

# Why Measure?

U

D

L

Precise. Reliable. Proven.

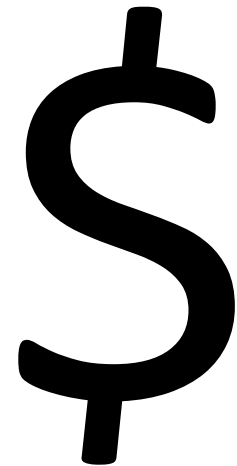


# Contributors to Wind Speed Uncertainty

1. Types of equipment used, the monitoring heights, mast set up and configuration
2. Anemometer calibrations, anemometer sensitivity and tower influences
3. Duration of the on-site measurements, quality of the measurement program and data (Data reasonableness and completeness)
4. Mast locations and number of masts on a project site to estimate the wind resource distribution across the project area and the uncertainty in the spatial distribution of the wind resource (the wind flow model)
5. Observed wind shear, influences on the shear (e.g., land cover, thermal stability, obstacles, tower influences), and the shear exponent from the top anemometer height to the hub height.
6. Quality of the correlation with the long-term reference station(s), and the length of the historical reference period

# Wind Resource Assessment - DRIVERS

- Larger scale wind farms
- Larger scale wind turbines
  - *80m typical though advancing to higher towers some regions*
- Higher finance requirements
  - *We are entering the era of the \$1B wind farm*
- Lowering of acceptable measurement uncertainty
  - *Wind turbine manufacturers want to know more about the resource*
    - *Understand Potential for Significant Destruction (PSD)*
    - *Protect manufacturer reputation*
    - *Underwriters wind turbine warranty terms*
    - *Correct specification of wind turbine for wind regime*
  - *Wind farm developers and owners want to know more about the resource to improve their understanding of project risk*

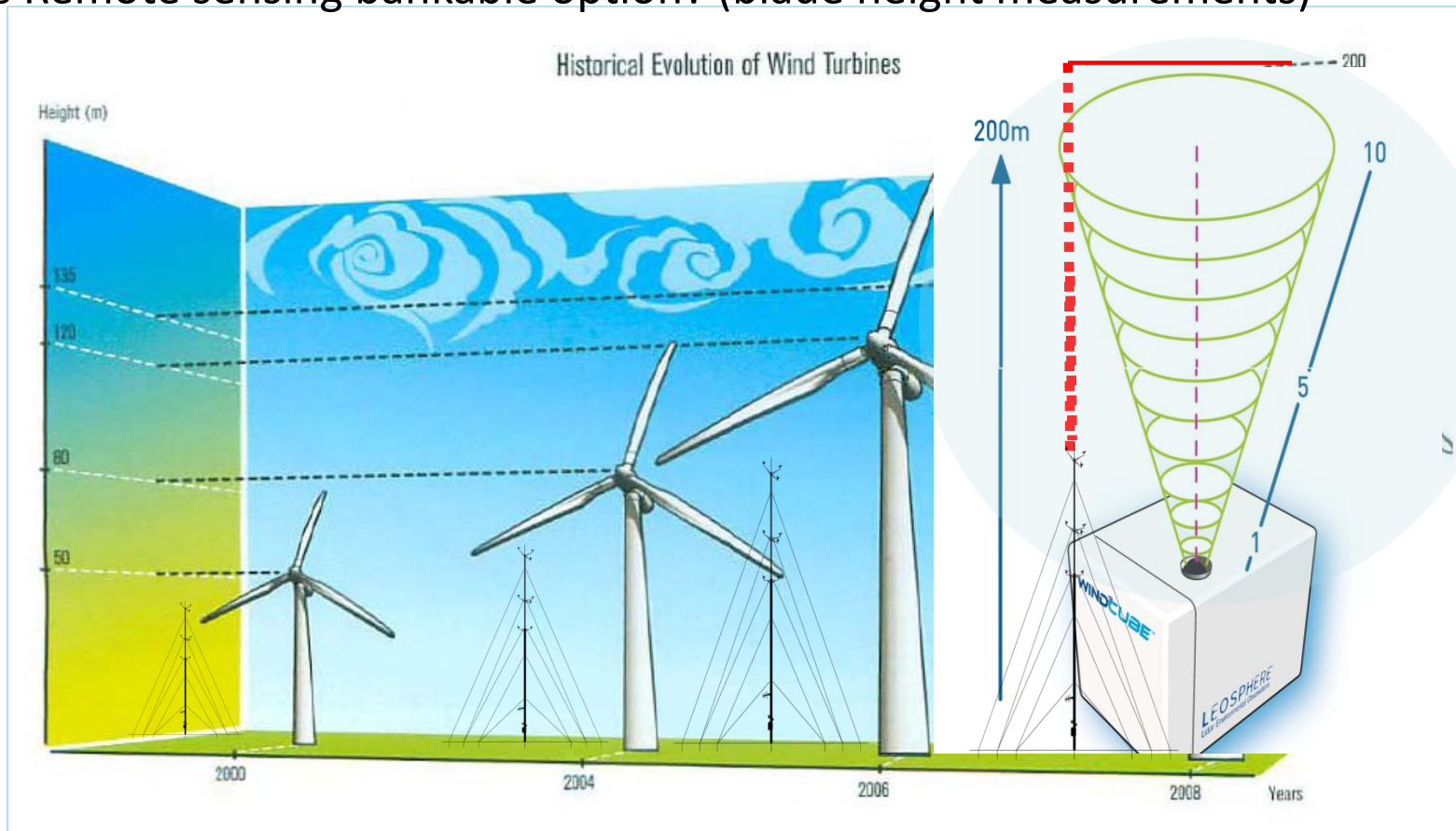


# Wind Resource Assessment - LIMITATIONS

- Tower based measurements rarely located precisely where wind turbines are constructed
- High error in hub height shear extrapolations
- Higher, hub height met towers are expensive structures requiring concrete foundations
  - *Cannot be moved once constructed*
- Anemometers are fixed or static – only measure a relatively small, fixed point in time
  - *Not capable of measuring the complete area utilized by the wind turbine blades*

# WRA - LIMITATIONS

- Wind turbine maximum blade tip height is not hub height
- Is Remote sensing bankable option? (blade height measurements)



Thank you

# Questions?

*Arvinder Singh*

*Sales Account Manager – Asia Pacific*

*NRG Systems, Inc.*

[as@nrqsystems.com](mailto:as@nrqsystems.com)

+91-99450-58233

[www.nrqsystems.com](http://www.nrqsystems.com)