



Zeeland Small Wind Trial study and certification in Holland

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Introduction

Background:

Delft University of Technology PhD 'wind energy in the built environment'
Delft University of Technology MSc Physics; fluid dynamics, wind energy
School of Engineering en Applied Science BEng Mechanical Engineering

Current position:

Director/ Owner Ingreenious B.V.

Ingreenious B.V.:

Wind resource measurements (existing buildings)
Wind resource studies (newly built buildings)
Urban wind turbine design
Project management renewable energy
Project management CSR

Dutch Wind Energy Association

Commission Finance & Exploitation
Certification Small Wind turbines

Zeeland, Schoondijke

Trial study and evaluation measurements
small wind turbines





The Netherlands

ZEELAND SMALL WIND TRIAL STUDY



Ingreenious
Ingenious with green

Zeeland Small Wind Trial



The 11 small wind turbines

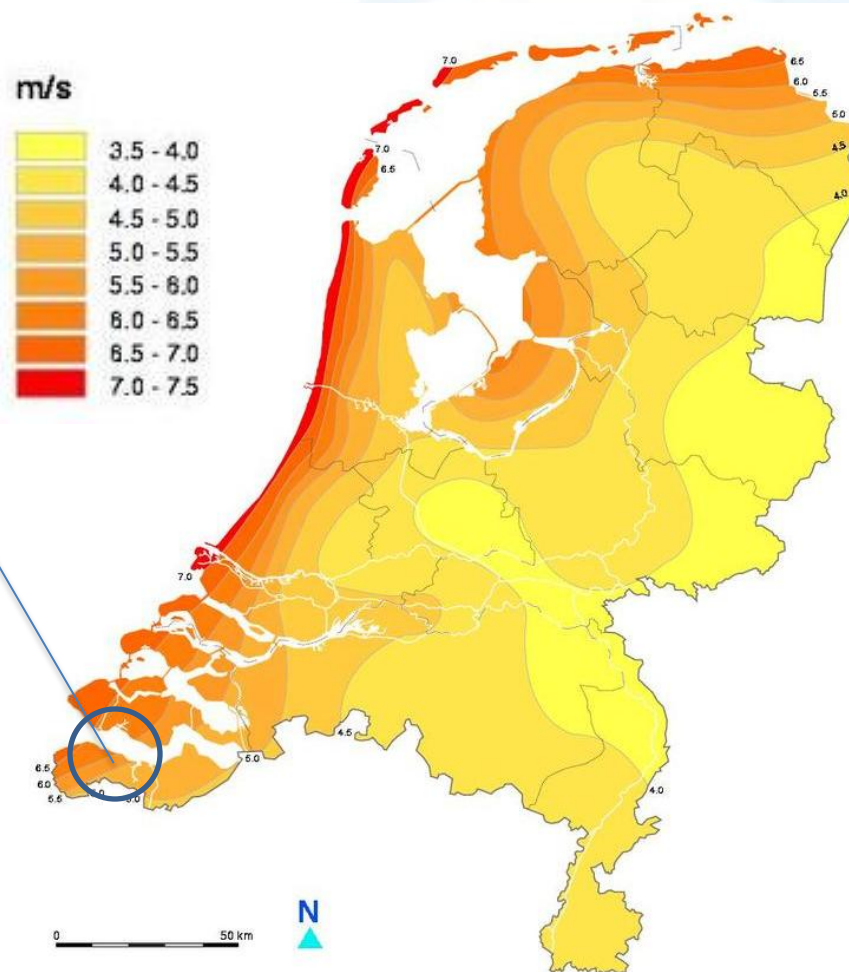
Supplier	Name wind turbine
CFC	WRE 030 & WRE 060
EWS Energy	Skystream
Bettink	Airdolphin
Fernegy	Swift
Home Energy	Energy Ball
Fortis Wind Energy	Passaat & Montana
Turby	Turby
Rietpol	Ampair
Windwalker	Windwalker

What was measured

1. Energy delivered
2. Energy used
3. Wind speed

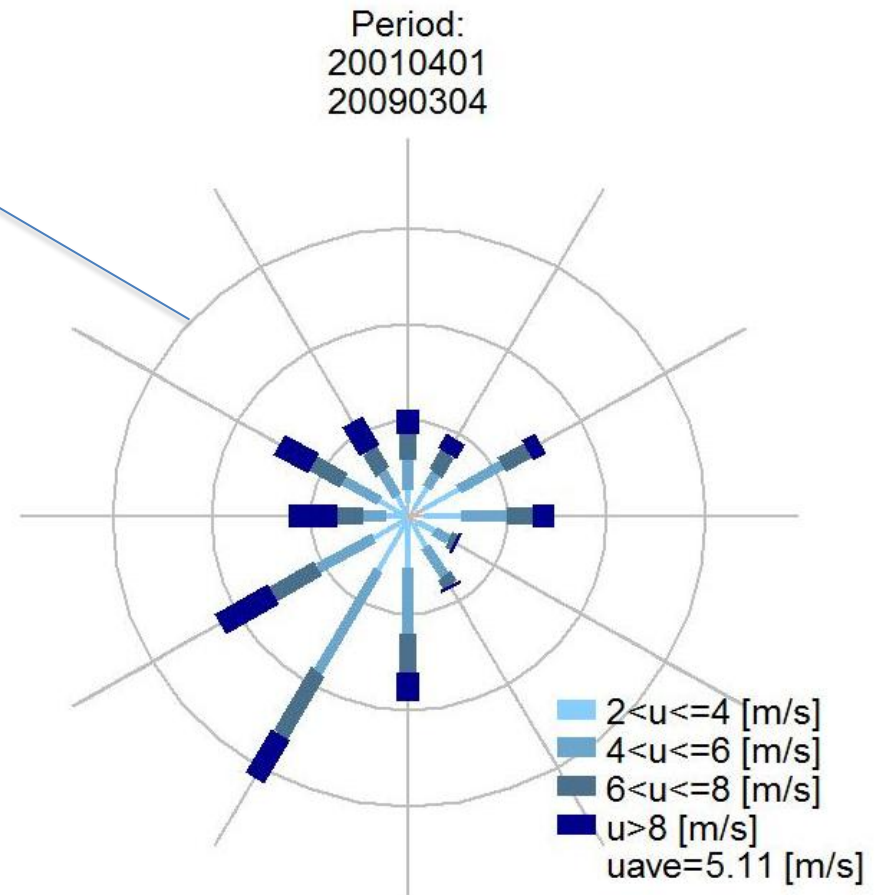
Wind speed

Guess project team
based on potential
wind speed: 6 m/s



Wind speed

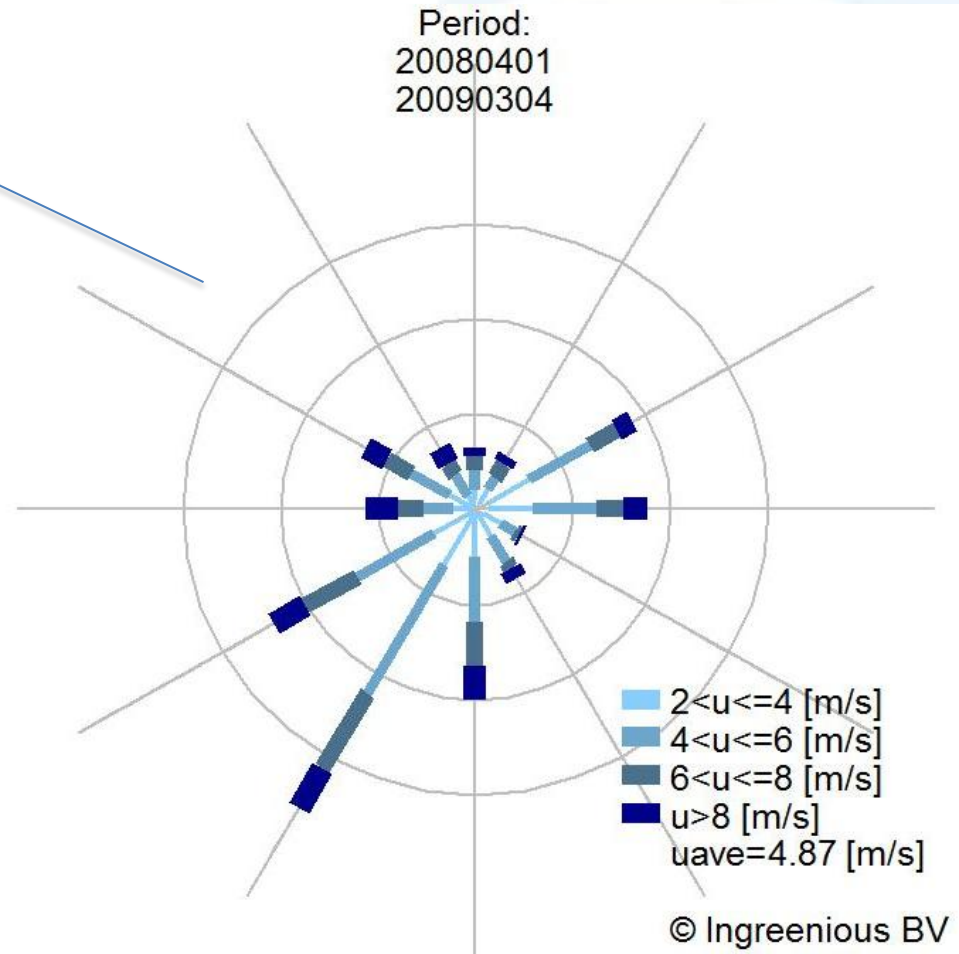
Potential wind speed, at a distance of 8 km, over the last 8 years : 5.1 m/s



© Ingreenious BV

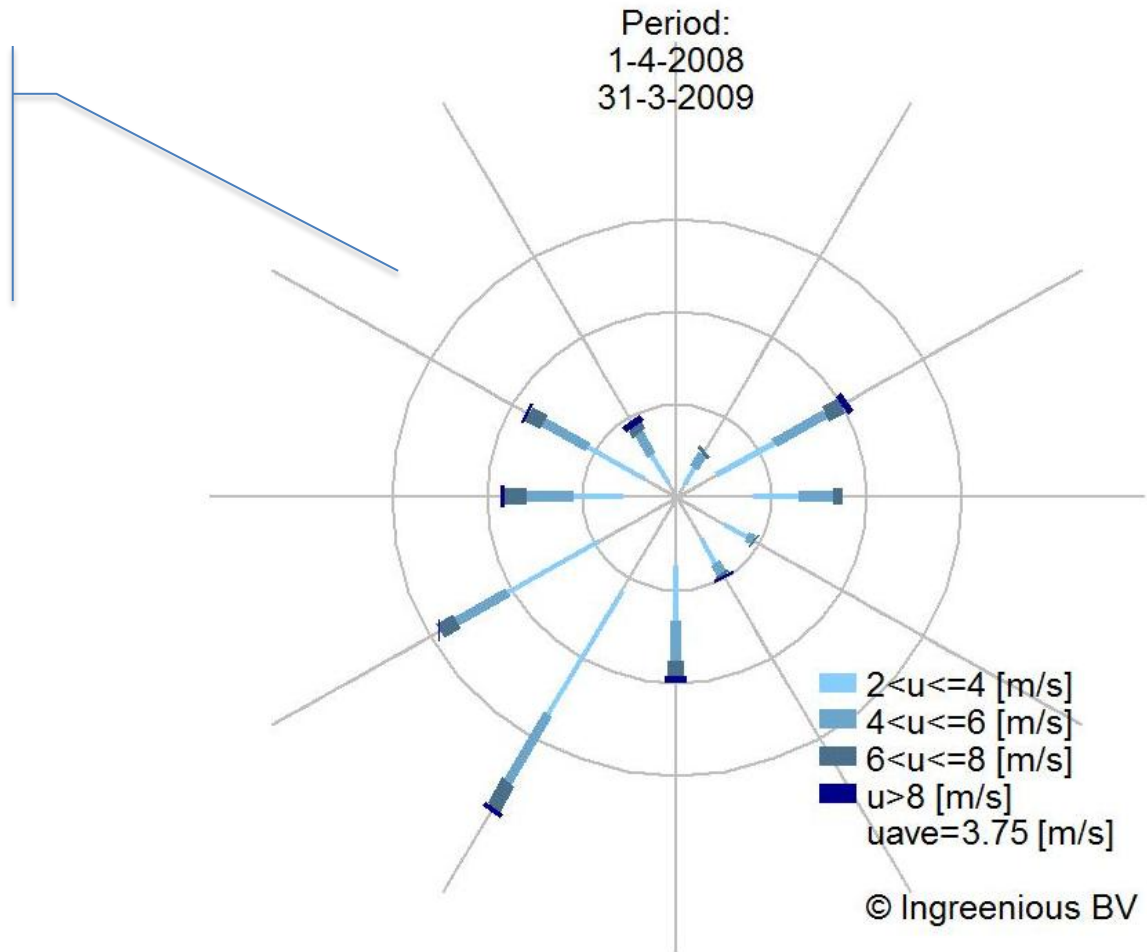
Wind speed

Potential wind speed, at a distance of 8 km, over the test year : 4.9 m/s



Wind speed

Measured wind speed at the testsite during the test year : 3.8 m/s



Wind speed

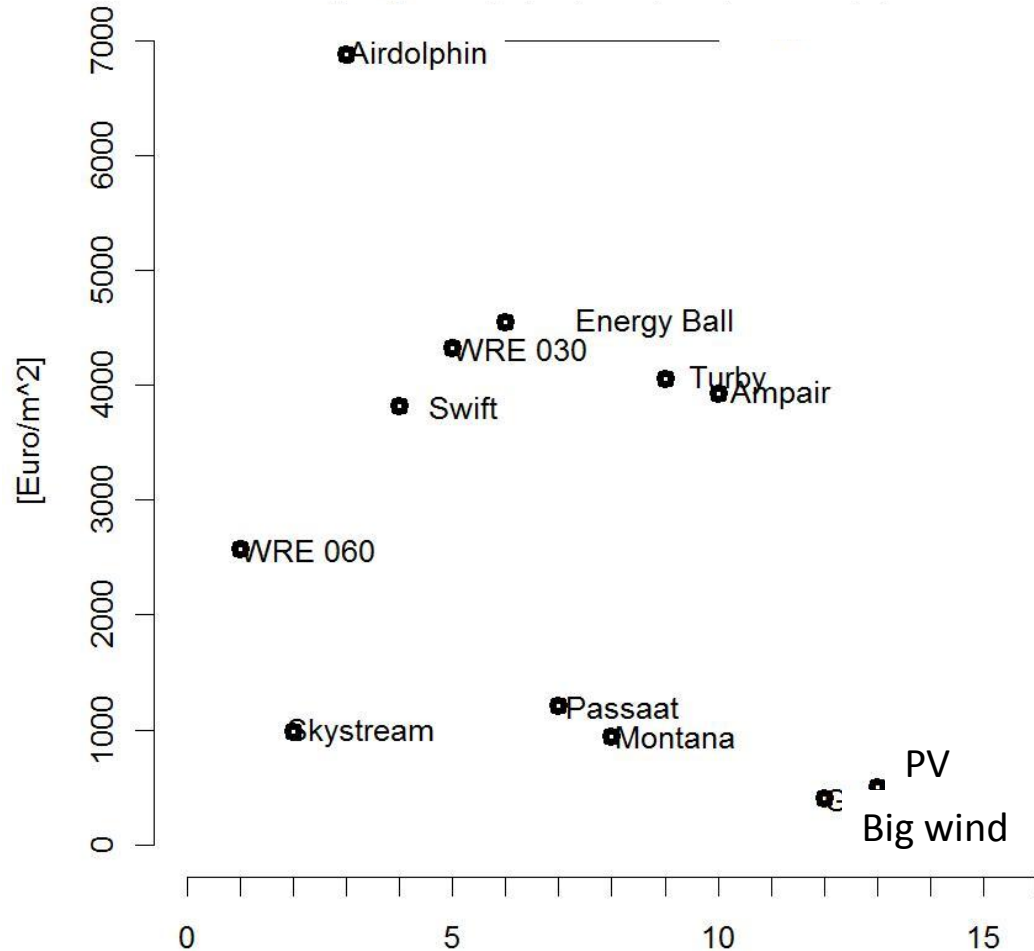
1. Initial thought project team: 6 [m/s]
2. Potential wind speed @ 8 km distance over the last 8 y: 5.1 [m/s]
3. Potential wind speed @ 8 km distance over the test year: 4.9 [m/s]
4. Measured wind speed @ the test site over the test year: 3.8 [m/s]

Energy yield @ 3.8 [m/s] = $\frac{1}{3}$ Energy yield @ [6 m/s]

This is difficult to explain to uninitiated ones and it is mostly skipped in the newspaper headings on the test results.

Comparing investment

- Big is cheap because of the costs of the mast.
- Large variance investment per square meter rotor area.

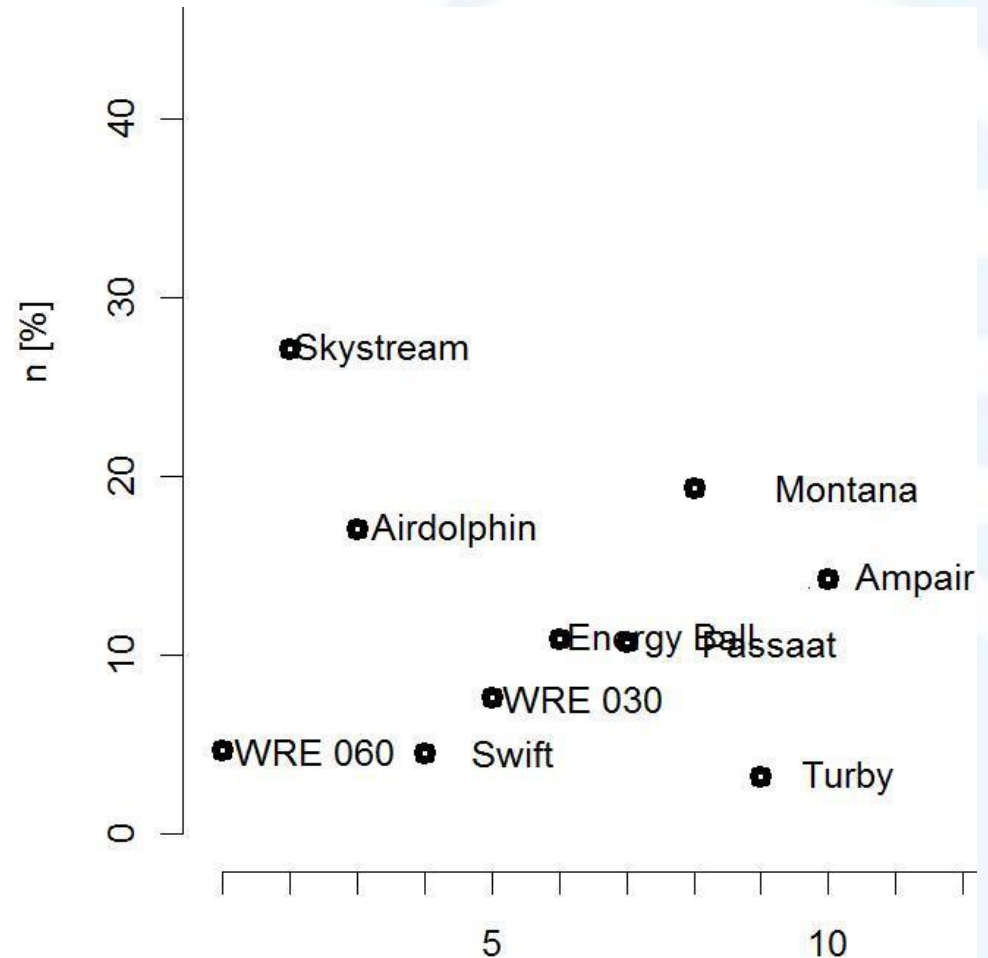


Comparing overall efficiency

- Based on standard power curve efficiency 0.3 and energy yield 212 [kWh/m²year]

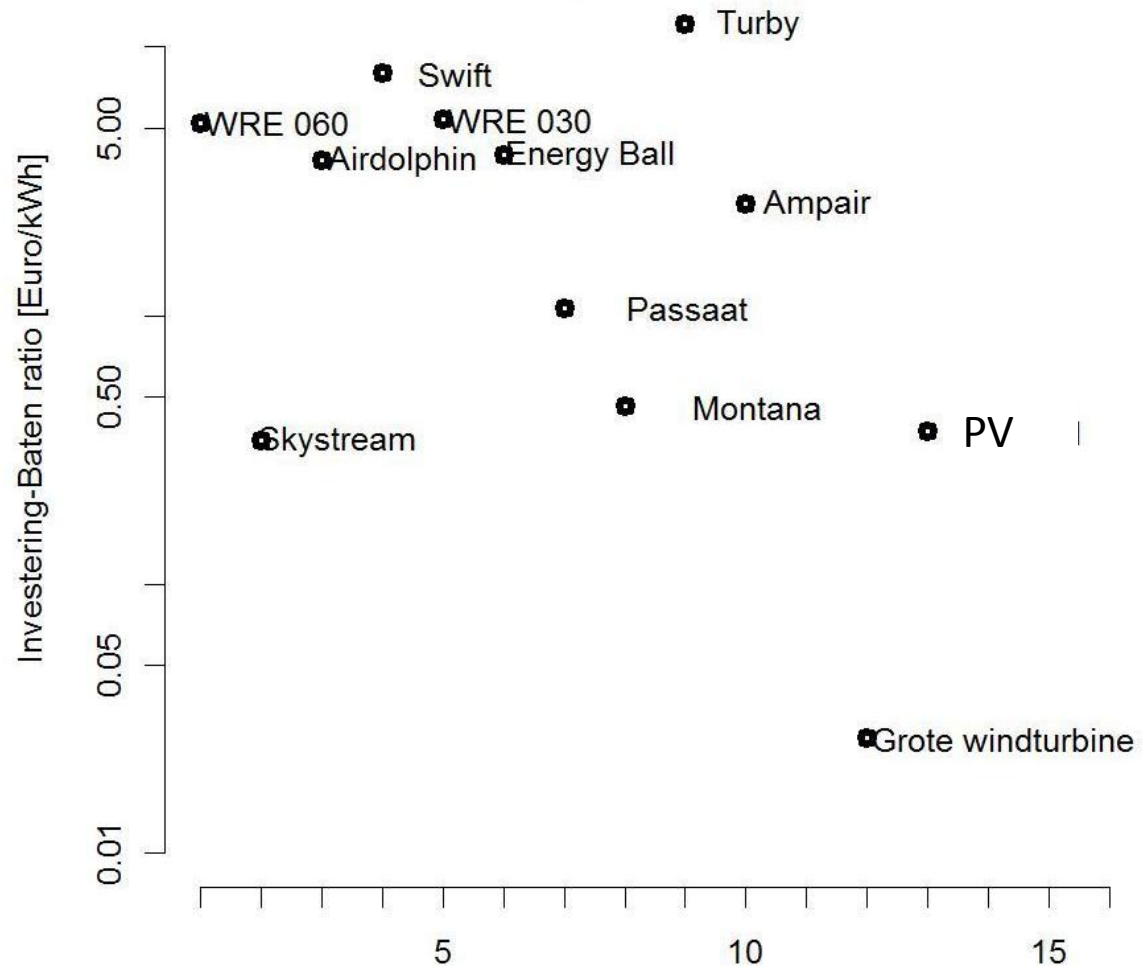
$$n = 0.3 \times E / 212$$

- Large variance overall efficiencies



Comparing Investment/kWh ratio

- 15 years lifespan
- Large variance in investment/kWh ratio



Results Zeeland trial

- Known performance (at least for the test site conditions)
- Extremely large variance in costs, efficiencies and investment-benefit ratio (=beginning of a market)
- Investment-benefit ratio best small wind turbines comparable to Solar panels
- Newspaper headings mostly mentioned the results as “disappointing”
- Subsidy for certification stopped



The Netherlands

CERTIFICATION SMALL WIND TURBINES



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Dutch Small wind turbine certification

- Why:** Ridiculous energy yields mentioned by some manufacturers/ suppliers,
No idea of performance (safety, noise, energy yield)
In order to boost the quality of the wind turbines
- Client:** Subsidy body of economic affairs, The Netherlands (paying)
Dutch small wind community (NWEA member part)
Governmental organizations
- Project:** Finished at the end of 2008
- Current state:** First thoughts to certify some wind turbines

Wishes stakeholders

Manufacturers/suppliers:

- Low costs (a few k Euro)
- Should fit international standards
- Bigger market

Potential buyers:

- Trustful information on performance
- Energy yield prediction
- Safety
- Nuisance (Noise, shadow, reflections)
- Should fit international standards

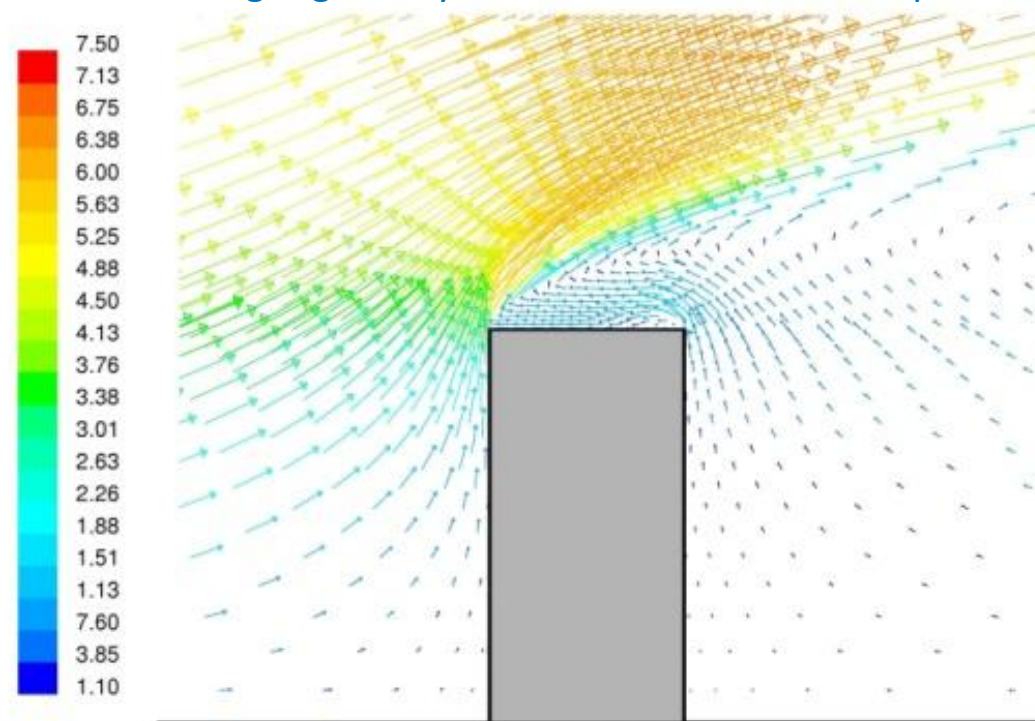


Dutch certification:

- Done by manufacturers/ suppliers but checked by third party
- Does not fit international standards
- Voluntary separate measurement of performance in built environment (check of the urban wind turbine claim)
- National database for performance in built environment

Measurements built environment

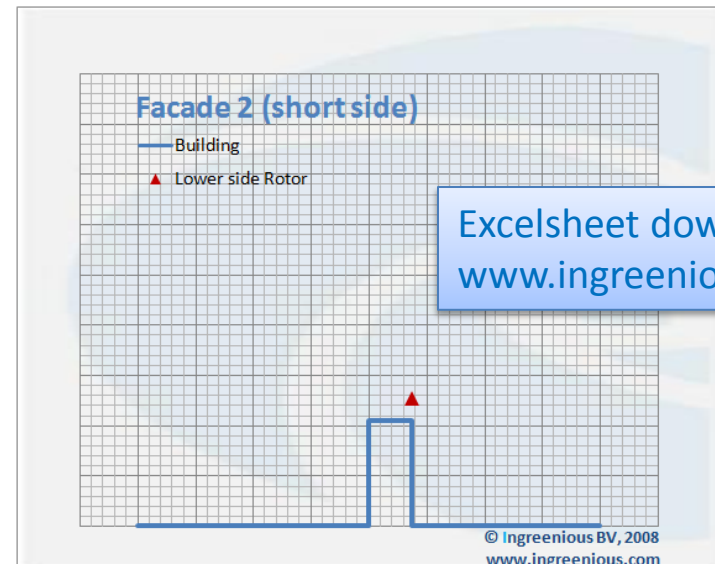
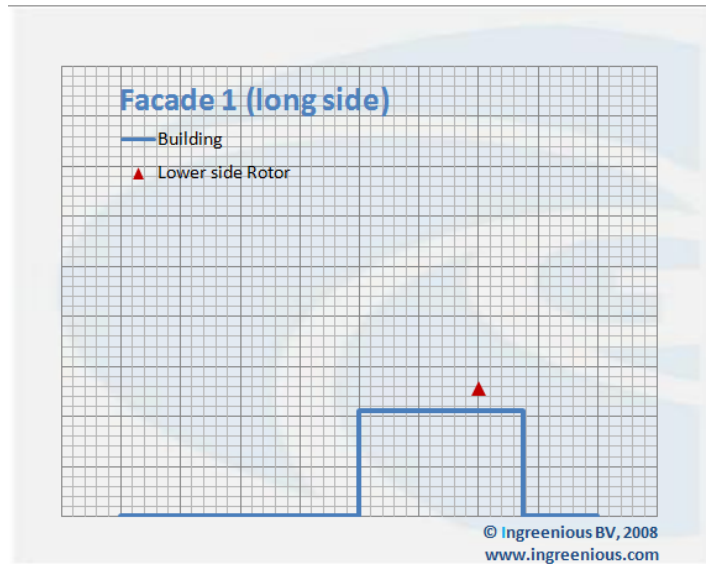
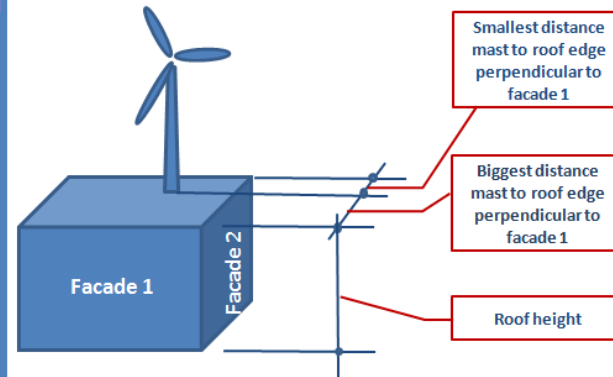
Importance of height above the roof is underestimated, no measurements in built environment below a height given by an Excel sheet that accompanies the certification



Velocity Vectors Colored By Velocity Magnitude (m/s)
© dr.ir.ing. Sander Mertens, 2006

Measurements built environment

Foot [ft] to meters [m] converter:	1 [ft]	0,3 [m]
Facade 1 (the long side):		
Roof height =	42 [m]	138 [ft]
Facade width = (L_1)=	55 [m]	180 [ft]
Biggest distance mast to roof edge perpendicular to long side =	15 [m]	49 [ft]
Facade 2 (the short side):		
Facade width = (L_2)=	15 [m]	49 [ft]
Biggest distance mast to roof edge perpendicular to short side =	40 [m]	131 [ft]
Output		
Minimal height of the lower side of the rotor measured from the ground =	50,86 [m]	167 [ft]
Minimal height of the lower side of the rotor measured from the roof =	8,859 [m]	29 [ft]



Excelsheet download:
www.ingreenious.com

Overall conclusions

1. Measure the wind speed before installing a small wind turbine
2. As a supplier do not go to small wind trials unless you are sure of a good performance (good wind speeds, good reliability and performance of your wind turbine)

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