

# Measuring Wind



## Turbine rotation, wind direction, wind speed and direction of line of turbines

### Equipment

Stop Watch

Compass

Beaufort scale (p2)

Anemometer

Recording sheet (p3)

### 1. Turbine Rotation

During a precise minute, (**Stop Watch**), count each time a blade passes the tower.

Then divide the total by 3. This will give you the revolutions per minute (rpm)

- Do they maintain the same speed during the whole visit?

### 2. Wind direction

What is angle of each blade in relation to wind? Are the blades pitched or feathered?

Using a **compass**, record direction of the wind (from where the wind is blowing) based on the direction the rotor is facing.

### 3. Direction of line of turbines

Using a compass, record the alignment of the row of turbines.

Which wind directions are likely to produce less electricity?

Why?

### 4. Wind speed

- Using the Beaufort scale to observe the effect of the wind on trees etc, decide and record the wind speed.
- Use the wind speed meter (anemometer) and measure the wind speed at
  - ground level
  - head height
  - at full arm stretch above your head
- Calculate the wind speed at hub height. Wind speed increases with height.

Generally, at 5 times the height of your recording, the wind speed is doubled.

Example: A reading taken at a height of 2m:

5X 2m = 10m (first doubling), 5X 10m = 50m (second doubling).

So multiply the reading by 2X2=4 to calculate the hub height speed



# Measuring Wind Speed using the Beaufort Scale

Beaufort scale	Miles per hour	Metres per second	Description	Features
0	0-1	0-0.45	Calm	Smoke rises vertically.
1	1-3	0.45-1.3	Light air	Direction of wind shown by smoke drift, but not by wind vanes.
2	4-7	1.8-3.1	Light Breeze	Wind felt on face; leaves rustle; ordinary vanes moved by wind.
3	8-12	3.6-5.4	Gentle Breeze	Leaves and small twigs in constant motion; wind extends light flag.
4	13-18	5.8-8.0	Moderate Breeze	Raises dust and loose paper; small branches are moved.
5	19-24	8.5-10.7	Fresh Breeze	Small trees in leaf begin to sway; crested wavelets form on inland waters.
6	25-31	11.2-13.9	Strong Breeze	Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.
7	32-38	14.3-17.0	Near Gale	Whole trees in motion; resistance felt when walking against the wind.
8	39-46	17.4-20.6	Gale	Breaks twigs off trees; generally impedes progress.
9	47-54	21.0-24.1	Severe Gale	Slight structural damage occurs (chimney-pots and slates removed).
10	55-63	24.5-28.2	Storm	Seldom experienced inland; trees uprooted; considerable structural damage occurs.
11	64-72	28.6-32.2	Violent Storm	Very rarely experienced; accompanied by wide-spread damage.
12	73-83	32.6-37.1	Hurricane	Violence and destruction



Devised by Sir Francis Beaufort in 1805, this is a system to estimate wind strengths without the use of instruments, based on the effects wind has on the physical environment.

**Yellow highlight shows the operational range of Westmill Turbines (10-55mph)**

*There is generally a doubling of the wind speed with each 5X increase of height so the wind is roughly 4X stronger on the rotors than felt at 2m.*



## Record sheet for Wind

Name \_\_\_\_\_

Revolutions per minute	rpm
Wind direction (eg SW)	
Direction of line of turbines	
Wind speed Beaufort scale	
Wind speed ground level kph	
Wind speed head height kph	
Wind speed full arm stretch kph	
Wind speed hub height calculation kph	