

## Measure Dimensions of turbines:



**Height**  
**Blade size**  
**Distance apart**  
**Circumference of base of tower**  
**Foundation diameter**

### And follow-up activities

#### Equipment

Tape measure  
Compass  
Square piece of paper  
Pencil  
Recording sheets (on page 4 of this handout)

#### Turbine scale

1. Measure **height of nacelle**, see methods below\*\*\*
    - Fixed angle of elevation method\*\* (Page 2)
    - Pencil method\* (Page 3)
  2. Measure **length of blade**
    - Measure height of tip at lowest sweep of blade using same methods, then calculate the difference between that height and the height of the nacelle
    - Establish position of tip of blade by standing underneath at its tip when it is horizontal. Using a tape measure, record length of blade from turbine base to this point and add radius of tower. See 5 below for circumference then divide by  $2\pi$ )
  3. Work out height of **highest sweep** of blade
  4. Measure **distance between each turbine**
    - Having established the height of the turbines, you can use that measurement to estimate the distance between each turbine using the pencil method.
  5. Measure **circumference of base** of turbine
    - by encircling it (hug)
    - using a **tape measure** – record circumference
- Using same children with same stretch of arms or the tape measure
- make a circle in an open area – **repeat at school eg on netball court. Make comparisons with size of court/classroom/tree.**
  - Stretch the children or tape measure into a line. **Compare with familiar objects**
6. Measure **diameter of foundation**
    - Establish edge of foundation. Use a tape measure record diameter by laying it from one edge, past the tower to the opposite edge. Record length.

**Using these measurements, with tapes and ropes, show an imaginary turbine on the ground.**

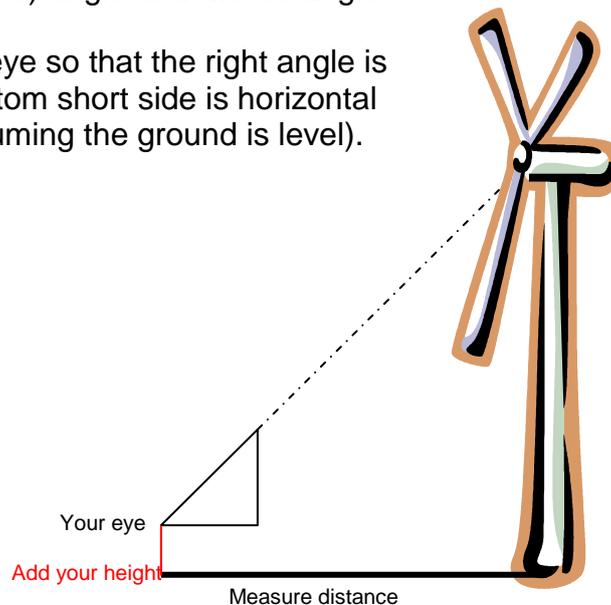
**Compare all these measurements with familiar objects**



## Measure height of turbine\*\*\* 1

### Fixed Angle of Elevation Method\*\*

1. Fold a **square piece of paper** in half so that it forms a triangle. The triangle will have one right (90 degree) angle and two 45 degree angles.
2. Hold the triangle near one eye so that the right angle is away from you, and the bottom short side is horizontal (parallel to the ground, assuming the ground is level).



3. Move back from the turbine until you can sight the top of the turbine at the top tip of the triangle. Close one eye to sight the tree's top. You want to find the point where your line of sight follows the hypotenuse of the triangle to the middle of the rotor.
4. Mark this spot and measure (**tape measure**) the distance from it to the base of the turbine. This distance, plus your height (because you used the angle of elevation from eye level, not from the ground) is the height of the turbine. (This works because the angle of elevation using your triangle is 45 degrees, and the tangent of 45 degrees = 1)

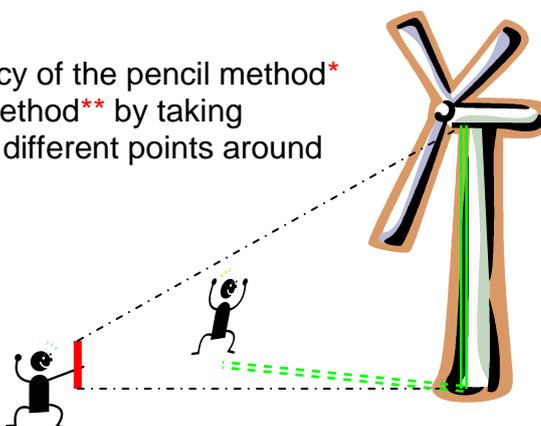


## Measure height of turbine\*\*\* 2

### Pencil Method\*

1. Stand far enough from the turbine so you can view the whole of it—top to bottom—without moving your head. For the most accurate measurement, you should stand so that you are on a piece of ground that is about level with the ground at the turbine's base. Make sure you can see the whole tower with nothing in the way.
2. Have a friend stand near the turbine.
3. Hold a pencil or a small, straight stick (such as a paint stick or ruler) in one hand and stretch your arm out so that the pencil is **at a full arm's length** in front of you (between you and the turbine).
4. Hold the pencil so that the point is at the top. Close one eye and adjust the pencil up or down so that you can sight the middle of the rotor at the pointed tip of the pencil. This should just cover centre of the rotor in your line of sight as you look at the turbine "through" the pencil.
5. Move your thumb up or down the pencil so that the tip of your thumbnail is aligned with the turbine's base. While holding the pencil in position so that the tip is aligned with the turbine's top (as in step 3), move your thumb to the point on the pencil (again, as you look "through" the pencil with one eye) where the turbine meets the ground.
6. Rotate your arm so that the pencil is horizontal (parallel to the ground). Keep your arm held straight out, and make sure your thumbnail is aligned with the middle of the turbine's base.
7. Have your friend move so that you can sight his or her feet "through" the point of your pencil. That is, your friend's feet should be aligned with the pencil's tip. He or she may need to move backward, sideways, or diagonally. As you may need to be some distance from your friend, use hand signals with your free hand to tell him or her to go to the place where you can see her through the tip of the pencil.
8. Your friend needs to stand still. Measure (with a tape measure) the distance between him and the turbine. The distance between your friend and the turbine is the height of the turbine.

9. You can improve the accuracy of the pencil method\* and the angle of elevation method\*\* by taking several measurements from different points around the turbine.



**Record sheet for measurements of turbine dimensions**

	<b>Metres</b>
Height of nacelle	
Length of blade	
Circumference of tower base	
Radius of tower base (circumference/ $2\pi$ )	
Highest sweep of blade	
Distance between turbines	
Diameter of foundation	