



Kleine en middelgrote windturbines Kwaliteit en conformiteit

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Inhoud

- Standaarden en certificering
- Hulpmiddelen
- Siting



Standaarden en certificering

Waarom?

Waar?

Wat?

Wie?

Standaarden en certificering

Waarom?

- objectiviteit voor consument



Standaarden en certificering

Waarom?

- bescherming van consument

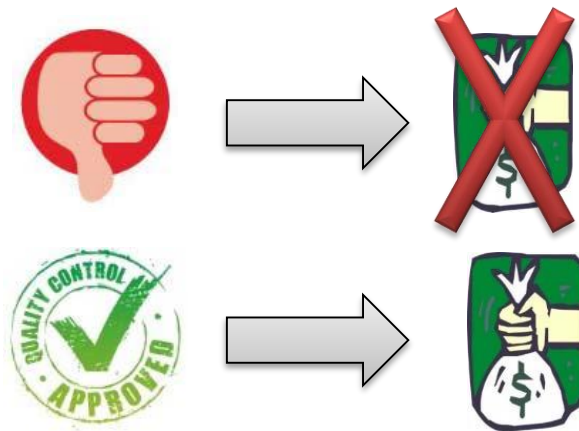


Bron: The Shetland Times

Standaarden en certificering

Waarom?

- financieringskanalen



bv.: FIT (UK) en investeringsaftrek (VS)

Standaarden en certificering

Waarom?

- geloofwaardigheid



Standaarden en certificering

Waarom?

Waar?

Wat?

Wie?

Standaarden en certificering

Waar?

- 2009 BWEA standaard (UK) en AWEA standaard (VS)
- 2010 MCS voor FIT in UK & certificatie eis voor incentives (VS)
- 2012 Japan FIT, JSWTA0001 standaard
- 2013 Denemarken Executive Order nr. 73

Standaarden en certificering

Waar?

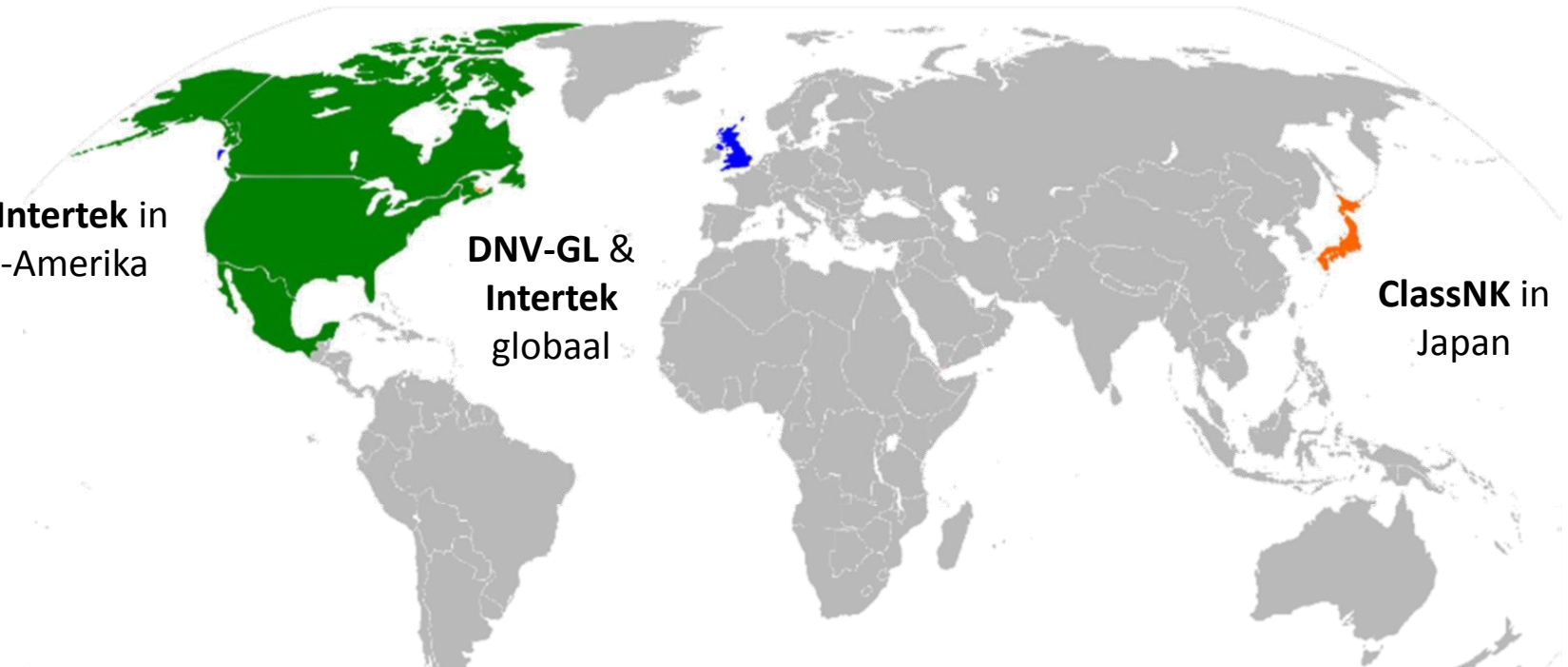
**Intertek, NEL, BBA
& BRE Global in UK**

**DTU Risø in
Denemarken**

**SWCC, Intertek in
Noord-Amerika**

**DNV-GL &
Intertek
globaal**

**ClassNK in
Japan**



Standaarden en certificering

Waar?

- SWCC (8) <http://smallwindcertification.org/certified-small-turbines/>
- Intertek (22) <http://www.intertek.com/wind/directory/>
- ClassNK (7) https://www.classnk.or.jp/hp/pdf/activities/windmill_attestation/en/reg_wind_e.pdf
- DTU Risø (12) http://www.dawt.dk/DK/Godkendte_small_WT.htm
- BBA (1) <http://www.bbacerts.co.uk/product-approval/microgeneration/>
- DNV-GL (5) http://www.gl-group.com/pdf/Wind_Turbines.pdf
- BRE Global (4) <http://www.bre.co.uk/page.jsp?id=1947>
- TUV-NEL (6) http://www.tuvnel.com/site2/subpage/environmental_wind_energy

Standaarden en certificering

Waarom?

Waar?

Wat?

Wie?

Standaarden en certificering

Wat?

Kleine windturbines

- $\leq 200 \text{ m}^2$ ($\emptyset \pm 16 \text{ m}$)
- 1,5 – 50 kW

Middelgrote windturbines

- $> 200 \text{ m}^2 - 1000 \text{ m}^2$ ($\emptyset \pm 35 \text{ m}$)
- 50 – 500 kW (Vlaanderen $\leq 300 \text{ kW}$)

Standaarden en certificering

Wat?

Kleine windturbines

- IEC 61400-2 (ed. 3): part I (design evaluation) & part II (type testing)
 - modellering belastingen en structurele analyse
 - veiligheid en functietest
 - duurtest
 - statische test turbine bladen

Standaarden en certificering

Wat?

Kleine windturbines

- IEC 61400-2 (ed. 3): part I (design evaluation) & part II (type testing)
- IEC 61400-11: Acoustic noise measurement ([Annex F](#))
- IEC 61400-12-1: Power performance ([Annex H](#))
- IEC 61400-21: Power quality characteristics (grid connected)
- IEC 61400-22: Conformity testing and certification
 - [aangepaste regels en procedures](#)

Standaarden en certificering

Wat?

Middelgrote windturbines

- IEC 61400-1: Design requirements
- IEC 61400-11: Acoustic noise measurement
- IEC 61400-12-1: Power performance
- IEC 61400-21: Power quality characteristics (grid connected)
- IEC 61400-22: Conformity testing and certification

Standaarden en certificering

Wat?

UK – [RenewableUK SWT Standard](#) (≤ 50 kW)

- Microgeneration Certification Scheme ([MCS 006](#))
- Microgeneration Installation Standard ([MIS 3003](#))

Standaarden en certificering

Wat?

VS – Performance and Safety Standard

- [AWEA 9.1 – 2009](#) ($\leq 200 \text{ m}^2$)

Standaarden en certificering

Wat?

Denemarken – Technical certification scheme

- [Executive order no. 73](#)
- $\leq 5 \text{ m}^2$ vrijstelling
- > 5 tot 40 m^2 vereenvoudigd
- $> 40 \text{ m}^2$ [IEC 61400-22](#) (conformity testing and certification)

Standaarden en certificering

Wat?

Japan – Technical certification scheme

- [JSWTA0001](#)
- < 200 m²
- < 20 kW

Standaarden en certificering

Wat?

- Toegekende certificaten (74)
 - BWEA Std (38)
 - AWEA Std (13)
 - Deense eis (8)
 - IEC 61400-2 (7)
 - JSWTA0001 (7)
 - GL guidelines (1)
- Unieke turbine modellen (59)
 - varianten
 - meerdere certificaten per turbine

Standaarden en certificering

Waarom?

Waar?

Wat?

Wie?

Standaarden en certificering

Wie?

Applicant	Turbine	UK (MSC)	US (AWEA 9.1)	Japan (JSWTA)	DK (ex. ord. 73)	IEC 61400-2
Aircon	Aircon 10	TUV-NEL				
Bergey	Excel 6		SWCC			
Bergey	Excel 10	BRE		Class NK		
Braun Windturbinen GmbH	Antaris 5.5				DTU Risø (<40m ²)	
C&F Green Energy	CF 11	Intertek				
C&F Green Energy	CF 15	Intertek				
C&F Green Energy	CF 20	Intertek				
Endurance Wind Power	S-343		SWCC			
EasyWind	EasyWind 6				DTU Risø (<40m ²)	
Evance	R9000	BRE	SWCC		DTU Risø (<40m ²)	
Evoco	Evoco 10	BRE	-	-	-	-
Fortis Wind Energy	Montana 5 kW				DTU Risø (<40m ²)	
Fujita HiVAWT	DS-3000			Class NK		
Gaia-Wind	133-11	TUV-NEL			DTU Risø (<200m ²)	
HS Wind	Viking 25				DTU Risø (<200m ²)	

Standaarden en certificering

Wie?

Applicant	Turbine	UK (MSC)	US (AWEA 9.1)	Japan (JSWTA)	DK (ex. ord. 73)	IEC 61400-2
Zhejiang Huaying Wind	HY5 AD5.6	TUV-NEL				
Kestrel Renewable Energy	e400 3.5	TUV-NEL	SWCC			
Kingspan Wind	KW6	TUV-NEL	SWCC		DTU Risø (<40m ²)	
Kingspan Wind	KW15	Intertek				
KVA Vind		5			DTU Risø (<40m ²)	
KVA Vind		6			DTU Risø (<40m ²)	
KVA Vind		10			DTU Risø (<40m ²)	
Nikko Company	NWG -1K			Class NK		
Osiris Technologies	Osiris 10		Intertek		DTU Risø (<200m ²)	
Proven Energy	P-35-2	TUV-NEL				
Ropatec	Ropatec Big Star				DTU Risø (<40m ²)	
Sonkyo 3.5	Windspot 3.5	Intertek	Intertek	Class NK	DTU Risø (<40m ²)	
Sumec Hardware & Tools Co., LTD	Phono Wind PWB01-30-48		Intertek			
Sumec Hardware & Tools Co., LTD	Phono Wind PWB02-40-48		Intertek			

Standaarden en certificering

Wie?

Applicant	Turbine	UK (MSC)	US (AWEA 9.1)	Japan (JSWTA)	DK (ex. ord. 73)	IEC 61400-2
Sumec Hardware & Tools Co., LTD	Phono Wind PWA03-44-250		Intertek			
Sumec Hardware & Tools Co., LTD	Phono Wind PWA05-50-280		Intertek			
Anders Riis Petersen	Selvbyggermølle VAWT				DTU Risø (<5m ²)	
Xzeres Wind Corporation	Skystream 3.7	BRE	SWCC			DNV-GL
Solid Wind Power	SWP 10				DTU Risø (<200m ²)	
Solid Wind Power	SWP 25				DTU Risø (<200m ²)	
Thy Møllen	TWP 40-6				DTU Risø (<40m ²)	
Thy Møllen	TWP 40-10				DTU Risø (<40m ²)	
Tozzi Nord	TN 535	NQA				
WindEn	WindEn45	Intertek				
Vindby	V1A-G9				DTU Risø (<40m ²)	
Xzeres Wind Corporation	442SR	BBA	SWCC			
Zenia Energy	Zenia ZA6				DTU Risø (<40m ²)	
Zenia Energy	Zenia ZA10				DTU Risø (<40m ²)	
Zephyr Airdolphin				Class NK		

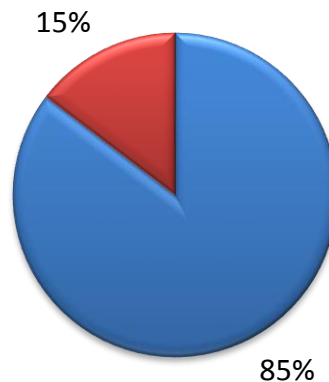
Standaarden en certificering

Wie?

up-wind / down-wind



Excel 10
Bergey Windpower Co.



Skystream 3.7
Xzeres Wind Corporation

Standaarden en certificering

Wie?



Kestrel e400nb
Eveready Diversified Products Ltd.

HAWT / VAWT



DS-3000
Fujita HiVAWT

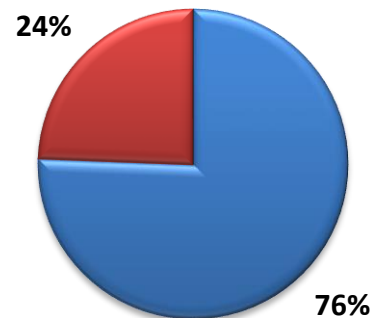
Standaarden en certificering

Wie?

PMG / IG



Windspot 3.5
Sonkyo Energy



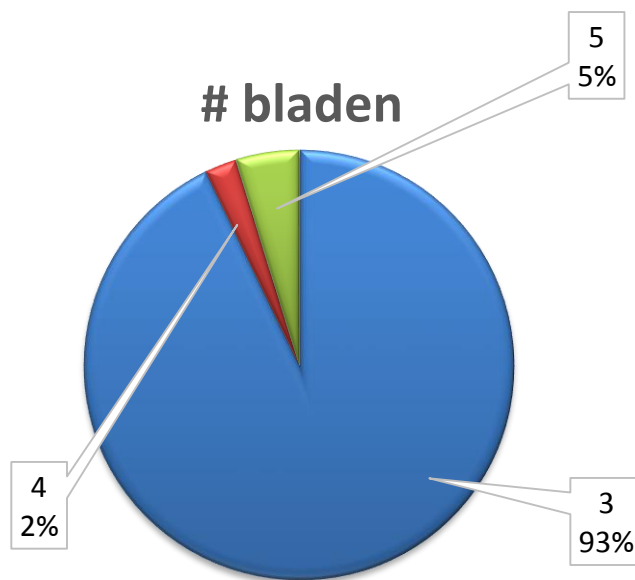
Endurance S-343
Endurance Windpower Inc.

Standaarden en certificering

Wie?



EasyWind 6
EasyWind



V1A-G9
Vindby



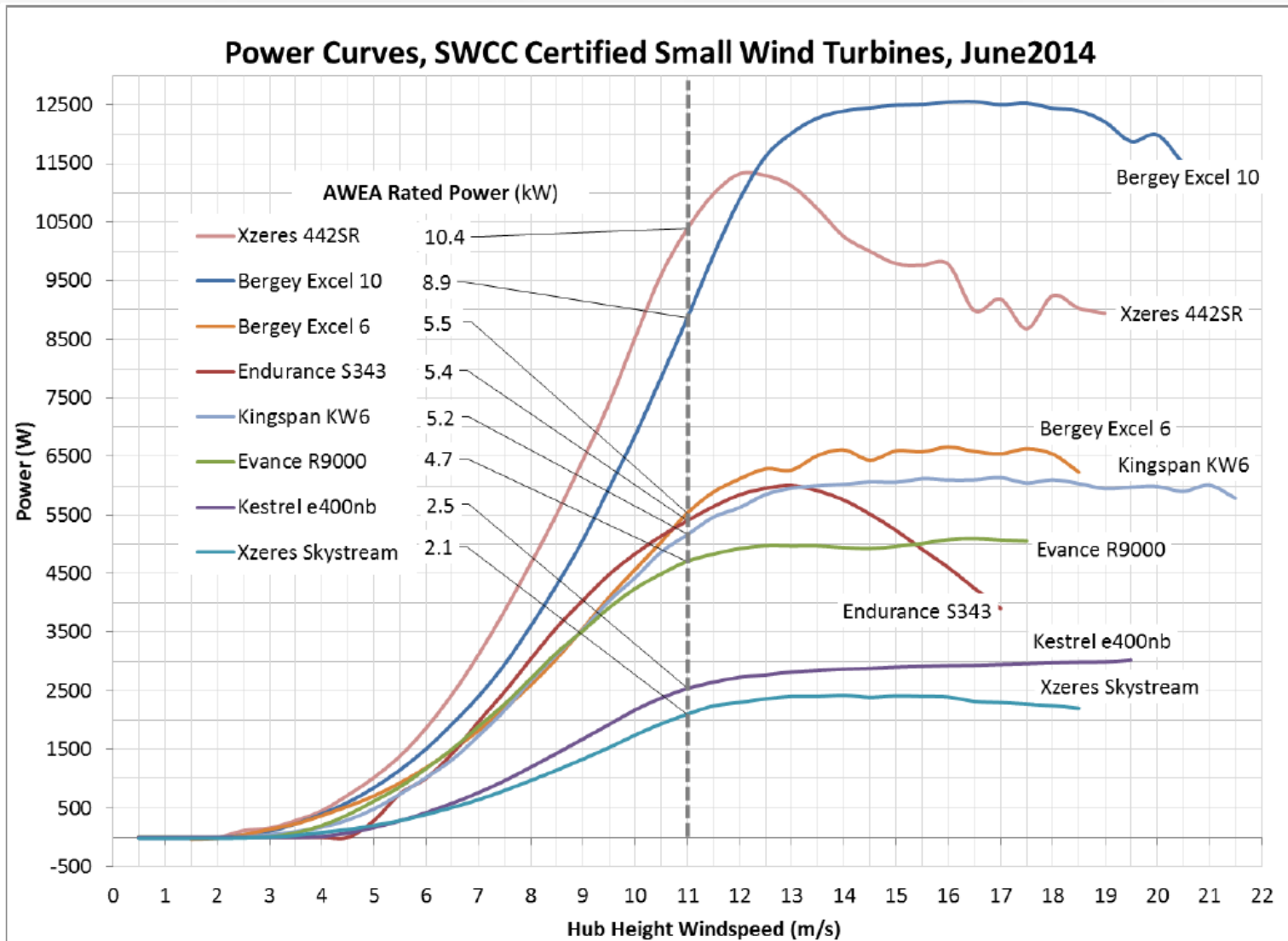
KW6
Kingspan Wind

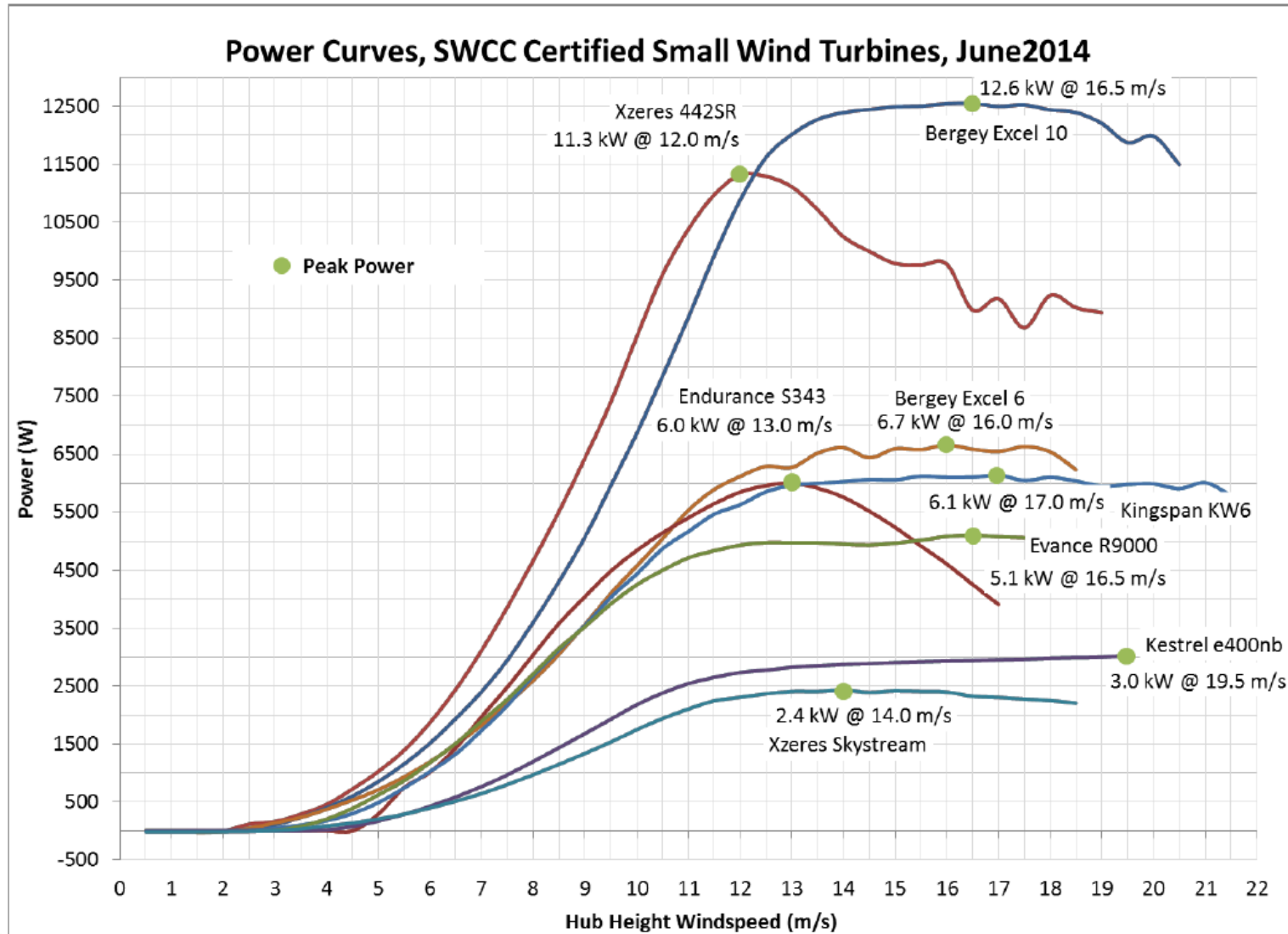
Standaarden en certificering

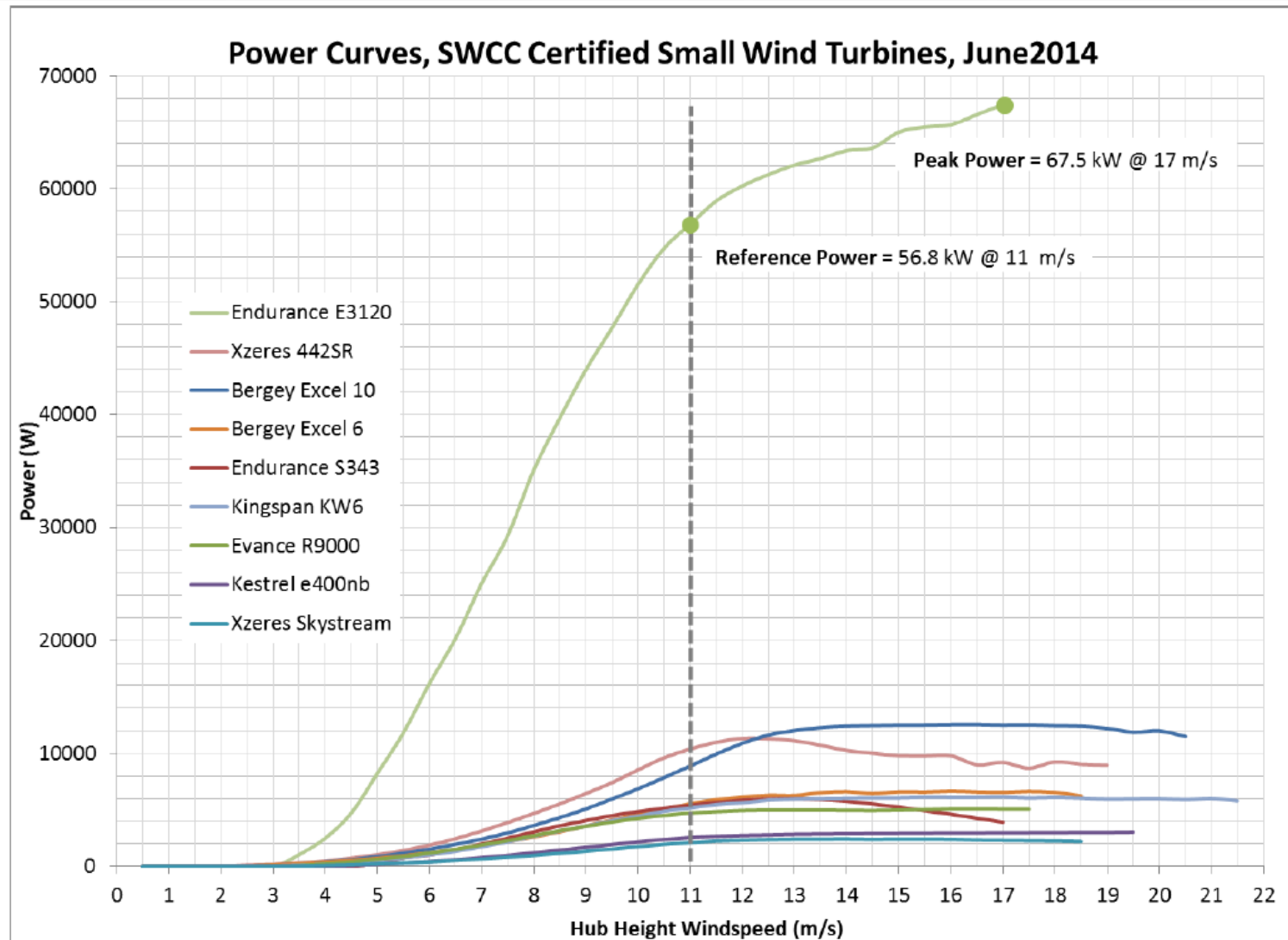
Wie?

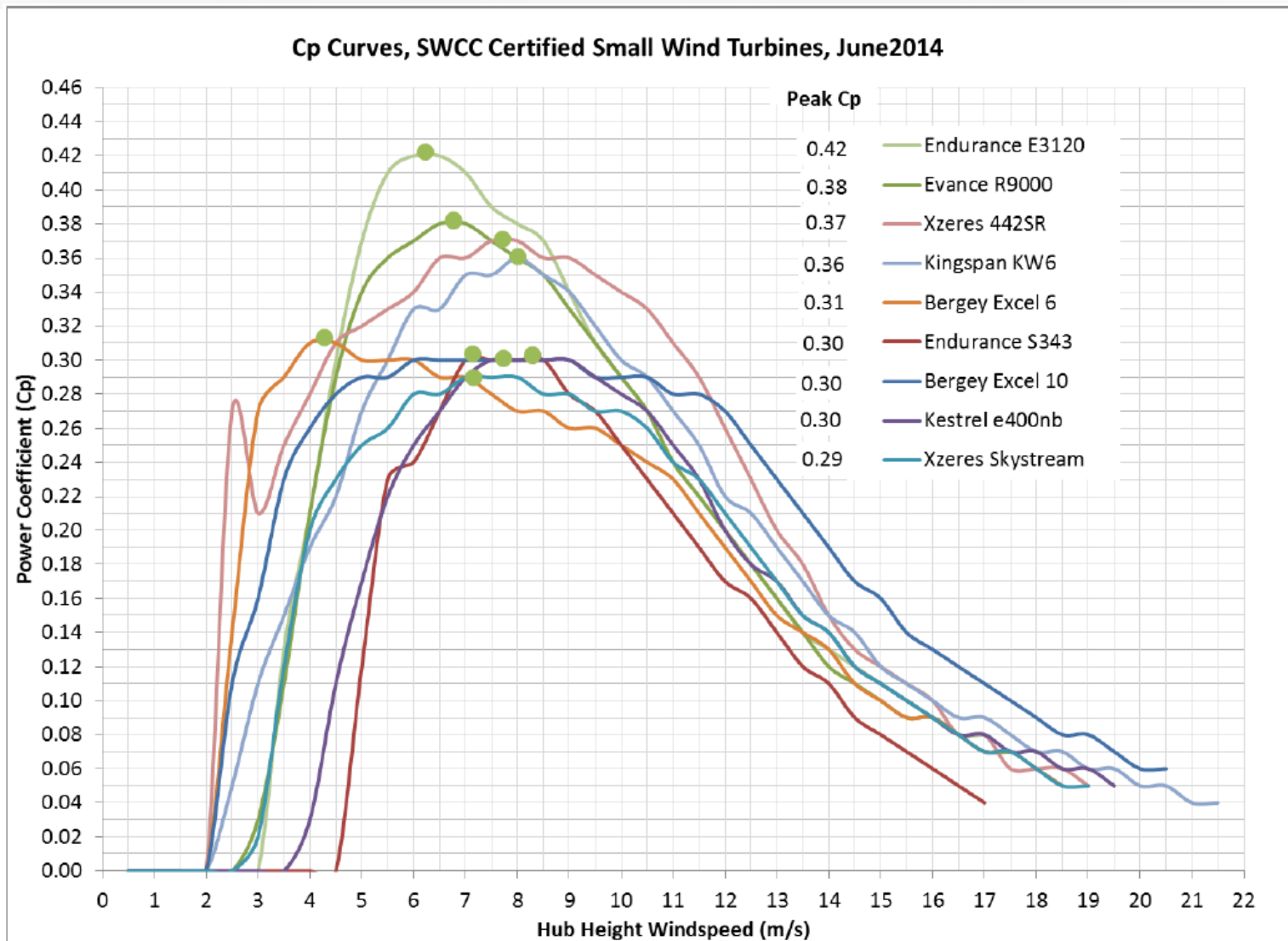
- SWCC: 7 SWT, 1 LPP* (Pika T701), 1 MWT
 - Bergey Windpower Co.: Excel 6, Excel 10
 - Xzeres Wind Corporation: 442SR, Skystream 3.7
 - Kingspan Renewables Ltd: KW6
 - Eveready Diversified Products: Kestrel e400nb
 - Endurance Wind Power Inc.: S343, E-3120

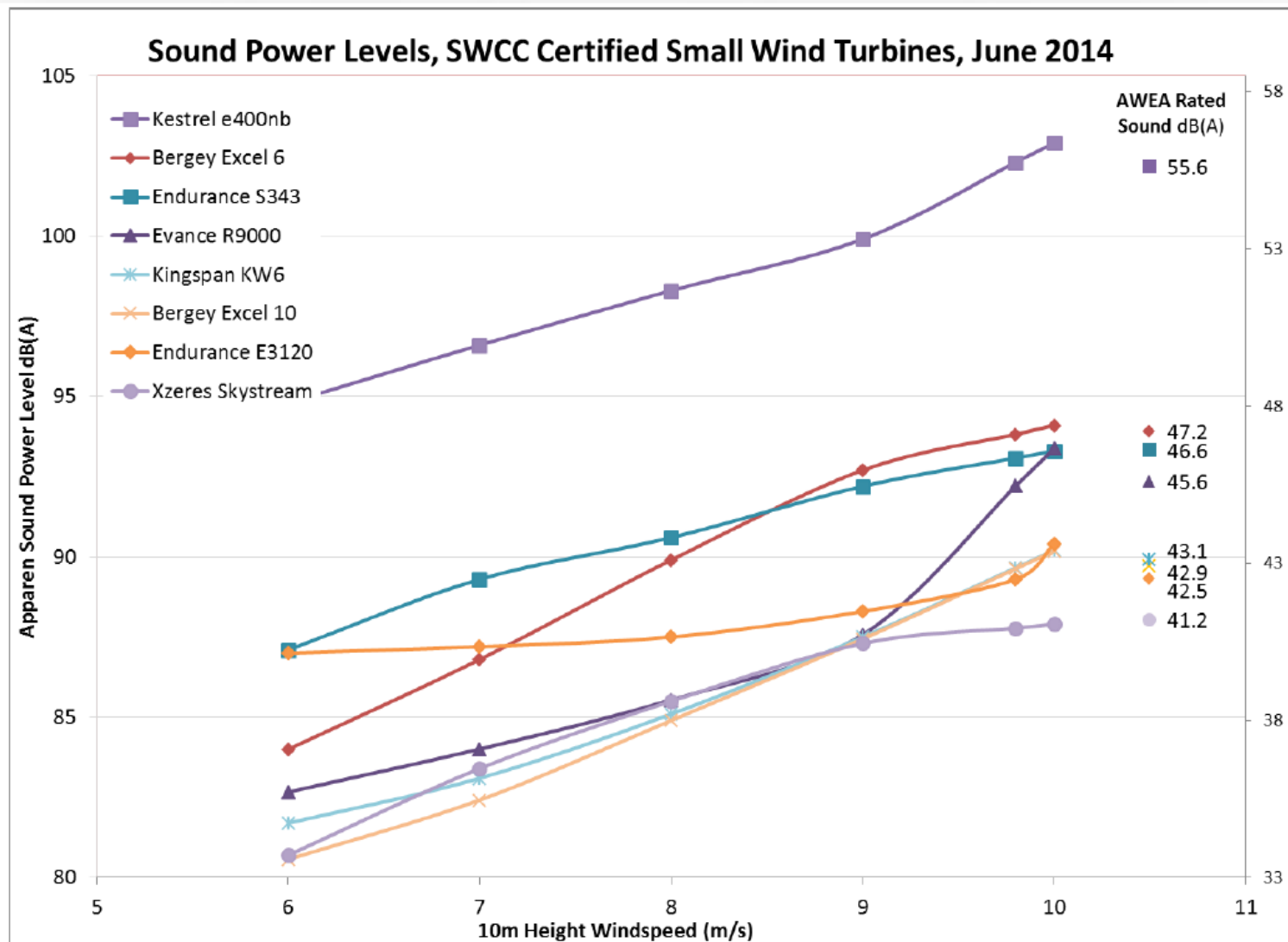
**LPP: Limited Power Performance certificate*











Inhoud

- Standaarden en certificering
- Hulpmiddelen
- Siting



Hulpmiddelen

IEA Task 27

renewableUK

Danish Wind Industry Association

Hulpmiddelen

IEA Task 27

- labelen van SWT
 - duurtest (IEC 61400-2)
 - power performance (IEC 61400-12-1)
 - acoustic noise (IEC 61400-11)

Test Results	
Manufacturer	Manufacturer
Model	Model
Reference Annual Energy <small>at 5 m/s average wind speed, actual production will vary depending on site conditions</small>	### kWh/yr
Declared Sound Power Level <small>at 8 m/s</small>	## dB(A)
Turbine Test Class <small>(I-IV or S for Special)</small>	II
Tested by	Test Organisation
Published Date <small>(Year-Month-Day)</small>	2011-03-04
<small>For more information, see the Task 27 section of www.ieawind.org</small>	

Hulpmiddelen

IEA Task 27

- labelen van SWT
- coördineren test organisaties
 - SWAT (Small Wind Turbine Association of Testers)

Hulpmiddelen

IEA Task 27

- labelen van SWT
- coördineren test organisaties
- SWT op en rond gebouwen



Bron: IEA

Hulpmiddelen

IEA Task 27

- labelen van SWT
- coördineren test organisaties
- SWT op en rond gebouwen
- design tools VAWT

Bron: IEA

Hulpmiddelen

IEA Task 27

renewableUK

Danish Wind Industry Association

Hulpmiddelen

renewableUK

- Technical note
 - [Guidance regarding inverter changes in Small Wind Turbine Systems](#)
- Planning Guidance
 - [Small Wind](#)

Hulpmiddelen

IEA Task 27

renewableUK

Danish Wind Industry Association

Hulpmiddelen

Danish Wind Industry Association

- Shade calculator
- Wind speed calculator

Hulpmiddelen

Danish Wind Industry Association

- [Shade calculator](#)

CALCULATOR

? Turbine hub height m

? Distance between obstacle and turbine m

? Roughness length m
= roughness class

? Obstacle height m

? Obstacle width m
= % of sector width

? Porosity %
= buildings

Submit Plot Wind Speed

Plot Wind Energy

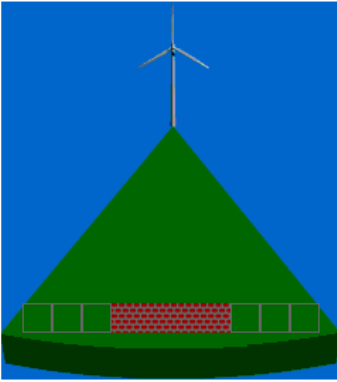
Plot Speed Profile for m/s
hub height wind speed

? Reset to Example

? Result: % wind speed decrease*

= % energy loss in this sector*





Click in grey squares to insert or remove obstacles



Energy in per cent of undisturbed airflow

70 75 80 85 90 95 100

Select obstacle porosity:

0% =  30% =  50% =  70% = 

To print the results of the plotter programme you should make a [screen dump](#)

Hulpmiddelen

Danish Wind Industry Association

- [Wind speed calculator](#)

CALCULATOR

roughness

- class	0.0	0.5	1.0	1.5	2.0	3.0	4.0
- length m	0.0002	0.0024	0.03	0.055	0.1	0.4	1.6
150 m	13.1	12.32	11.25	10.93	10.59	9.65	8.44
140 m	13.03	12.25	11.16	10.84	10.49	9.53	8.31
130 m	12.96	12.16	11.06	10.73	10.38	9.41	8.17
120 m	12.88	12.07	10.96	10.62	10.26	9.28	8.02
110 m	12.79	11.98	10.84	10.5	10.14	9.14	7.86
100 m	12.70	11.87	10.71	10.37	10	8.99	7.69
90 m	12.6	11.75	10.58	10.23	9.85	8.81	7.49
80 m	12.49	11.62	10.42	10.06	9.68	8.62	7.27
70 m	12.36	11.47	10.24	9.88	9.48	8.41	7.02
60 m	12.21	11.3	10.04	9.67	9.26	8.15	6.74
50 m	12.03	11.1	9.8	9.41	9	7.86	6.4
40 m	11.82	10.85	9.5	9.11	8.67	7.5	5.98
30 m	11.54	10.53	9.12	8.71	8.26	7.03	5.45
20 m	11.14	10.07	8.59	8.15	7.67	6.37	4.69
10 m	10.47	9.3	7.67	7.19	6.67	5.24	3.41

[Plot](#) [Plot](#) [Plot](#) [Plot](#) [Plot](#) [Plot](#) [Plot](#)

Inhoud

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Siting – case studie Vlaanderen



→ 3 identieke turbines, 3 ≠ locaties

Siting – case studie Vlaanderen



SWT Field Lab, Oostende
15m
3,2 MWh/jaar



Zwijndrecht
15m
0,6 MWh/jaar



Heffen
18m
2 MWh/jaar

Siting – case studie Washington



Peshastin, Washington
30m
0,5 MWh/jaar (8 MWh verwacht)



Ellensburg, Washington
30m
17 MWh/jaar (16 MWh verwacht)

Bron: NREL



Bedankt voor jullie aandacht

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