5: Power performance – Assessment of obstacles and terrain*

IEC 61400-12-6, *Wind energy generation systems – Part 12-6: Measurement based nacelle transfer function of electricity producing wind turbines*

IEC 61400-50-1, *Wind energy generation systems – Part 50-1: Wind measurement – Application of meteorological mast, nacelle and spinner mounted instruments*

IEC 61869-2, *Instrument transformers – Part 2: Additional requirements for current transformers*

IEC 61869-3, *Instrument transformers – Part 3: Additional requirements for inductive voltage transformers*

ISO 2533:1975, *Standard atmosphere*

ISO/IEC GUIDE 98-3:2008, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

accuracy

closeness of the agreement between the result of a measurement and a true value of the measurand

3.2

AEP

annual energy production

estimate of the total energy production of a wind turbine over a one-year period by applying the measured power curve to different reference wind speed frequency distributions at hub height, assuming 100 % availability

3.3

AEP-measured

measured annual energy production

estimate of the total energy production of a wind turbine during a one-year period by applying the measured power curve to different reference wind speed frequency distributions at hub height, assuming 100 % availability, without power curve extrapolation to higher wind speeds

3.4

AEP-extrapolated

extrapolated annual energy production

estimate of the total energy production of a wind turbine during a one-year period by applying the measured power curve to different reference wind speed frequency distributions at hub height, assuming 100 % availability, with power curve extrapolation to cut-out wind speed of the turbine

3.5

complex terrain

terrain surrounding the test site that features significant variations in topography and terrain obstacles that may cause flow distortion