

Testing and certification for small wind turbines (SWT): challenges and actions to address them

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Outline

- Existing standards and recommendations
- Challenges
- Actions
- Conclusions

SWT Testing and Certification

- International Electromechanical Committee (IEC) standards
- EU Directives (CE marking)
- Country standards:
 - USA
 - UK
 - ...
- International Energy Agency (IEA)

IEC Standards related to SWT

- **IEC 61400-2:** 2006, Ed 2 “**Design requirements** for small wind turbines”
- **IEC 61400-11:** 2006 Ed 2.1 “**Acoustic noise** measurement techniques”
- **IEC 61400-12-1:** 2005 Ed 1 “**Power Performance** measurements of electricity produced wind turbines”
- **IEC 61400-14:** 2005 Ed 1 “**Declaration of apparent sound level and tonality values**”
- **IEC 61400-21:** 2008 Ed 2: “**Measurement and assessment of power quality** characteristics of grid connected wind turbines”
- **IEC 61400-22** 2010 Ed 1: “**Conformity** testing and certification”
- **IEC 61400-23:** 2001 Ed 1: “**Full scale structural testing of rotor blades**”

IEC 61400-2:2006, Ed.2 “Design requirements for small wind turbines”

Scope of Application

- Swept rotor area $< 200\text{m}^2$
($< \sim 16$ m diameter, < 65 kW)
- AC voltage $< 1000\text{V}$ or
DC voltage $< 1500\text{V}$

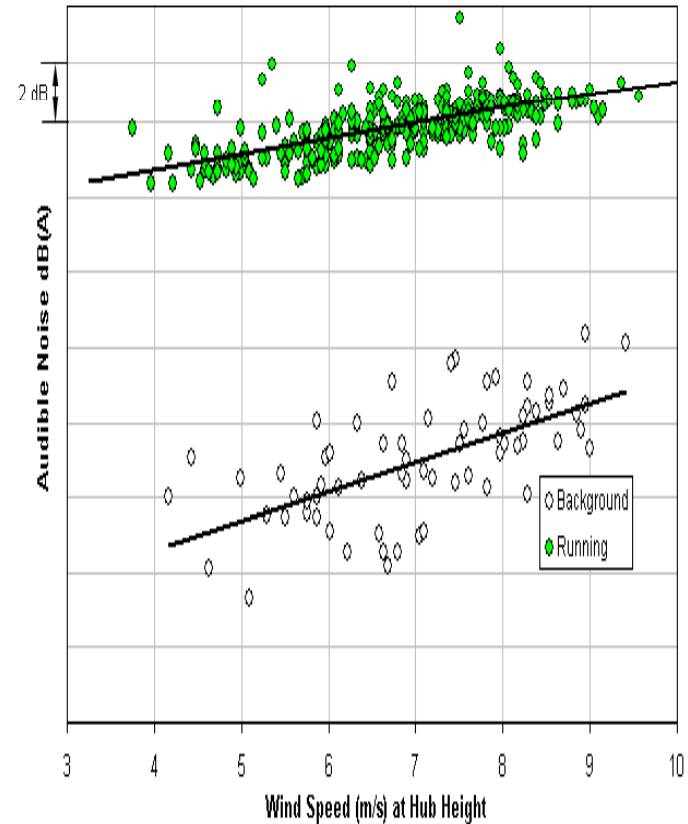


IEC 61400-2:2006, Ed.2 “Design requirements for small wind turbines”

- **Design methodology.** One of these:
 - Simplified load equations (horizontal axis, 2 or more blades, cantilever blades, rigid hub)
 - Aeroelastic modelling
 - Mechanical loads testing
- **Static blade test is required**
- **Safety, function and duration tests are required**

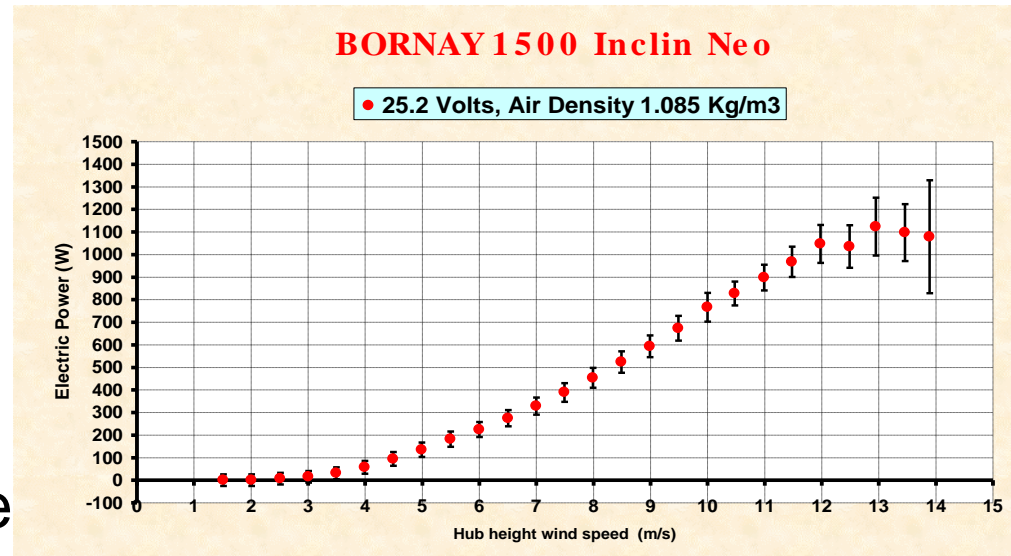
IEC 61400-11: 2004 “Acoustic noise measurement techniques” Annex F

- Establishes two methods:
 - A general one
 - Other for small wind turbines in Annex F
 - Either method can be used, however the methods shall not be mixed.



IEC 61400-12-1: 2006 Power Performance measurements Annex H

- Methodology that will ensure consistency, accuracy and reproducibility in the measurement and analysis of power performance by wind turbines
- A procedure to determine the power performance characteristics of small wind turbines in Annex H



CE Marking

EU directives

- 2006/42/EC machinery directive
- 2006/95/EC low voltage directive
- 2004/108/EC electromagnetic compatibility EMC.

Challenges to certify SWT

- It is very costly
- It is not mandatory, except some subsidized programs
- It is possible to sell SWT's without any quality requirement
- Frequent poor design
- Funding/guaranties are not required
- Most of the customers present poor knowledge about SWT technology

Actions to address them

USA


- **AWEA 9.1 SWT Performance and Safety Standard, 2009**
 - Subset of IEC 61400-2
 - Subset of Acoustics 61400-11 Annex F
 - 61400-12-1 Power Performance Annex H
- **Small Wind Certification Council (SWCC) roles:**
 - Certify that small wind turbines meet requirements of AWEA Standard
 - Develop regional tests centers (with NREL)
- **Electrical Safety NEC, IEEE 1547, UL 1741, UL 1004B**



Actions to address them

United Kingdom

- BWEA, Small Wind Turbine Performance and Safety Standard, 2009 Ed.2
 - Accredited laboratory
 - Certification body
- Microgeneration Certification Scheme (MCS), 2008
- Grid Code: G85

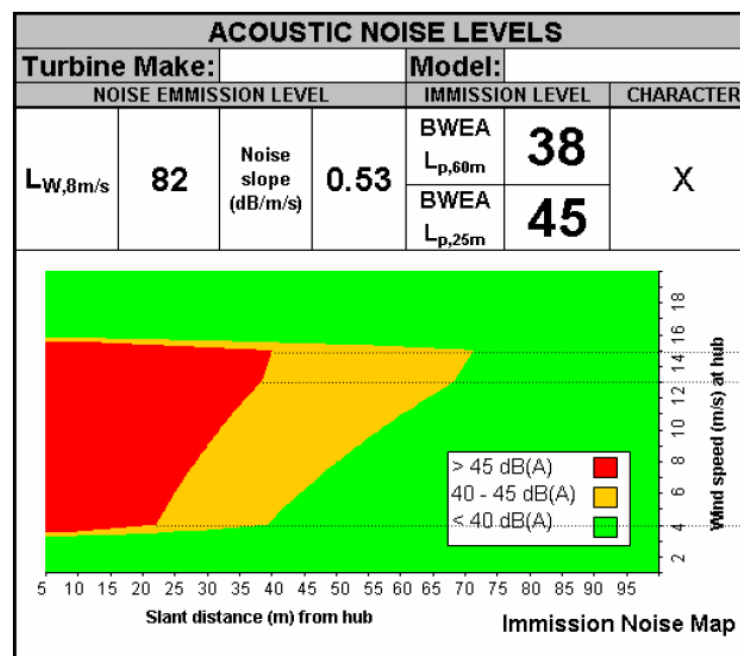


Certified by

BWEA small wind turbine standard 2008

Reference Annual Energy **6,780** kWh

Annual average wind speed of 5 m/s (11 mph). Your performance may vary.



Actions to address them

- International Energy Agency (IEA): Task 27 - *Technical recommendations for small wind turbine consumer labelling*
- IEC-MT2 and IEA-Task27 liason work
- Considerations of this work
 - Intersection of standards, certifying agents, and test centers
 - Identifying the holes in the international work



iea wind

IEA Wind 27 Task's definition



- **Development of small wind turbines (up to 200 m² rotor swept area) consumer labelling for grid tie and battery connected applications**
- Peer reviewed testing and development at **Small Wind Association of Testers (SWAT)**
- Increase of **public awareness for SWT quality** and its labelling. Dissemination



Workshop “Needs and Gaps on Standardisation for Renewable Energy: Actions to facilitate the best use of Standardisation for renewables”



IEA Task27

INDEPENDENTLY TESTED WIND TURBINE	
Manufacturer Model	Ampair 600/230 Mk 2.5
Duration Test Class <small>Standard classes are I-IV, where I = toughest conditions. S = conditions defined by manufacturer</small>	II
Ref Annual Energy (kWh/yr) at 5 m/s average wind speed <small>Actual Production will depend on how the turbine is controlled and where it is located.</small>	481
Declared Sound Power Level (dBA)	89
<p><symbols for special conditions like cold climate></p> <p>Wind speeds apply to hub height.</p>  	
<p>Label awarded by: A=accredited certification body; B=independent accredited test lab; C=independent unaccredited test lab</p>	

INDEPENDENTLY TESTED SMALL WIND TURBINE	
MANUFACTURER MODEL	AMPAIR 600/230 Mk2.5
ANNUAL REFERENCE ENERGY @ 5 m/s average wind speed Actual production will vary depending on site conditions	481 kWh/yr
DECLARED SOUND POWER LEVEL	89 dBA
TURBINE CLASS (I-IV or S for special)	II
SEPEN	<p>Tested by: SEPEN : Site Expérimental pour le Petit Eolien de Narbonne</p> <p>Tested date: 15 October 2009</p> <p>http://www.swat.org</p>

Conclusions

- Reliable small wind turbines are still a challenge.
- Currently, there are different standards available for SWT certification, all of them in continuous process of adaptation to SWT requirements
- Small wind turbines have great potential, for remote areas and for grid connection because of new promotion programs in some countries (US, UK, Italy, Portugal, Japan...) are emerging
- As market quality control is not possible nowadays in this sector, it is clear that all kind of small wind turbine subsidy should be linked to requirements for 3rd party type approval and operating statistics should be public

Thank you for your attention