

Gurteen Agricultural College
Environmental and Sustainable Farming

Level 6 Certificate
In association with
Susliving

Module 8

Evaluation of Energy and Resource Usage, Efficiency
and Conservation on Farms

**8.7 Alternative and Renewable Energy Sources for
Farms:**

**Wind Energy, Bio Energy Options, Anaerobic Digesters, Solar
Power, Air Source Heat Pumps**

Renewable Energy on Farms

Unit 8.7

This section aims to provide the learner with the knowledge:

- To appreciate the different renewable energy sources, their advantages and limitations and application as viable alternatives on farms.
- Understand wind energy using a domestic wind turbine and Gurteen College's commercial wind turbine to appreciate their operation, performance and viability.

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What is renewable energy?

"Renewable energy is:

- Any energy resource that is naturally regenerated over a short time scale and derived directly from the sun (such as thermal, photochemical, and photoelectric),
- Indirectly from the sun (such as wind, hydropower, and photosynthetic energy stored in biomass),
- or from other natural movements and mechanisms of the environment (such as geothermal and tidal energy).
- Renewable energy does not include energy resources derived from fossil fuels, waste products from fossil sources, or waste products from inorganic sources."

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How do wind turbines work?

Windspeed creates mechanical force to rotate a shaft, turning a magnet through a coil.

This shaft can be vertical or horizontal .

Power generated is a direct result of the wind speed (in metres per second (m/s)) and swept area (size of the rotor/blades).

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Wind Energy;

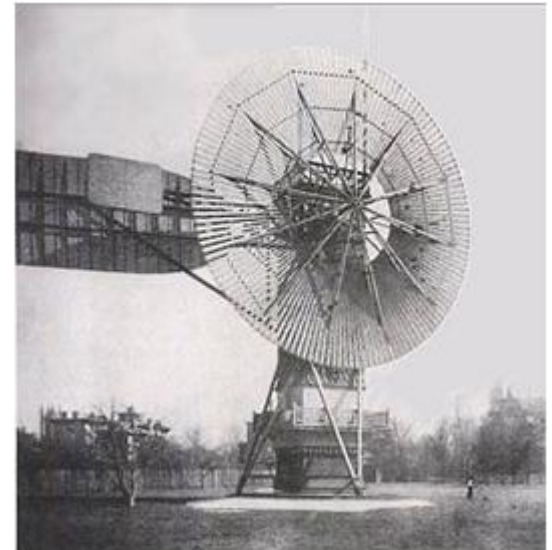
The oldest and largest contributor to renewable energy



**Water
pumping**



milling



**1st electrical wind turbine
Charles brush 1888 12kw DC
17m Diameter cedar**

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Wind Turbines Types

Horizontal Axis Wind Turbine

H.A.W.T



Vertical Axis Wind Turbine

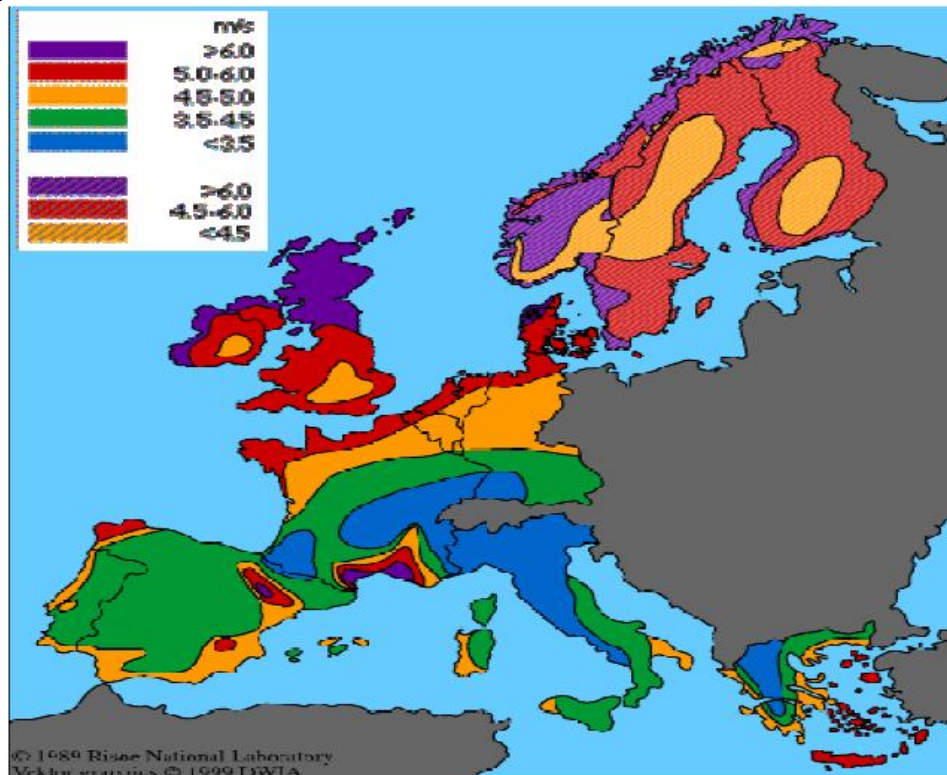
V.A.W.T



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Ireland ; Some of the best wind resources in Europe



Windspeed increases with height

More economic to have 1 large windturbine than lots of small ones .

Power generated increases dramatically with windspeed and Rotor diameter

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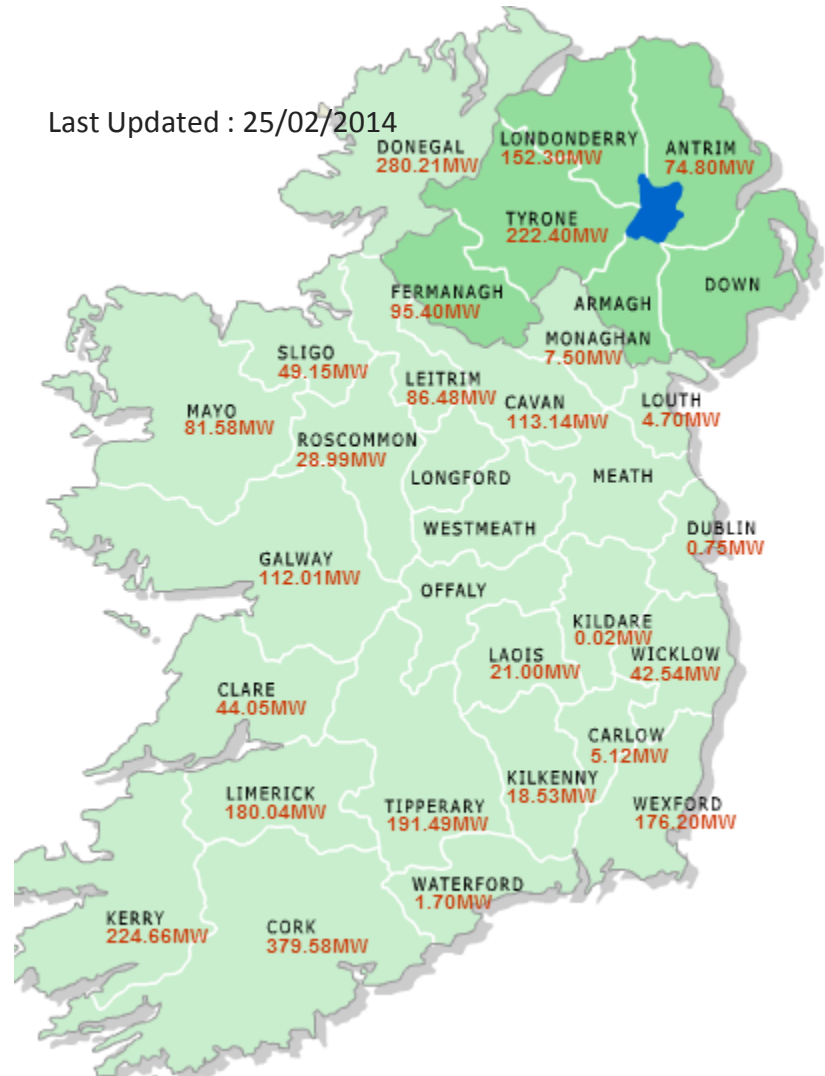
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Installed Wind energy by County

Sept. 2010)



Last Updated : 25/02/2014

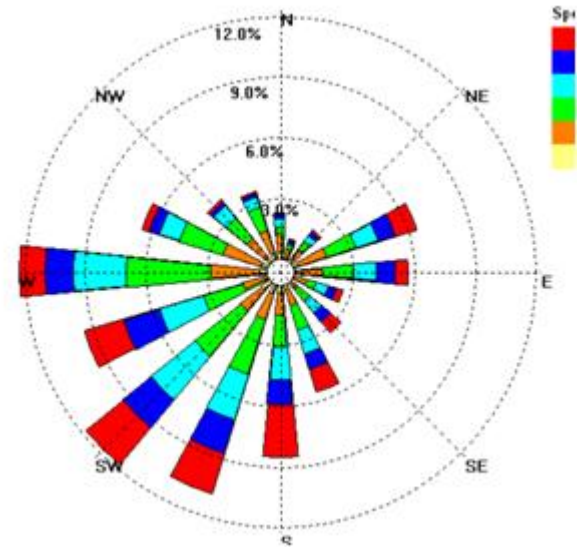


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Windrose; speeds and direction

Wind is very site dependent; Assessing your site is vital; Measure windspeed for at least 1 year

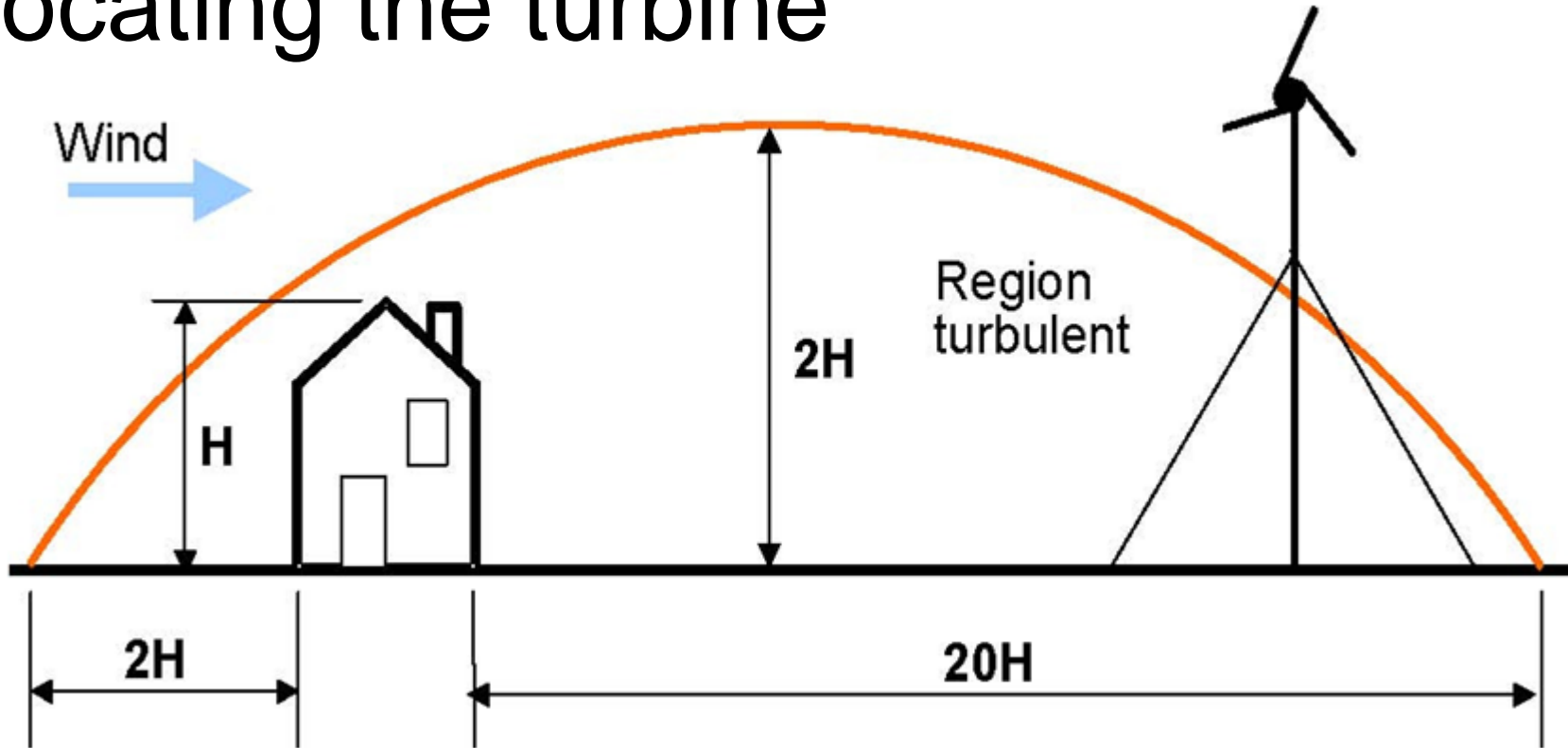


Site assessment tools; anemometer and wind vein



Sited at the proposed height and location

Locating the turbine



**10 metre rule of thumb ; 10m above any obstruction within 100 metres of tower;
Favours rural site**

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Biggest economic factor in promoting windpower is Feed in Tarriff

REFIT for 2010 – (REFIT 3)

Source:	Tariff:
Micro-generation Wind <small>(11KW for 3-Phase and 6 KW for single-Phase)</small>	9 cent per produced kWh + 10 cent for first 4000 connected Micro-gen. by 2012 for 5 years for the first 3000 kWh
Small scale Wind <small>(under 5 MW)</small>	6.86 cent per produced kWh
Large scale Onshore Wind <small>(over 5 MW)</small>	6.63 cent per produced kWh
Offshore Wind <small>(no size limit)</small>	14 cent per produced kWh
Balancing payments are to be paid up to 2025. All other forms of support are to be payable for a maximum of 15 years and must not extend beyond 2030.	

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Wind

Practical Wind Energy Demo : 2 M diameter home made domestic turbine ; Hugh Piggott Design



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Wind

Case study of small commercial turbine; 15 M diameter 50 kW turbine at Gurteen College.



Make AOC15/50 (Atlantic Orient Corporation)

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Wind

Features of the AOC15/50

Casestudy of College Turbine

Rating

50 kW at 12.0 m/s (26.8 mph)

cut in speed 4.6 m/s

Predicted performance

145,000 kWh at average windspeed of 6.7m/s

Advanced NREL thick series airfoils

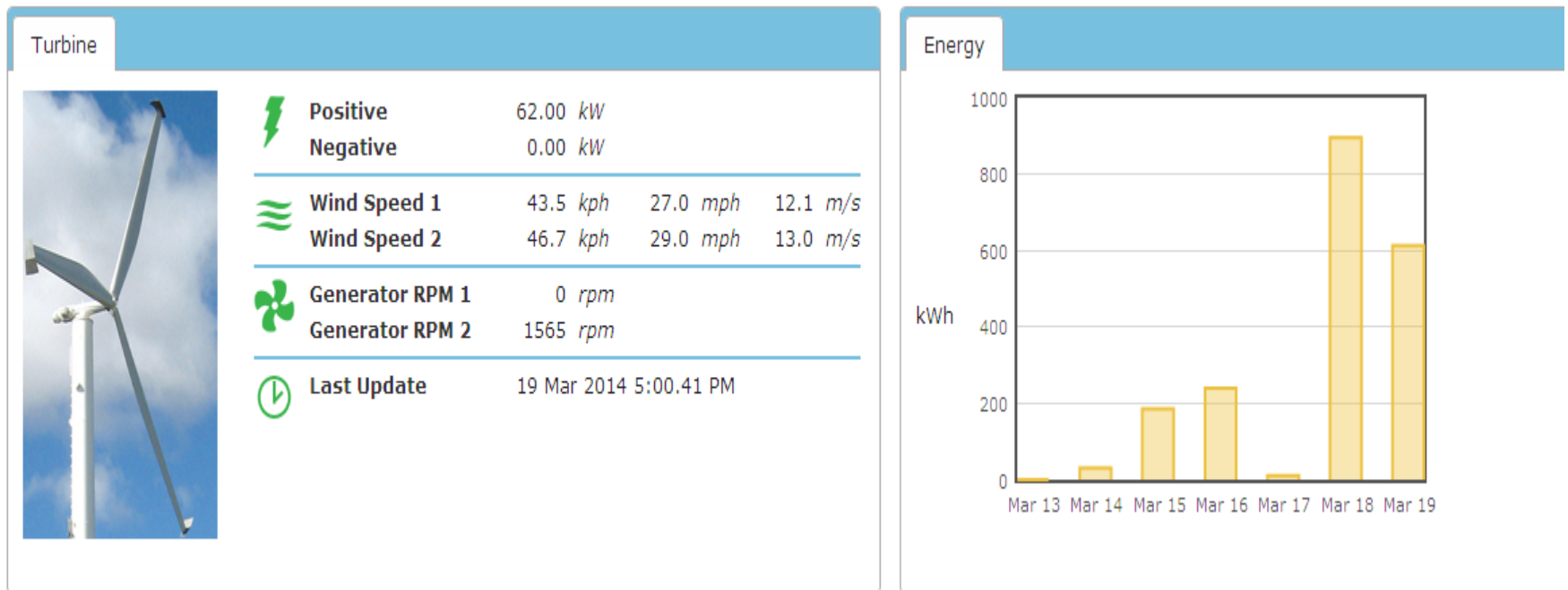
- High strength to weight ratio wood/epoxy or fiberglass blades
- Electro-magnetically/actively controlled tip brakes
- Single piece hub casting
- Rotary transformer to power the tip brake magnets
- Integrated planetary gearbox
- Induction generator
- Single piece cast tower top with turn table yaw bearing
- Uniformly tapered lattice tower
- Dynamic brake
- PLC based controller with adaptive features
- Optional tilt-up lattice tower

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Wind

Gurteen Continual Performance monitoring



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Wind

2.0 System Description

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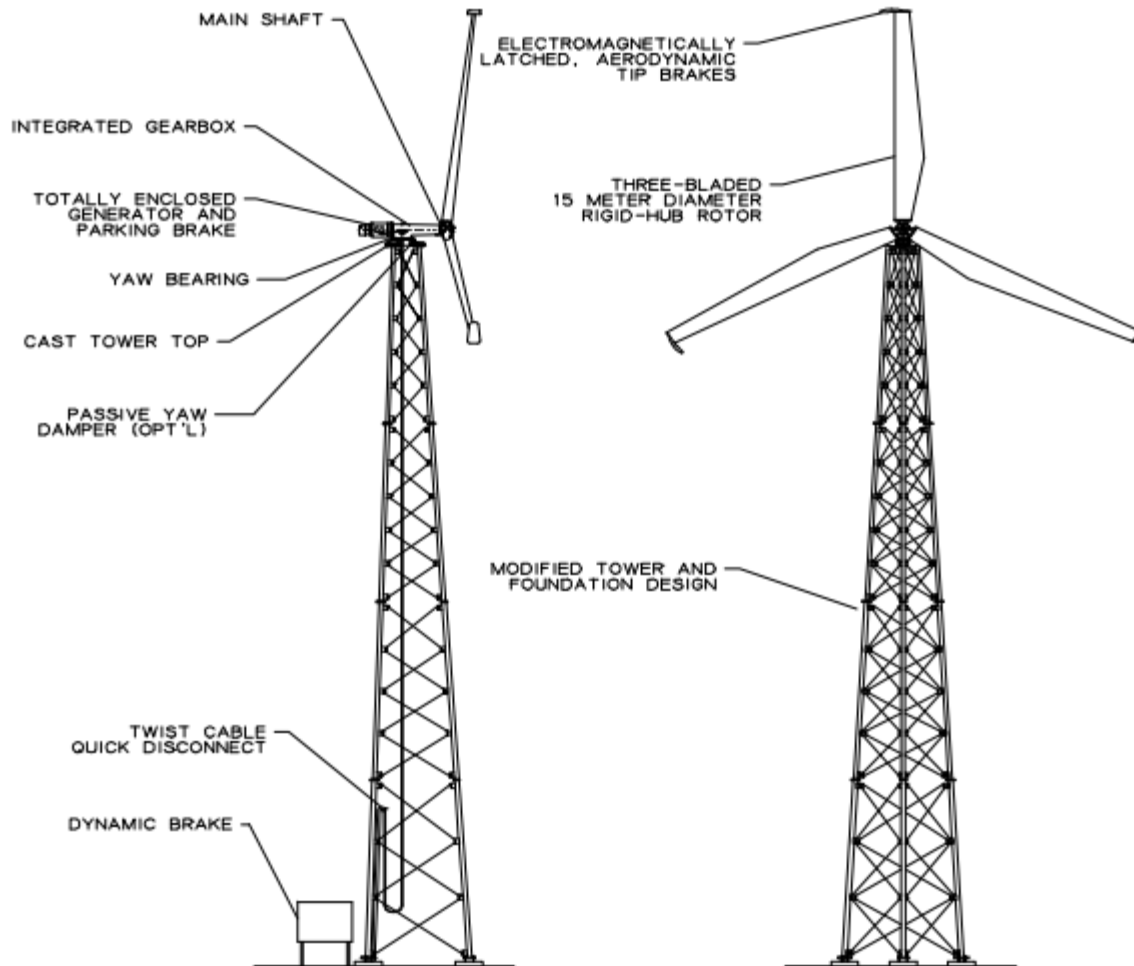


Figure 2-1 AOC 15/50 Wind turbine