

# Centre for Energy Technology

A new era for energy



THE UNIVERSITY  
OF ADELAIDE  
AUSTRALIA

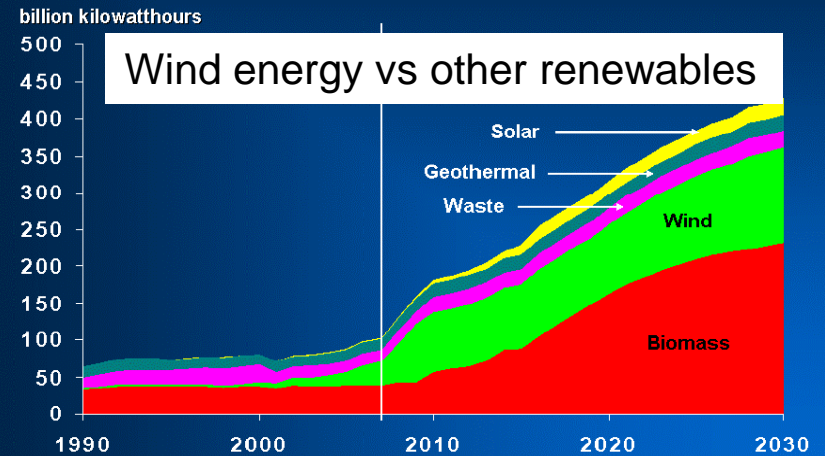
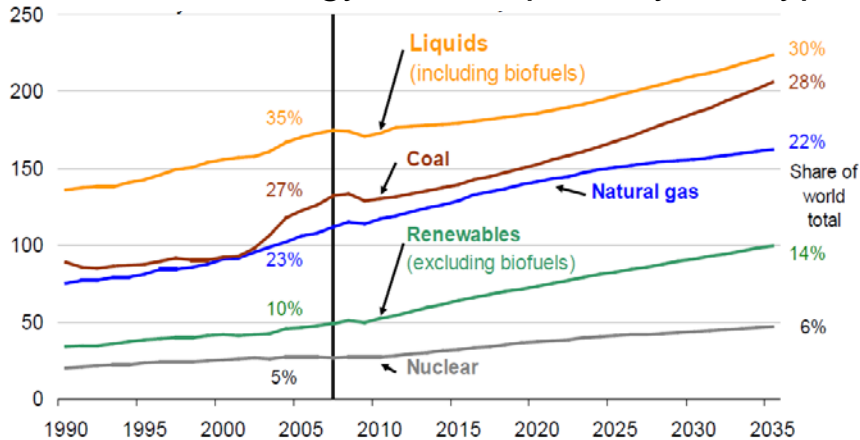


## Future Vision of Wind Energy

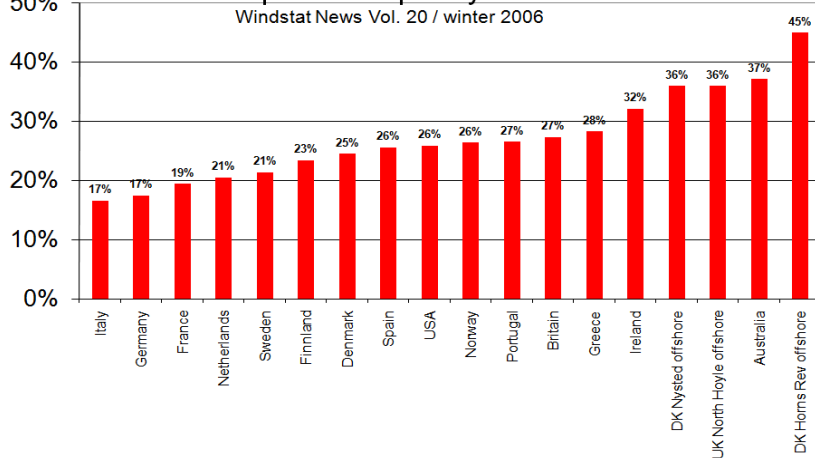


Dr Maziar Arjomandi  
School of Mechanical Engineering

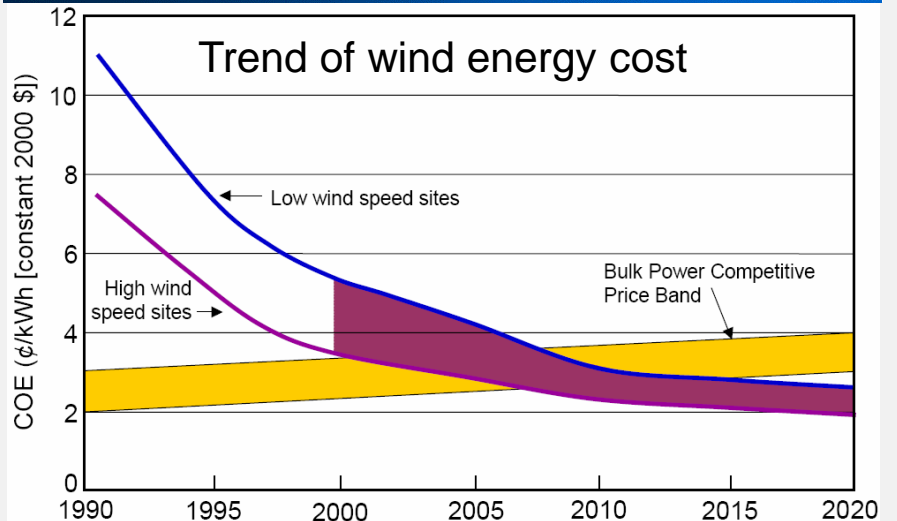
World energy consumption by fuel type



wind power capacity factors



Trend of wind energy cost

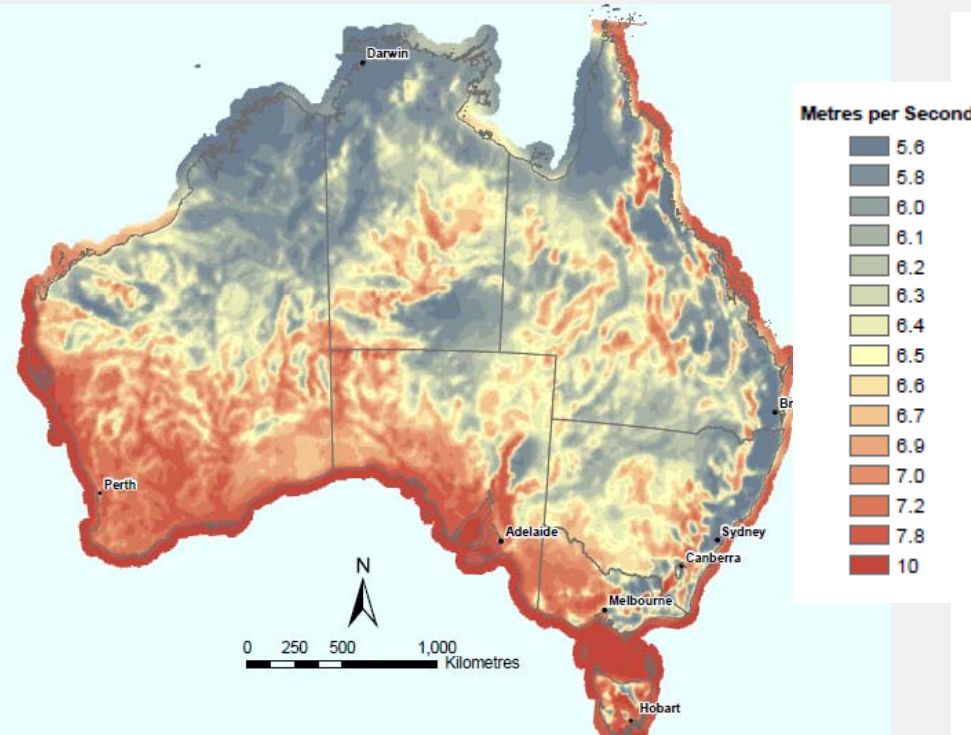


Sources: University of technology Sydney 2009, EIA Annual Energy Outlook 2009, [geosci.uchicago.edu](http://geosci.uchicago.edu), Windstat News Vol. 20/ winter 2006

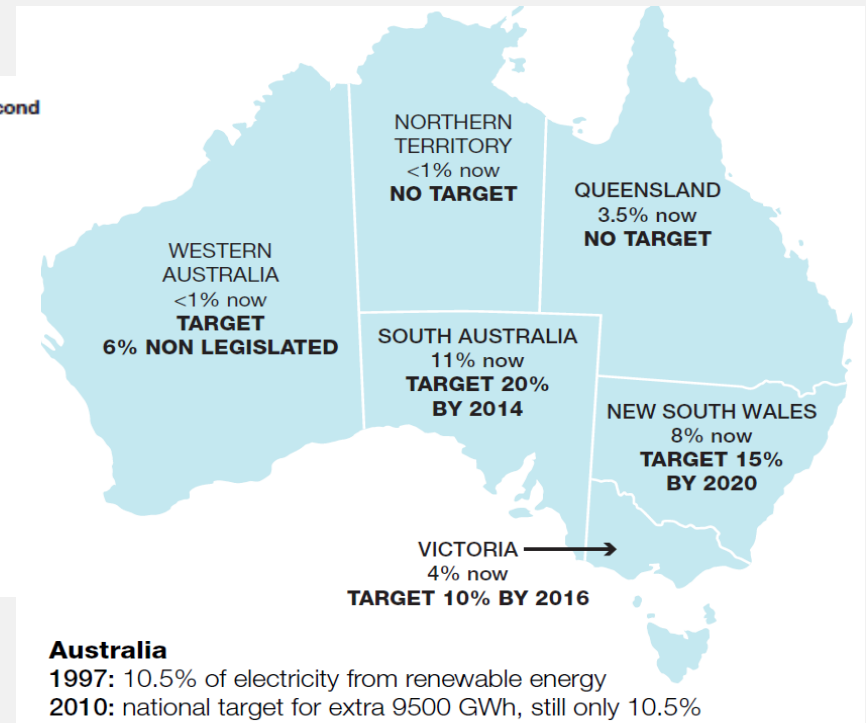
Life Impact The University of Adelaide



Wind power availability



Renewable Energy Target- National Picture



Mean Wind Speed at 80m above ground level

Sources: A Bright Future: 25% Renewable Energy for Australia by 2020, ACF, [www.environment.gov.au](http://www.environment.gov.au)



Issues:

1- Could we increase the turbine diameter to reduce the price?

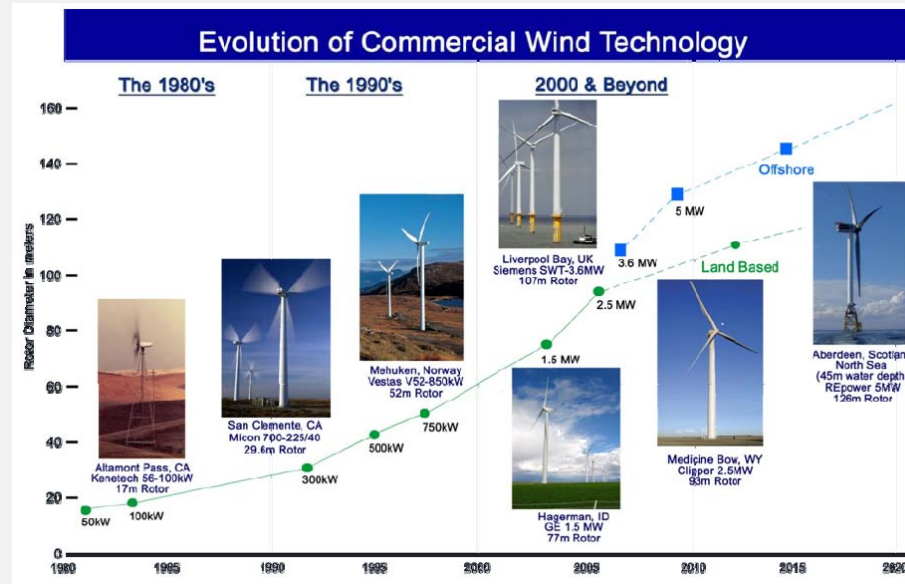
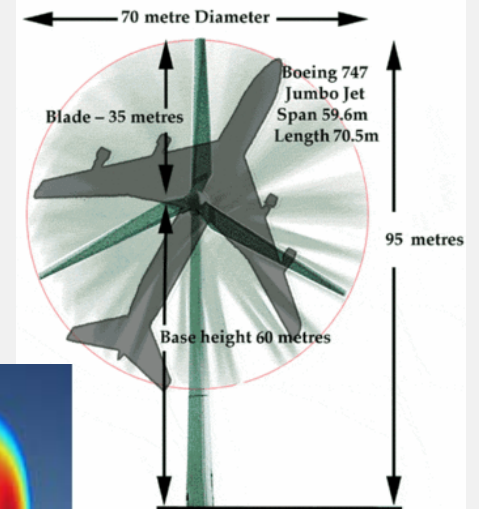
square-cube law ( $P \propto D^2$  and  $C \propto D^3$ )

2- Noise issues? Is it a barrier?

Airfoil trailing edge noise  $\propto$  vortex shedding

3- On-shore or off-shore?

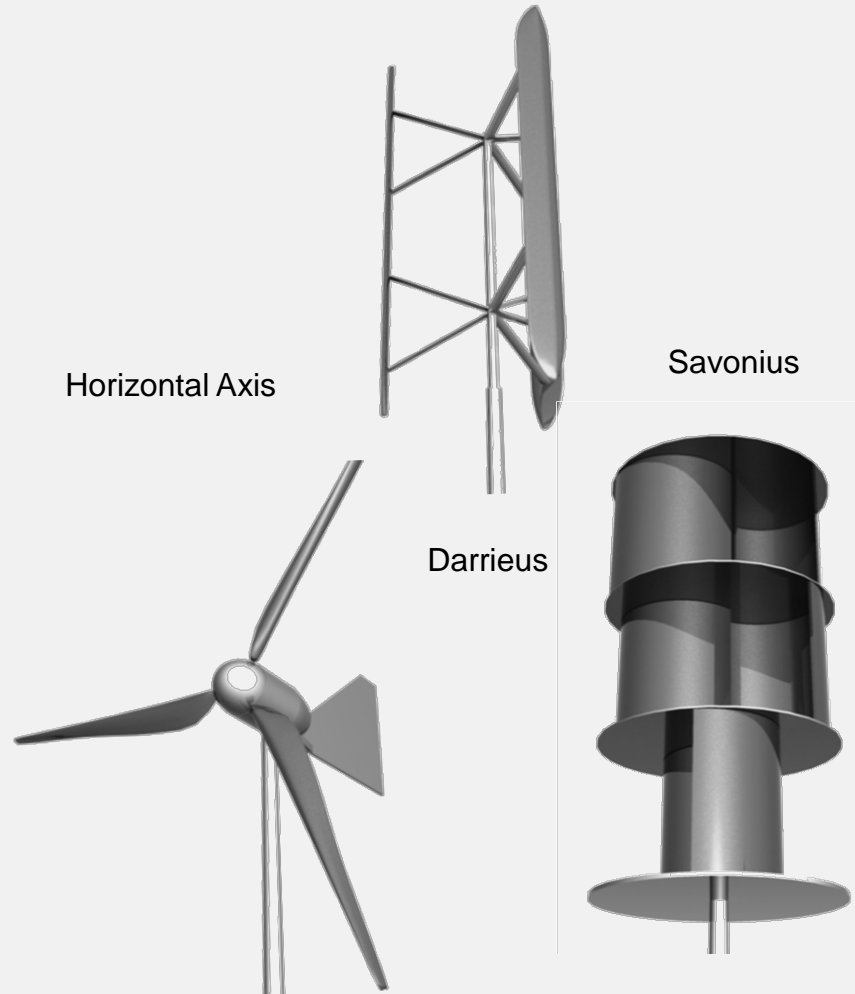
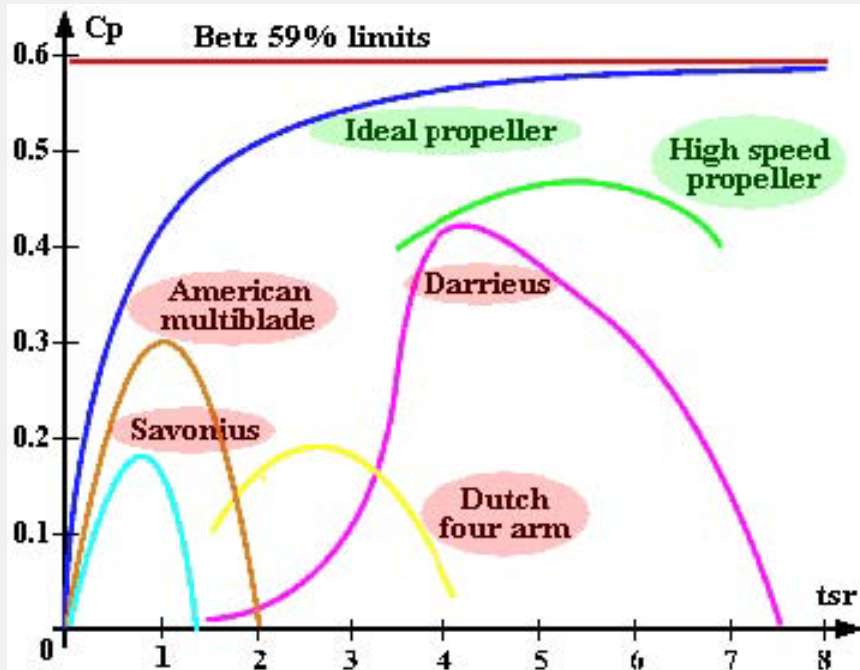
Depends on the capacity factor



Sources: sites.google.com, [www.universiteitwente.nl](http://www.universiteitwente.nl), 20% Wind by 2030 Technology & Science Challenges, NREL, NWTCC, 2009



Design and configuration?



Sources: University of Toldeo, 1986



Wind Turbine Technology. Small scale turbines and urbane environment?

- Noise
- Vibration
- Aesthetic
- Micro –siting
- Low wind speed
- Wind agility
- Turbulence
- Accessibility and installation



Sources: [www.envirocitizen.org/](http://www.envirocitizen.org/); [www.planetthoughts.org/](http://www.planetthoughts.org/); <http://www.mywindpowersystem.com/>



## Summary of the facts

- ✓ **Off-shore wind farms** with large turbines (>5MW) will be spaned around the World. Wind-wave-solar hybrid energy platforms will be developed.
- ✓ **Noise pollution** and **capacity factor** will be the main limiting factors for further increase of on-shore wind farms.
- ✓ **Stand-alone (off-grid) applications** of the wind turbines and wind-solar energy systems will be enhanced.
- ✓ New methods for overcoming the problem of **energy storage** will be proposed.
- ✓ The application of the wind turbines for **non-electrical energy** production will be increased.
- ✓ **Hybrid off-grid wind-solar small scale** energy systems will be the first choice for many applications in the cities such as street lighting and billboards.
- ✓ New types of wind turbine with higher performance at **low wind speed** and **insensitive to wind direction and turbulence** will be developed for built environment.
- ✓ More research will be done in wind energy related areas, such as micro-siting, aerodynamics, noise control and .... **Wind energy is a research intensive area.**

