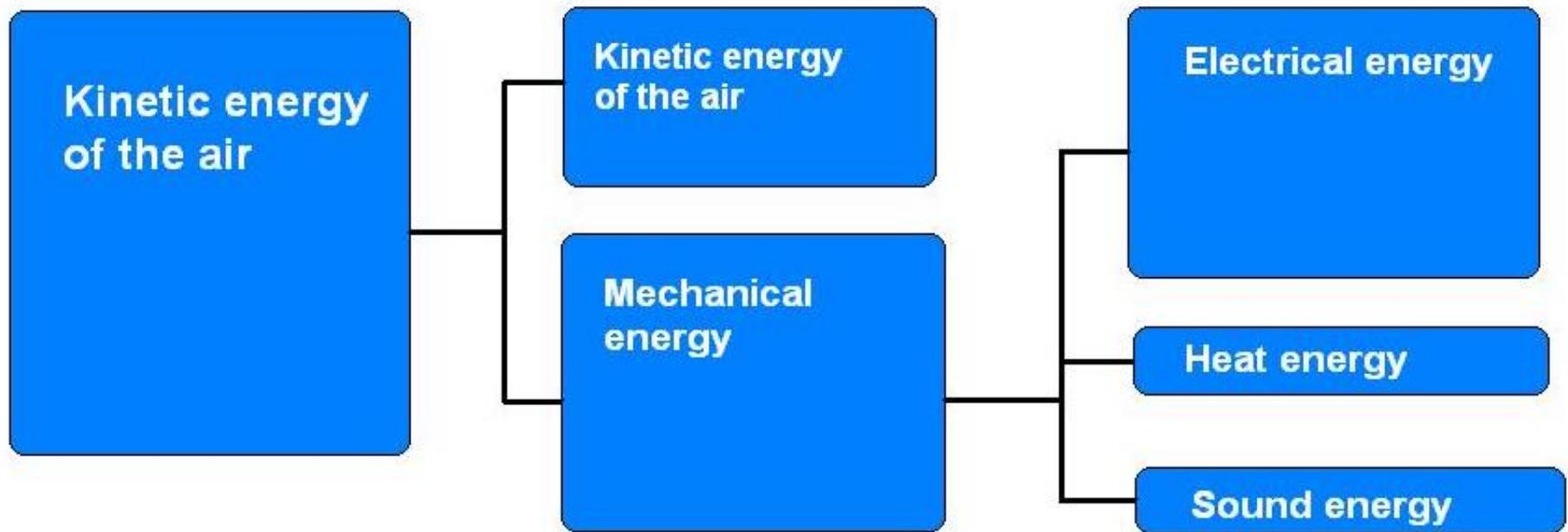




**Wind – tapping into a
renewable energy resource**

Energy transformations in wind turbines



How do wind turbines work?

- Moving air pushes against the blades of the turbine, making them spin.
- Some of the kinetic energy of the moving air is transformed into the mechanical energy of the spinning blades. (The wind still has some kinetic energy as it flows away from the turbine.)
- The shafts and the gears inside the gear box transfer energy from the turbine to the generator. (The gears make the drive shaft to the generator spin faster than the shaft connected to the blade hub.)
- The generator transforms mechanical energy into electrical energy.
- Some of the original kinetic energy supplied by the wind is 'wasted' as it is transformed into heat energy and sound energy within the turbine.



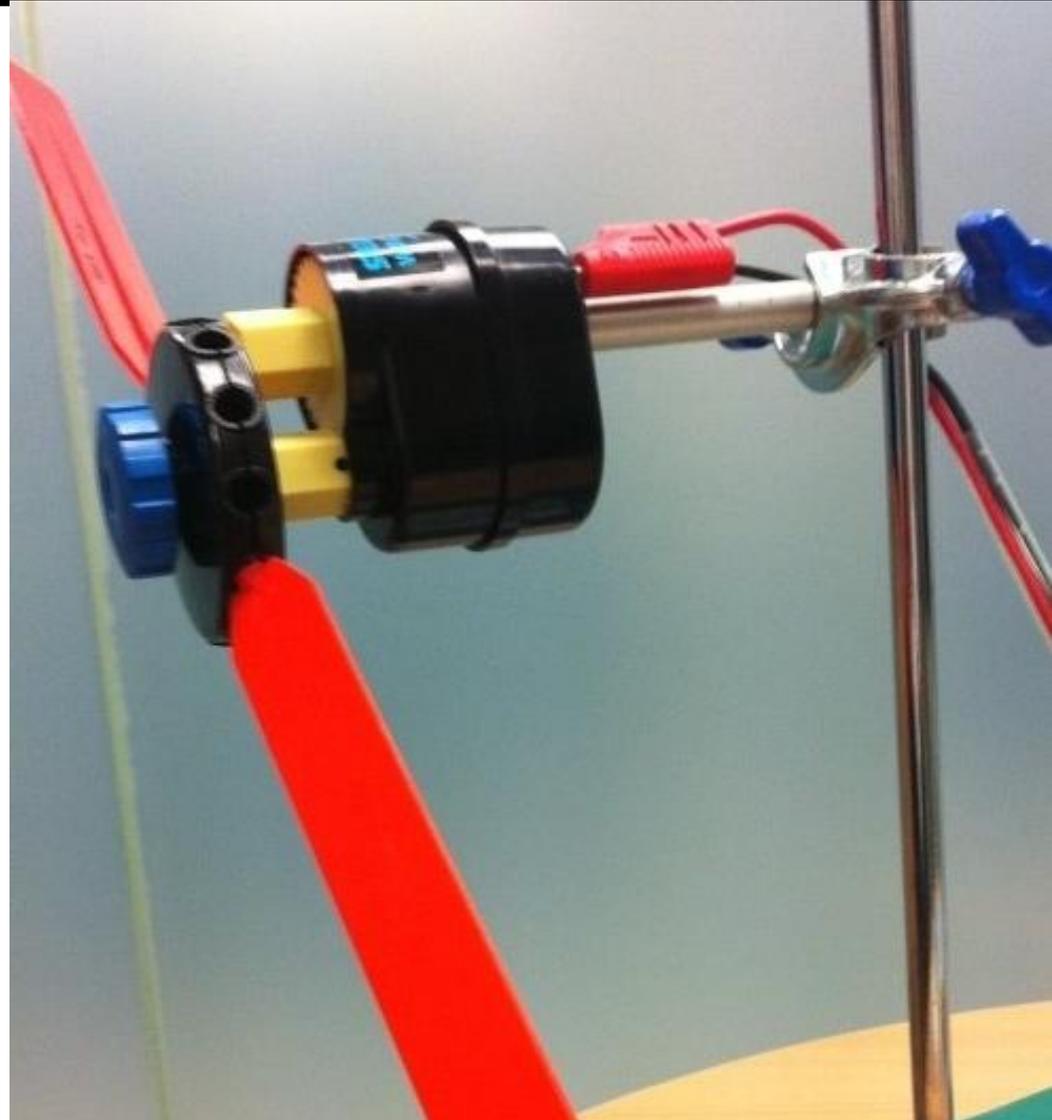
Image sourced from

http://www.alliantenergykids.com/wcm/groups/wcm_internet/@int/@aekids/documents/image/022691.jpg

What affects the amount of electrical power produced?

Factors affecting the amount of electrical power produced by wind turbines include:

- The speed of the wind
- The number of blades
- The length of the blades
- The shape of the blades
- The pitch (angle) of the blades to the wind
- The use of gears
- The type of generator used



Disadvantages of wind turbines

Disadvantages of wind turbines include:

- The electrical power delivered varies because wind speed and direction vary. Sometimes the wind speed is too low to even start rotation.
- Very strong winds can damage turbines.
- It can be costly to connect a wind farm to the electricity grid due to the distances involved.
- Some people think they spoil the landscape.
- Some people believe the sound they produce is annoying or even harmful. However, tests by sound engineers have determined that the loudness of sound heard in any location depends on wind direction and speed, and that no infrasound (very low frequency sound) is produced
- There may be some impact on local bird populations.



Other Technical Issues

- Factors such as the topography of the surface of the Earth from where most of the wind comes, and of the site have a big impact on the amount of electrical power that can be generated at a site.
- A good site might have a 35 % capacity factor – this means that the turbines will produce 35% of their capacity on average over a year.
- In many countries, most wind turbines are constructed off-shore , usually because people do not want them across the land. This is much more expensive, and presents problems such as corrosion by seawater.



Social Issues

Communities can object to the installation of a proposed wind farms due to concerns about :

- The potential damage to local sacred Aboriginal sites
- The effect on the appearance of the landscape and possible impact on any local tourist industry
- Noise
- The possible impact on the local environment, and on local populations of birds and other animals



In Australia

Snowtown Wind Farm



Alternative Technologies

Some types of wind turbine may have a vertical axis



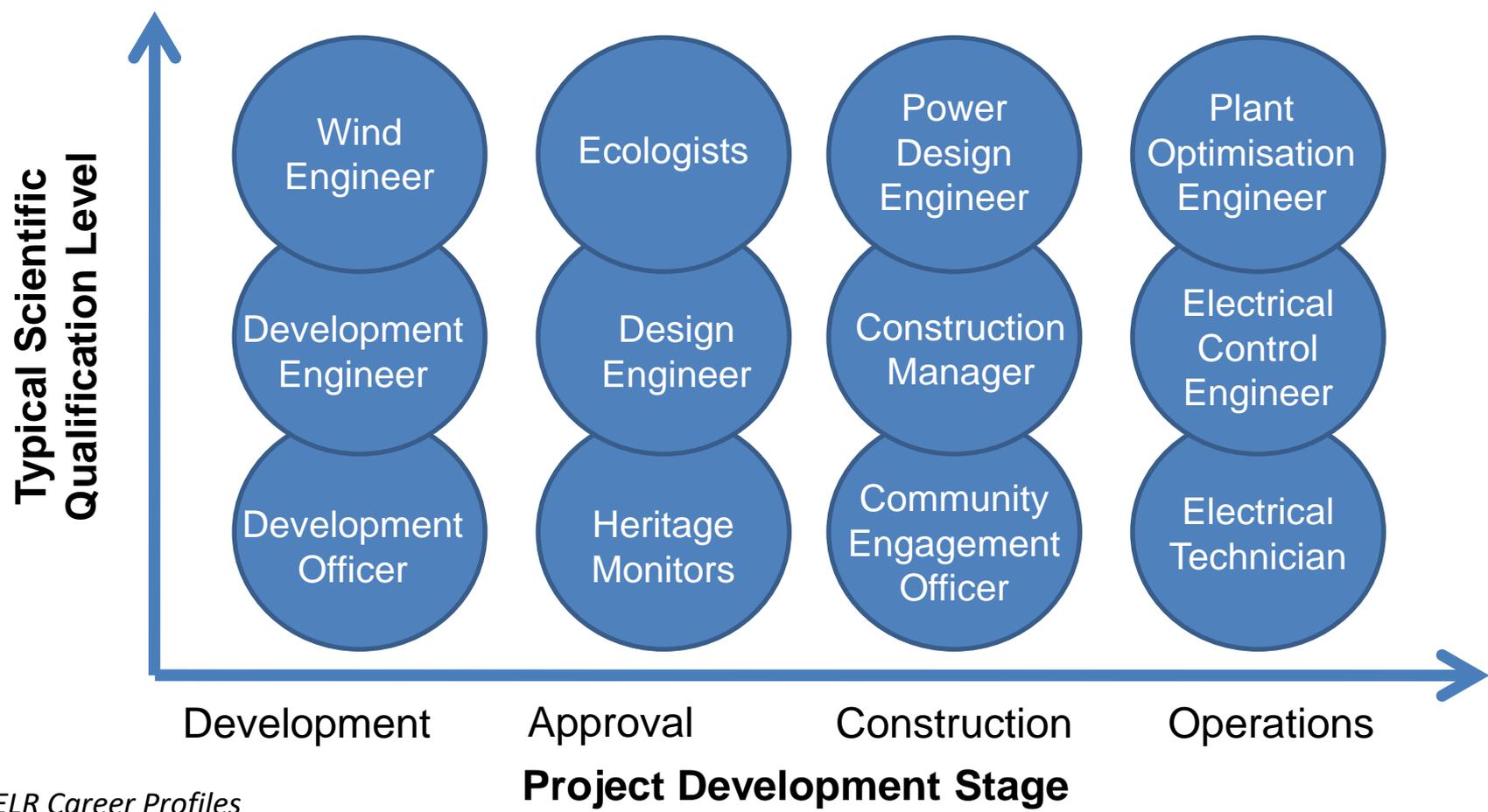
Darrieus turbine



Other vertical egg-beater turbines, with different blade shapes

Careers

Example Early Stage Career Opportunities



Career Profile

Name: Rick Morgans

Job: Wind Mapper

Employer: Cyclopic Energy

- Rick measures and simulates the wind flow for potential sites for small scale wind turbines in cities, using computer modeling
- Read Rick's career profile on the STELR website.



Revision Questions

- What energy transformations occur when a wind turbine operates?
- Why is wind energy considered to be a renewable energy resource?
- What factors affect the amount of energy ‘captured’ by a wind turbine?
- How efficient are wind turbines?
- What are three disadvantages of using wind turbines to produce electrical energy?
- List two issues that scientists and engineers need to consider when developing a wind farm.