Nordic Folkecenter
for Renewable Energy

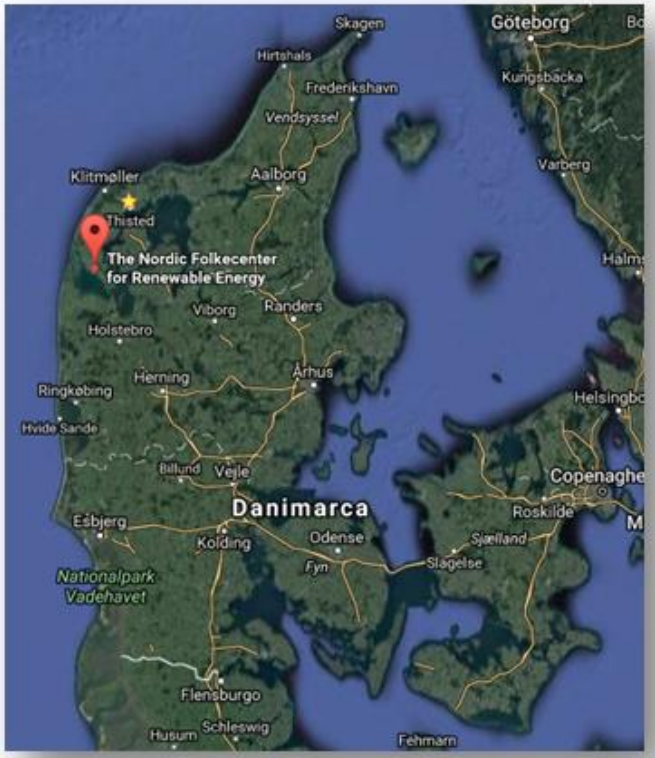
DANISH TEST AND RESOURCE CENTRE FOR SMALL WIND TURBINE

Tonny Brink
Nordic Folkecenter for Renewable Energy

7th International Conference on Small & Medium Wind Energy
21 September 2022

The Nordic Folkecenter for Renewable Energy

- NGO founded in 1983
- Focus: Renewable Energy
- Bridge between education and industry
- Well known at international level
- Multi-cultural and multi-disciplinary environment
- Has hosted hundreds of interns, professors, researchers from different fields and from all over the world
- 6000+ visitors/year (1,7 mio. Online)



Goal: Favour the transition towards a 100% renewable energy society

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Test Site Location & Collaborators

DANISH ASSOCIATION
for Small and Medium Wind Turbines

DTU Technical University of Denmark

AARHUS UNIVERSITET

AALBORG UNIVERSITET

HOUSE OF ENERGY

SMVdanmark

energy CLUSTER DENMARK

TEKNIQ ARBEJDSGIVERNE
Industri & Installation

DANSK METAL

DANISH TEST AND RESOURCE CENTRE FOR SMALL WIND TURBINES
Small Wind Test and Lab

Danish Legislation of 30 November 2020 defines three categories of household windmills (m^2 swept area):

1. Below 5 m^2
2. Up to 40 m^2
3. Up to 200 m^2
4. Maximum 25 m to blade tip
5. Maximum 25 kW generator size
6. To be installed nearby existing buildings (20 - 25m)
7. To be installed private households for self-supply in rural areas

IEC 61400-2 & IEC 61400-22 / IECRE OD554

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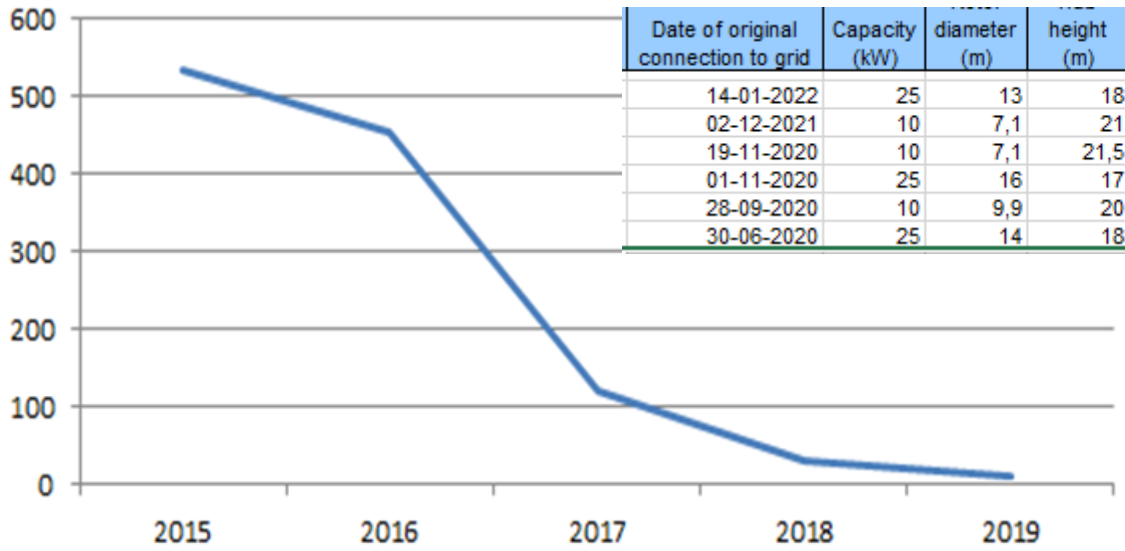
Small Wind DK



Date of original connection to grid	Capacity (kW)	diameter (m)	height (m)	Manufacture	Model	Local authority no	Local authorit name
14-01-2022	25	13	18	HSWind Aps	Viking 25	250	Frederikssunc
02-12-2021	10	7,1	21	THY møllen Aps	TWP-40-10	741	Samsø
19-11-2020	10	7,1	21,5	Ukendt	Ukendt	400	Bornholm
01-11-2020	25	16	17	Solid Wind Power A	SWP10-14TG20	671	Struer
28-09-2020	10	9,9	20	KVA Vind	KVA Vind 10-10	340	Sorø
30-06-2020	25	14	18	Solid Wind Power A	SWP25-14TG20	330	Slagelse

- Market Update - 5 Grid connected Wind Turbines in 2020
- Generel Assembly - White Book on Stupid Legislation
- Behind the meter market - Electricity Prices are Sky High in Denmark
- Energy corropertives

DANISH TEST AND RESOURCE CENTRE FOR SMALL WIND TURBINES

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Year/Month

EUR/MWh

	DK1
2021	88,14
2020	24,98
2019	38,49
2018	44,05
2017	30,08
2016	26,67
2015	22,90
2014	30,67
2013	38,98
2012	36,33
2011	47,96
2010	46,49
2009	36,05
2008	56,43
2007	32,40

DKK/MWh

	DK1
2021	655,48
2020	186,18
2019	287,39
2018	328,32
2017	223,79
2016	198,55
2015	170,75
2014	228,62
2013	290,67
2012	270,45
2011	357,32
2010	346,20
2009	268,42
2008	420,70
2007	241,37

DK1

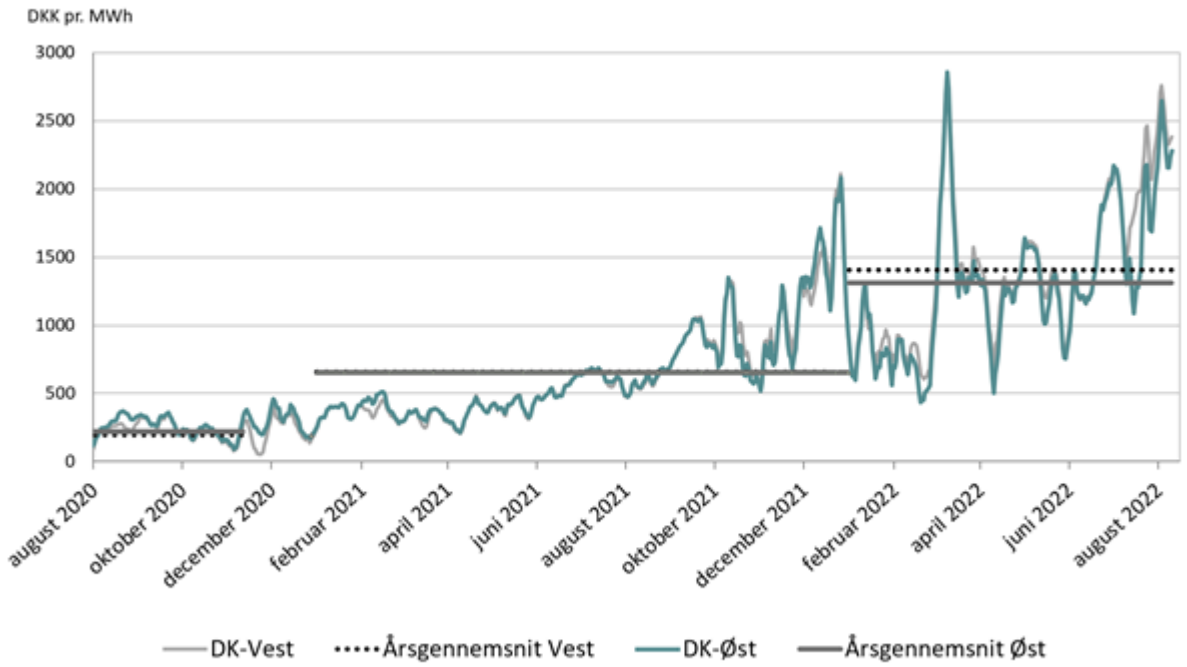
EUR/MWh

	DK1
22 - Aug	456,75
22 - Jul	275,04
22 - Jun	214,43
22 - May	171,86
22 - Apr	163,64
22 - Mar	235,78
22 - Feb	113,12
22 - Jan	117,99
21 - Dec	189,35
21 - Nov	141,80
21 - Oct	116,90
21 - Sep	125,36
21 - Aug	82,79
21 - Jul	80,00
21 - Jun	73,72
21 - May	54,31
21 - Apr	47,97
21 - Mar	45,11
21 - Feb	47,26
21 - Jan	50,21
20 - Dec	34,51
20 - Nov	23,75
20 - Oct	25,75

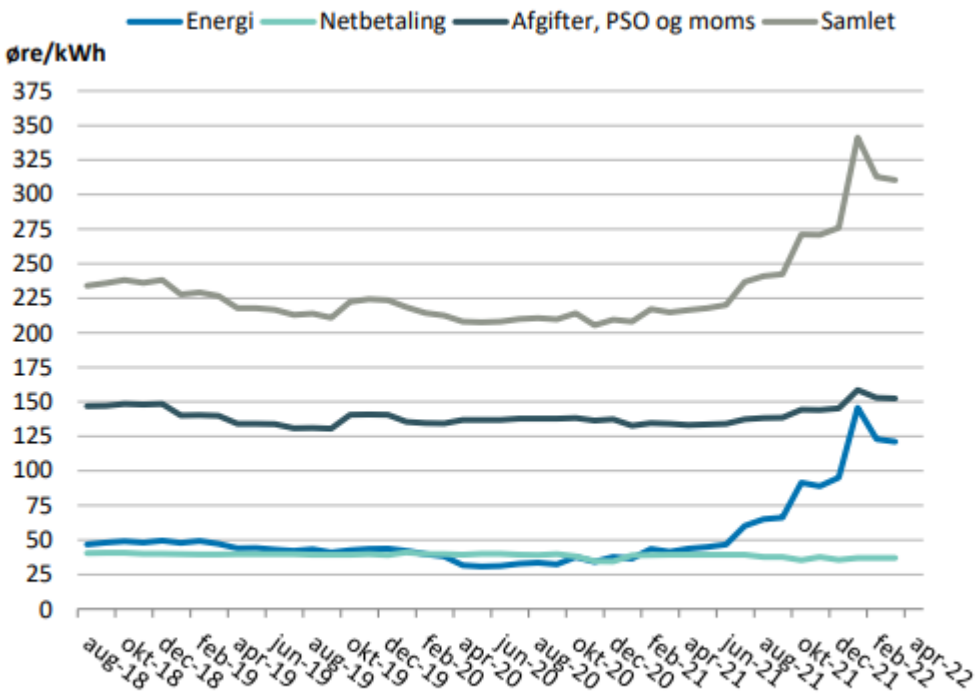
DKK/MWh

	DK1
22 - Aug	3 397,77
22 - Jul	2 046,91
22 - Jun	1 595,24
22 - May	1 278,64
22 - Apr	1 217,25
22 - Mar	1 754,15
22 - Feb	841,70
22 - Jan	877,93
21 - Dec	1 408,00
21 - Nov	1 054,57
21 - Oct	869,72
21 - Sep	932,21
21 - Aug	615,69
21 - Jul	594,97
21 - Jun	548,21
21 - May	403,83
21 - Apr	356,72
21 - Mar	335,42
21 - Feb	351,47
21 - Jan	373,47
20 - Dec	256,82
20 - Nov	176,87
20 - Oct	191,61

Figur 3: Elprisen



Anm.: Data er spotpriser, der er udglattet til syv dages gennemsnit, sidste observation er 10. august 2022.
Kilde: Data er hentet fra Energinet, der baserer sig på data fra Nord Pool, EEX, Nasdaq OMX og DI-beregninger



Kilde: Elpris.dk, Energinet, Skatteministeriet samt Forsyningstilsynets egne beregninger.

Danish Energy Agency - Positiv List for Grid Connection

DANSK ENERGI

List of grid-connected wind turbines which comply wit

Manufacturer	Designation	Certificate number from RisøDTU	Version	Power AC	No. of phases	Approval	E
[Name]	[Type]		[Rev. / ver]	[kW]	[no.]	[date]	
HSWIND	Viking VS10	DTU 2016-5 TC-B		10	3	23.june 2017	
	Viking VS25	DTU 2016-4 TC-B		25	3	23.june 2017	
Ryse Energy							
	G-11-RfG-DK			11	3	17 June 2022	
Solid Wind Power	SWP10-16TG20	DTU 2019-1 TC-A		10	3	26 June 2020	
KVA Wind Int.	VFXG46-046S1			15	3	4 September 2020	
Thy Windpower ApS	TWP 6-40-F3			6	3	11 December 2020	
	TWP 10-40-F3			10	3	12 February 2021	
Standards							
Technical requirements for connection of generating power plants to the LV grid Version 1.2							

*Note	The expiry date is when a new techincal regulation is published or a when the wind turbine is updated (new version or revision)
Note	A wind turbine is only approved as an electricity-generating unit
Note	NTR = Next Technical Revision (Future)

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	Price ex. Vat	Yearly Expected Energy Production
VIKING WIND	740.000 DKK	65.000 – 90.000 Kwh
THYmøllen	412.000 DKK	12.000 – 18.000 Kwh
	436.000 DKK	18.000 – 30.000 Kwh
Ryse Energy	383.000 Dkk	12.000 - 15.000 Kwh
	587.000 Dkk	30.000 – 40.000 Kwh
Solid wind power	969.000 DKK	60.000 – 120.000 Kwh
KVA Wind Int.		

*Service Cost

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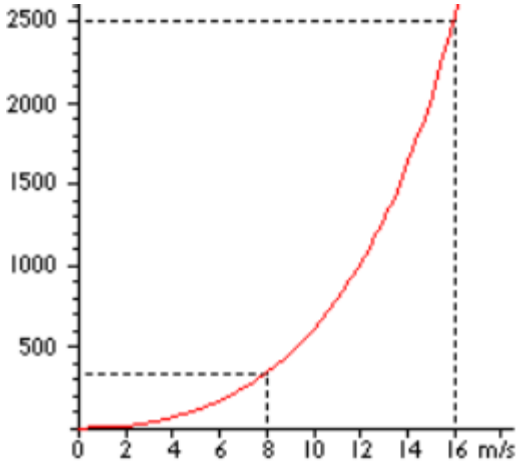
400 watt Procure

Delivered in a box
- ready for installation

2 kW Proven

Wind speed is not linear with Kw

- Watt/m2=1/2 x 1,225 x m/s^3
- Wind speeds in 3rd potency * Betz
- 2m/s=5w x 0,4 = 2 w
- 4m/s = 39w x 0,4 = 15 w
- 6m/s=132w x 0,4 = 52 w
- 8m/s=313w x 0,4 = 125 w
- 10m/s=612w x0,4 = 244 w



Grid connected or island, it almost gives itself

- Is there the possibility of grid connection and the price relevant, grid connection
- If there is no grid, then island operation

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DANISH ASSOCIATION
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- HUSUM 2021- Hamburg 2022
- Rep. Members of Small Wind Association

WWEA
World Wind Energy Association

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Teststation Today

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- Blade Testing

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- Hundborg
- AMarkWind

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Autonomous wind power:
In operation at the Folkecenter since 1996

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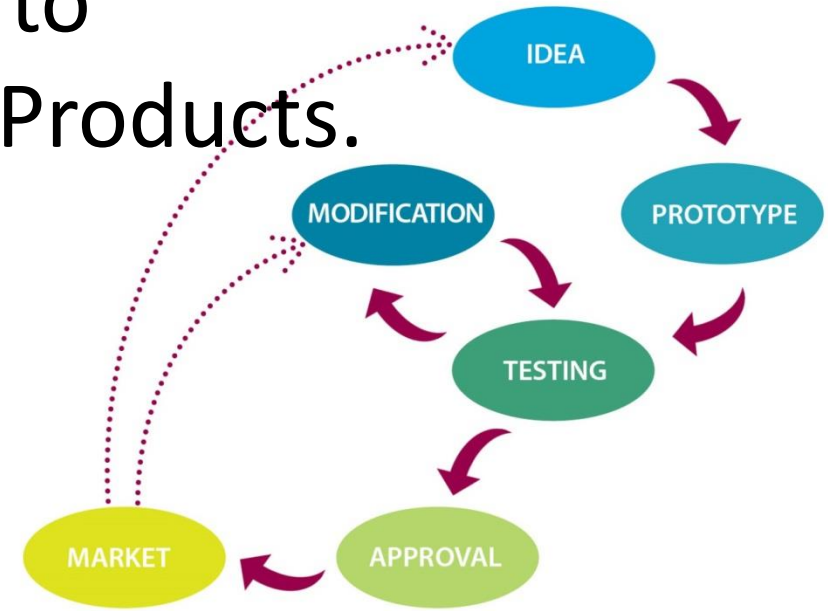
From Back Yard inventors to commercialized Certified Products.



Dansk Standard, S-588, TC88, IEA – Task 41

Strategy for S-588 Vindenergisystemer

Purpose

To ensure that TC 88/S-588 initiates and participates in all standardization projects related to Wind Energy

Active participation in Technical areas

- IEC TC 88 Wind energy generation systems
- CLC TC 88 Wind Turbine
- IECRE – The IEC System for Certification to Standards Relating to Equipment for Use in Renewable Energy Applications
- All Wind energy related projects under IEC TC 14 Power transformers
- All Wind energy related projects under ISO TC 60 Gear
- All standardisation projects related to Wind energy in other Technical Committees.

Denmark has since 2013 held the secretariat for IEC TC 88 Wind energy generation systems

DS DANSK STANDARD

Kilde:Dansk Standard

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Tonny Brink, Nordic Folkecenter for Renewable Energy

Educated as a Marine Engineer, he is Folkecenter's Chief Technical Director. He has got 35 years of experience in the international wind industry, working for Vestas Wind Systems A/S and Folkecenter. This has provided him with broad knowledge in service and maintenance site management and construction and operational project management. Hold positions and responsibilities: Travel Technician, Site Manager, Logistics Coordination, Area Service Manager, Technical Support Dept., People Manager, Technical After Sales/Customer Reporting, WTG Performance and Diagnostic analysis, Communication, Planning, Controlling, Technology Transfer, Project Management and Execution Leader.

www.smallwind.dk or www.smallwind.eu

Visitors are always welcome!