 **The Green  
Company**

An independent onsite  
wind and solar developer

0800 0787 243  
[www.the-green-company.com](http://www.the-green-company.com)

## Wind Assessment

Ben Cosh  
Director, The Green Company

International Small  
Wind Conference 2010

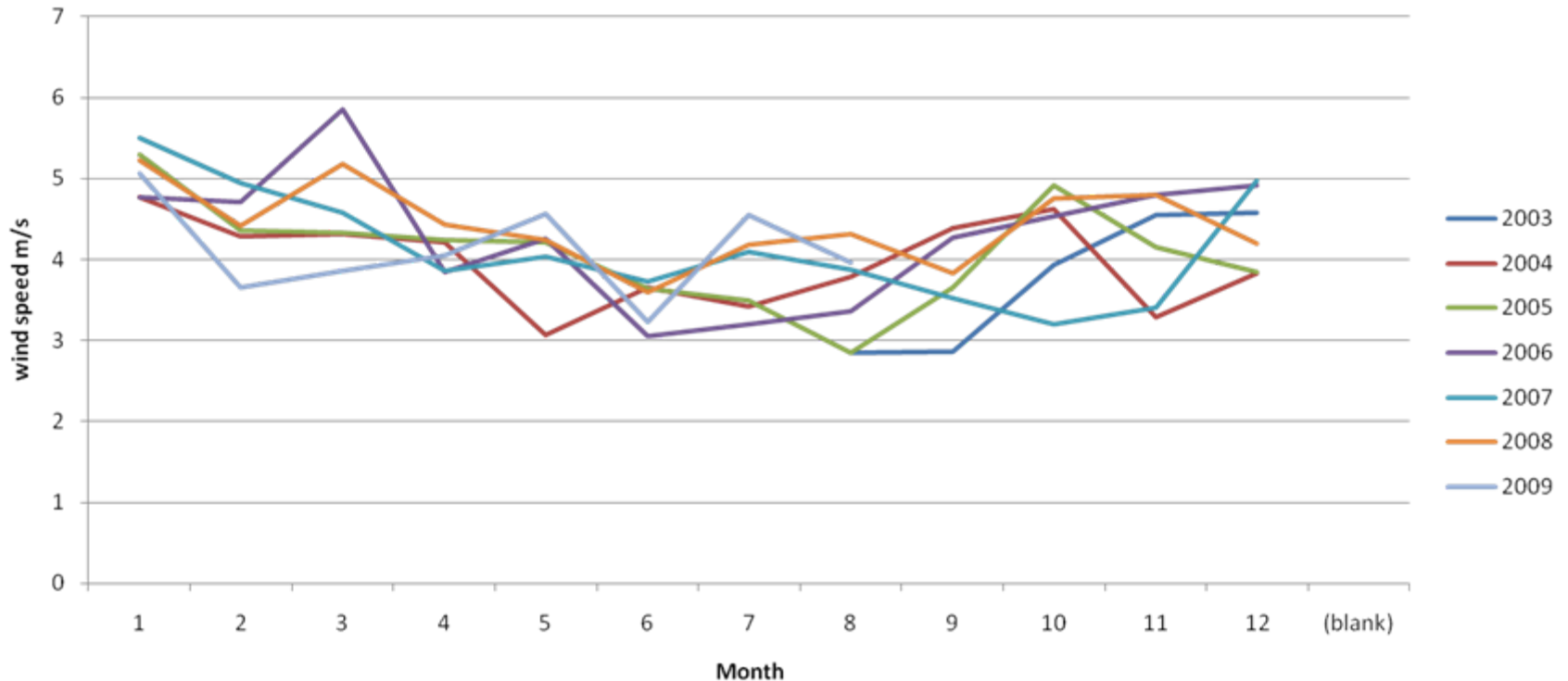
## Questions to ask about the wind resource before you buy a turbine

1. What is the expected annual income?
2. Is the extreme wind speed within the design specification of the turbine?
3. Is the site turbulence within the design specification of the turbine?

Expected annual income

# Average wind speed is volatile

Reference Data



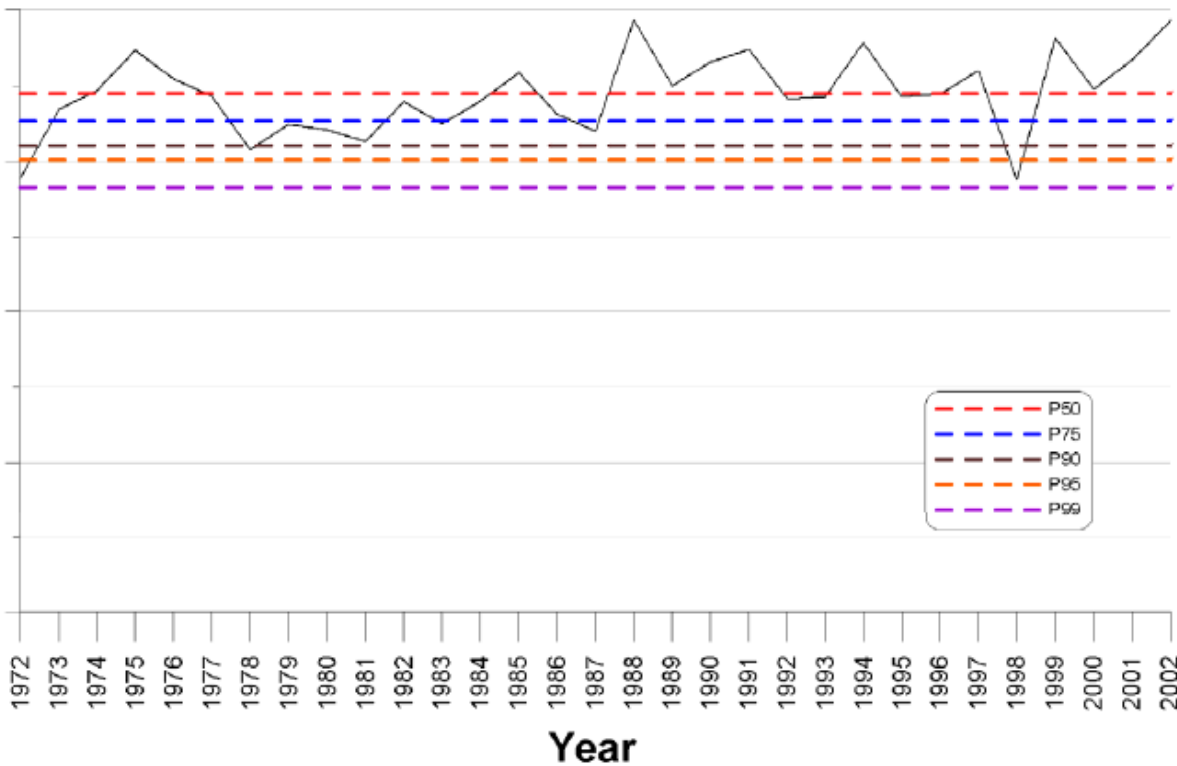
~20% difference in wind speed between a good and bad **year**

>100% difference in wind speed between a good and bad **month**

4 >200% difference in energy (i.e. cash) between a good and bad **month**

# P75 is a better term for predicting yields

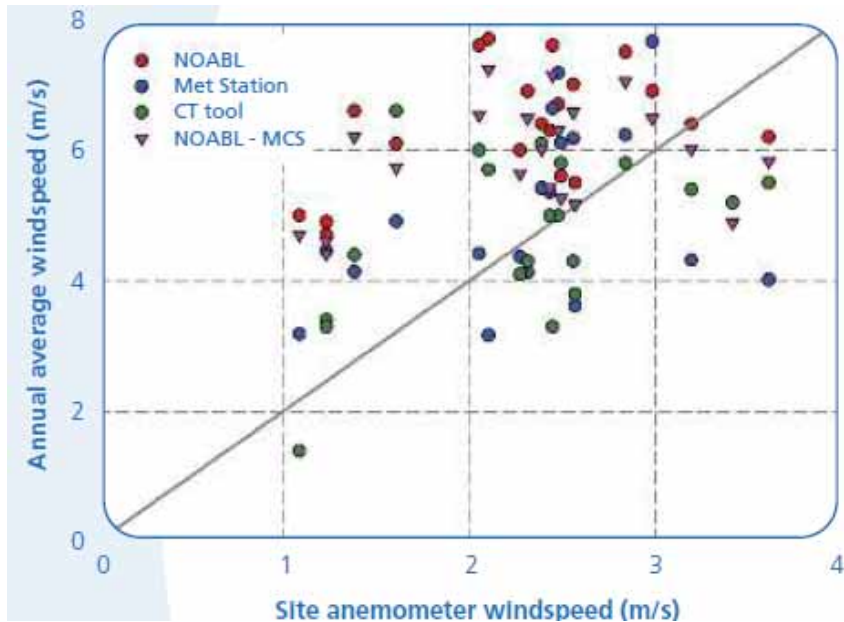
(Annual Energy - 1972-2002)



P75 is the minimum expected output for 3 in 4 years

Average yields (i.e. P50) are not achieved 50% of the time

# Predictive modelling techniques are **grossly misleading**



- Professional assessments for wind farms achieve 10% uncertainty on P75
- MCS & NOABL model achieve +65% to -85% uncertainty on P50
  - Eg £3,500pa for a 6kW turbine
  - Eg £30,000pa for a 50kW turbine
- Carbon Trust model achieves +80% to -1000% uncertainty on P50
- 20% uncertainty on P75 should be achievable for small wind

## Why are modelled tools **so** bad?

- Garbage in = Garbage out
  - Data sources are not high enough resolution
  - Data sources are not calibrated
- Methodologies do not take topography, trees or buildings within 2 km into account. These cause complex turbulence.

# Extreme wind speeds

# Extreme wind speeds

- Turbines are designed to withstand storms as set out in the Wind Class definitions in the international design and safety standard IEC 61400.

	Average Wind Speed	Max 3 Second Gust	Max 10 Minute Gust
Class I	10 m/s	70 m/s	50 m/s
Class II	8.5 m/s	60 m/s	42.5 m/s
Class III	7.5 m/s	52 m/s	37.5 m/s

- BS6399 methodology assesses 3 second and 10 minute extreme wind speeds at your location
- Results need to be accepted by your insurance company

# Turbulence

# Turbulence is the wild card

- As many as 5% of rural pole mounted turbines suffer from chronic turbulence:
  - Up to 80% reduced output
  - Increased fatigue, higher maintenance bills & shortened life
- Even in rural areas turbulence is complex to understand
  - Turbulence intensity (gust)
  - Swirl (wind shift)
  - Updraft
  - Shear factor
  - Wind shadow
- <sup>11</sup>• Turbulence affects different turbines in different ways

A turbine in open fields suffers from chronic turbulence



In the right place, a wind turbine can be a fantastic investment, but careful due diligence is required before purchasing

1. What is the expected annual income?
  - i. What is the minimum expected income for 3 in 4 years (P75) ?
  - ii. Does this forecast have less than 20% uncertainty?
  - iii. How does onsite data correlate with long term validated data sets?
  - iv. What is the measured wind speed at hub height over a representative period?
  - v. Does your advisor accept liability for the accuracy of energy forecasts?
  - vi. Does your advisor have professional indemnity insurance that will cover the entire value of your forecast income for the life of the turbine?
  - vii. Is this professional indemnity insurance valid if your advisor goes bust?
  - viii. If the bank using your house as security, what happens in low wind months?
2. Is the extreme wind speed within the design spec of the turbine?
  - i. Will your advisor calculate extreme wind speeds?
  - ii. Will the manufacturer sign off the validity of the warranty and design life?
  - iii. Will insurance be renewable following a significant claim?
  - iv. What will full revenue protection and reinstatement insurance cost for the life of the machine?
3. Is the site turbulence within the design specification of the turbine?
  - i. Will your advisor measure turbulence?
  - ii. Can your advisor factor turbulence effects into your expected income for your chosen turbine?
  - iii. Will the manufacturer sign off the validity of the warranty and design life?
  - iv. Who is carrying the liability for maintenance bills which may be larger than anticipated?