



Renewable Energy Lecture 19: Wind Energy

Grade: 4th Class

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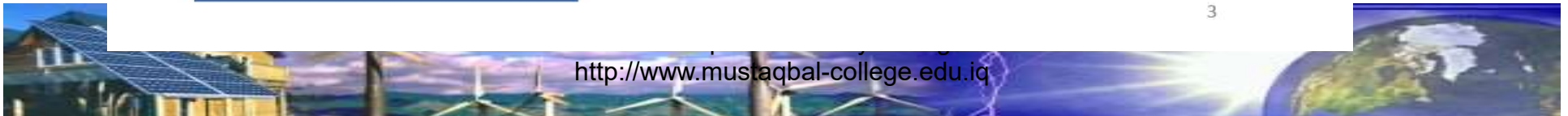
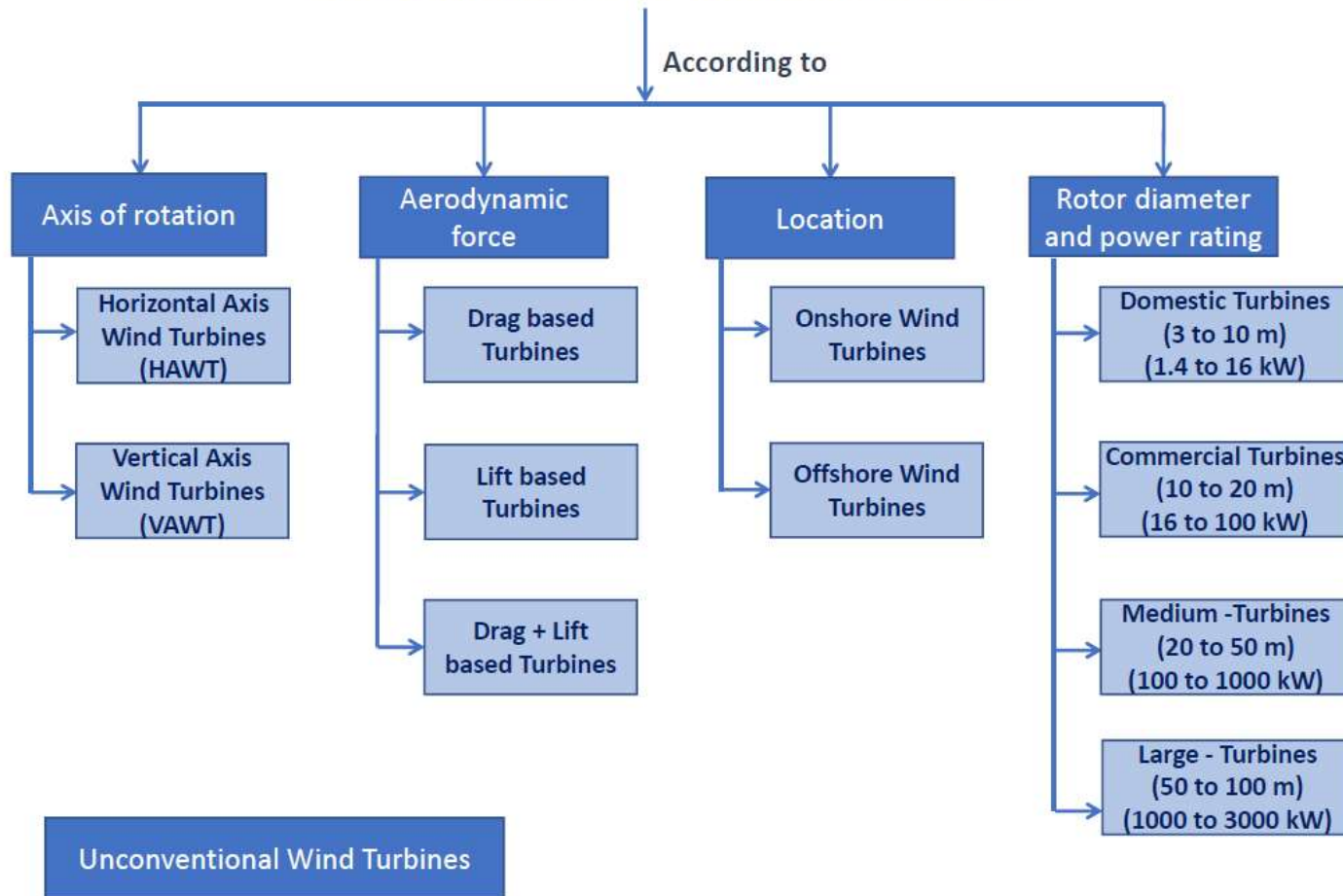
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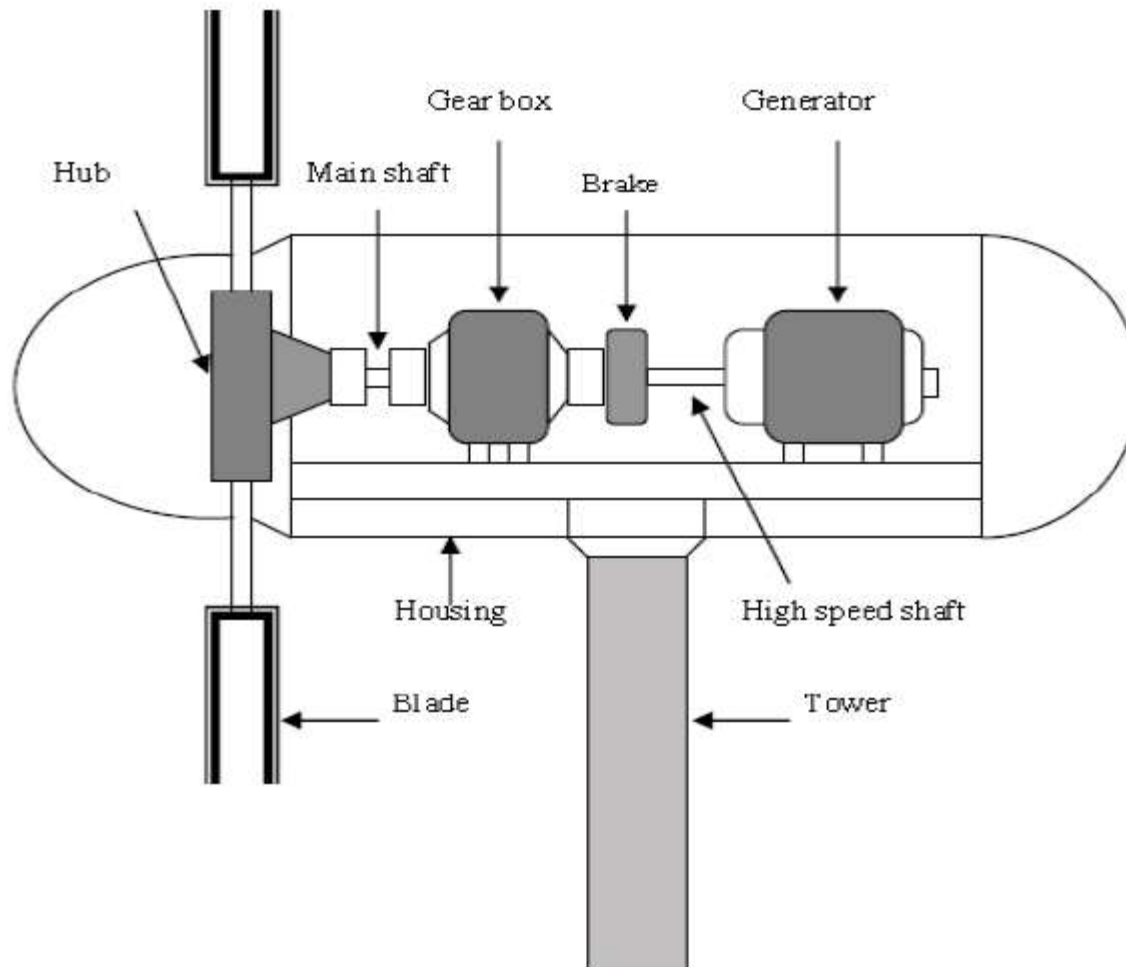
Classification of Wind Turbines



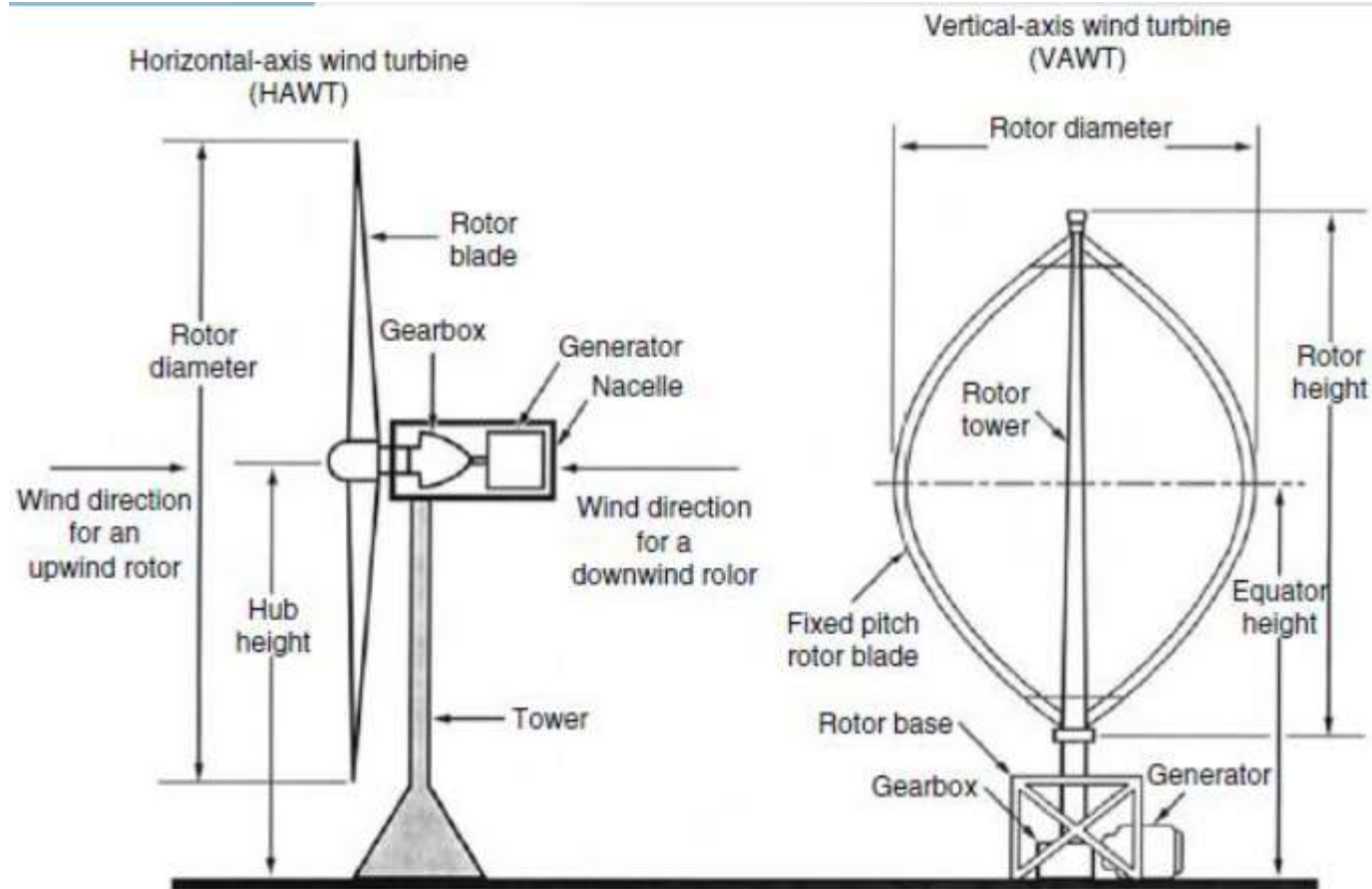
Classification of Wind Turbines



Components of a wind electric generator



Classification of Wind Turbines



Schematic of Basic Wind Turbine Configurations.

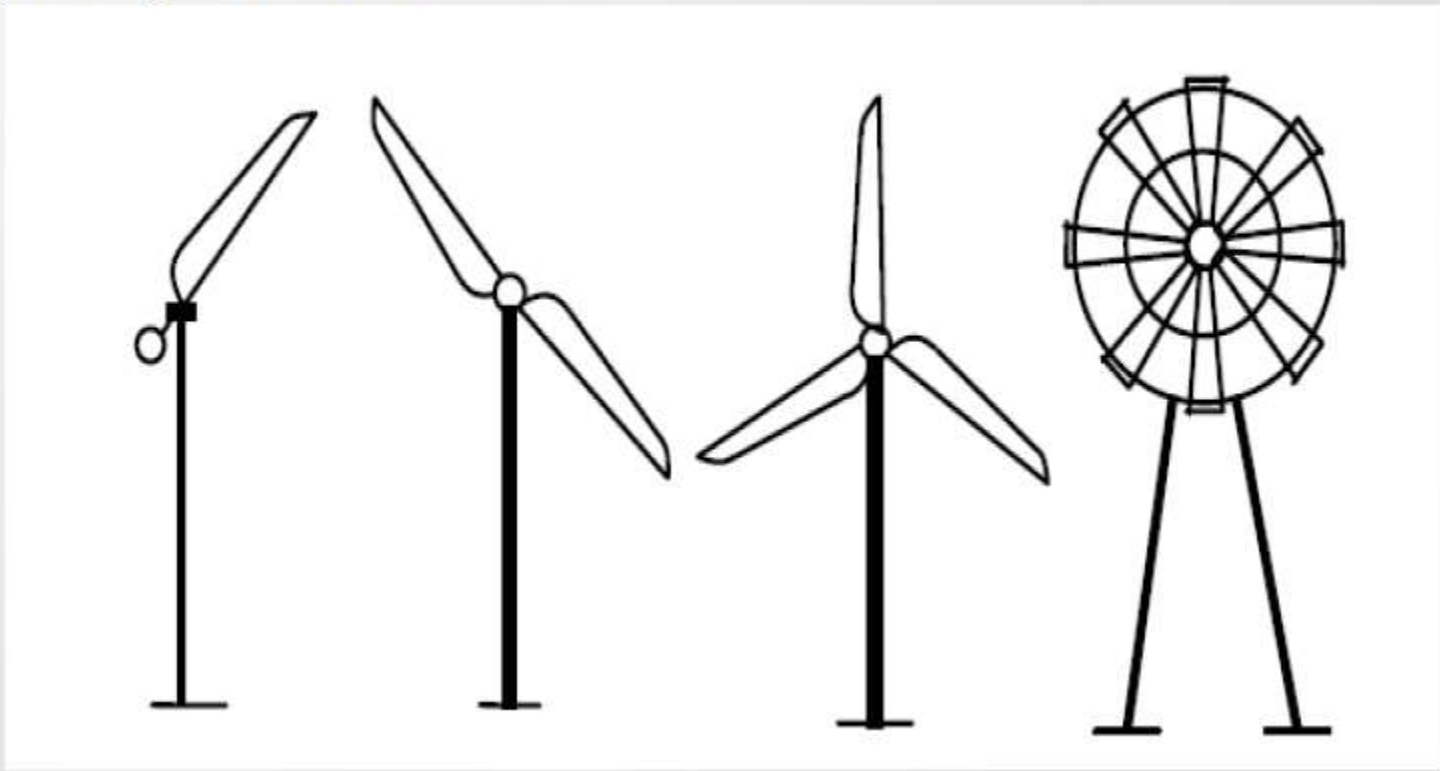


Classification of Wind Turbines



Horizontal Axis Wind Turbines:

Depending on the number of blades



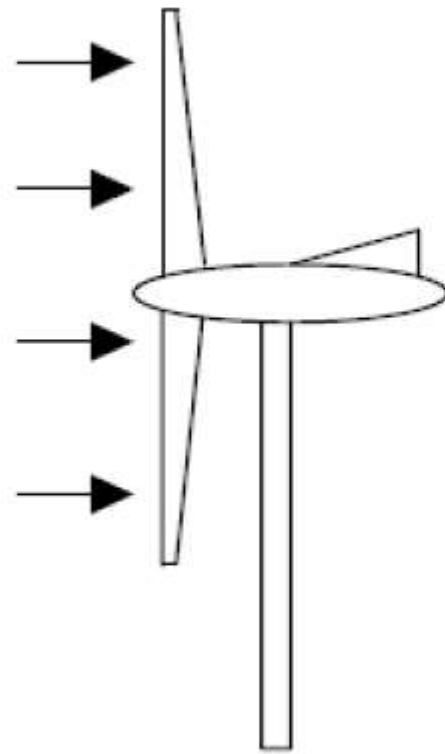
Single bladed, two bladed, three bladed and multi bladed turbines



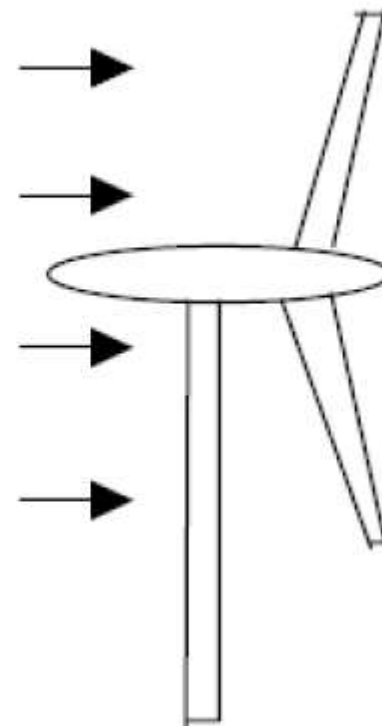
Classification of Wind Turbines



Based on the direction of receiving the wind:



Upwind



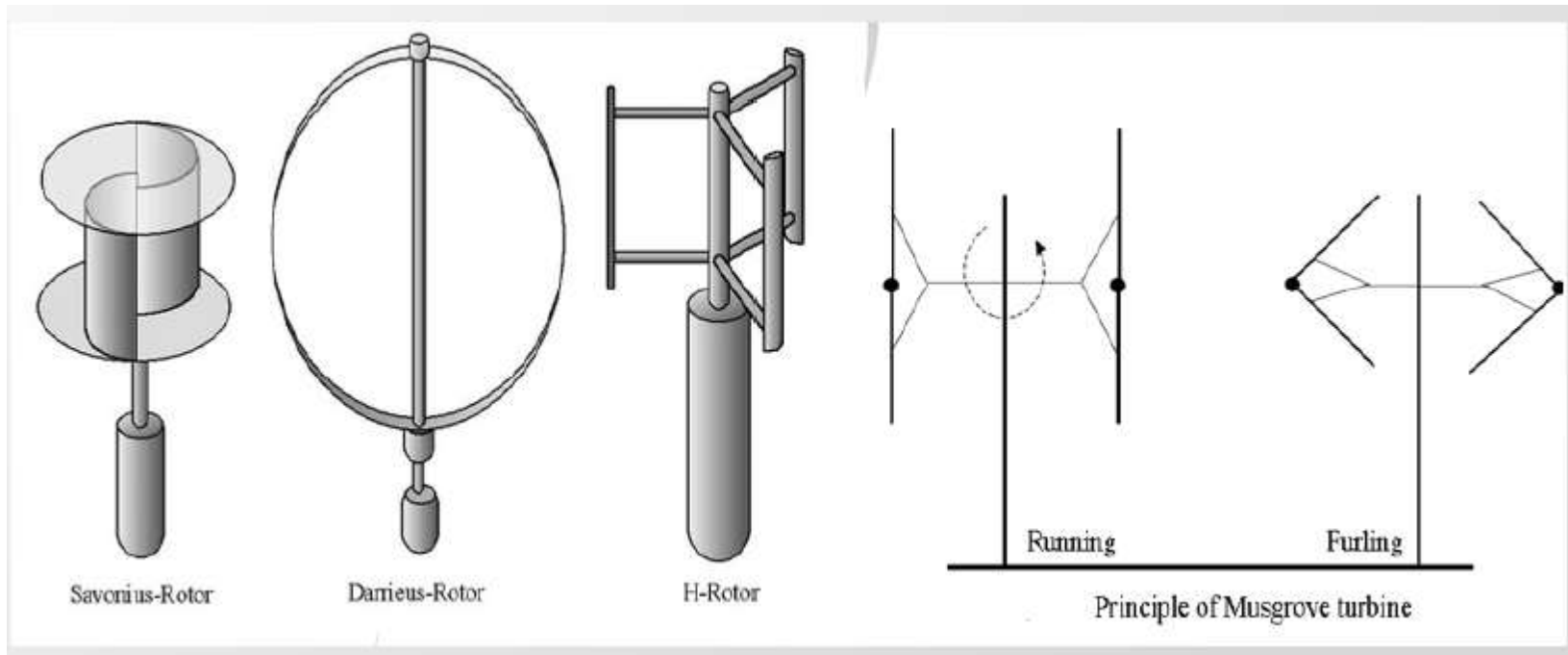
Downwind



Classification of Wind Turbines



Vertical axis wind turbines:



Classification of Wind Turbines



Comparison between HAWTs and VAWTs.

Items	HA-WTs	VA-WTs
Output power	Wide range	Narrow range
Starting	Self starting	Need starting means
Efficiency	Higher	Lower
Cost	Lower	Higher
Wind direction	Need redirected when the Wind change its direction	Does not needs redirected into the wind direction
Generator and gear box	At the top of the tower	At the ground level
Maintenance	Difficult	Easy

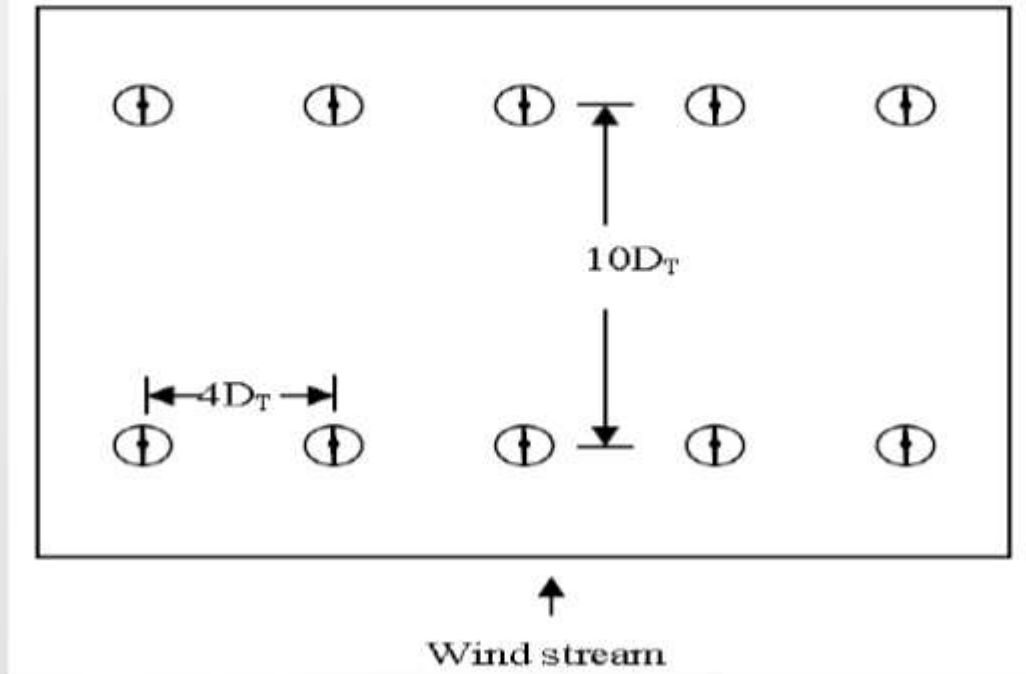


Wind farms



Type of a wind farms

1. Offshore wind farms.
2. Onshore wind farms (a land based wind farms).

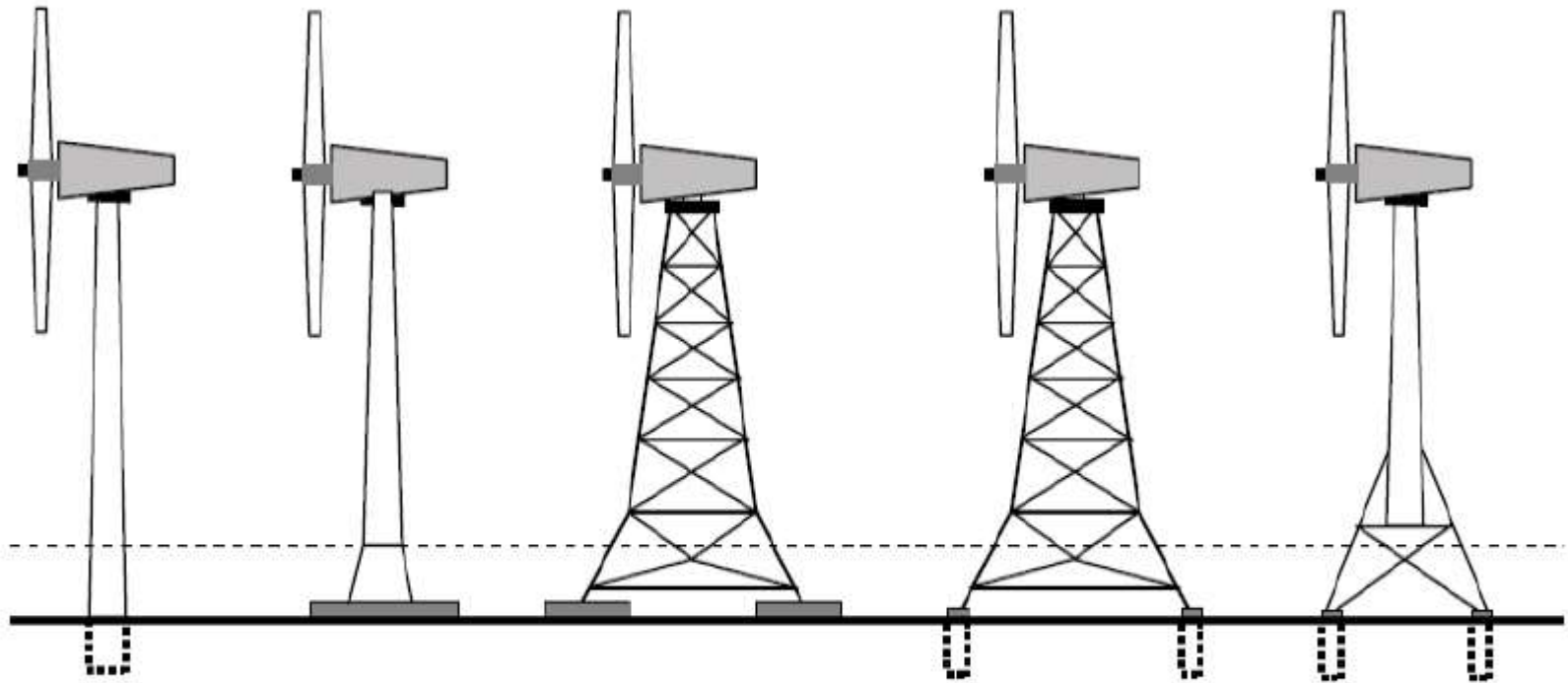


Typical layout of a wind farm



Wind farms

Different foundations for offshore turbines



Tubular tower on mono-pile foundation

Tubular tower on gravity base structure

Lattice tower on gravity base structure

Lattice tower with piles

Tripod and tubular tower structure

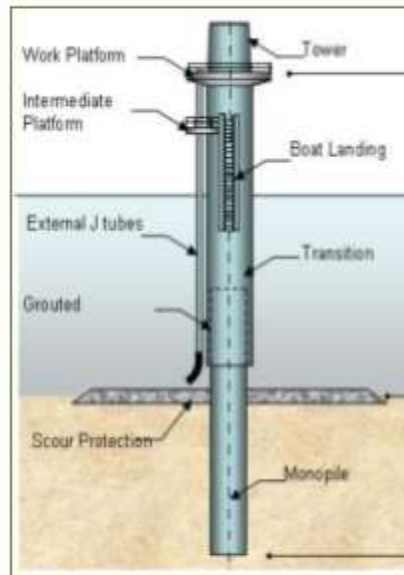
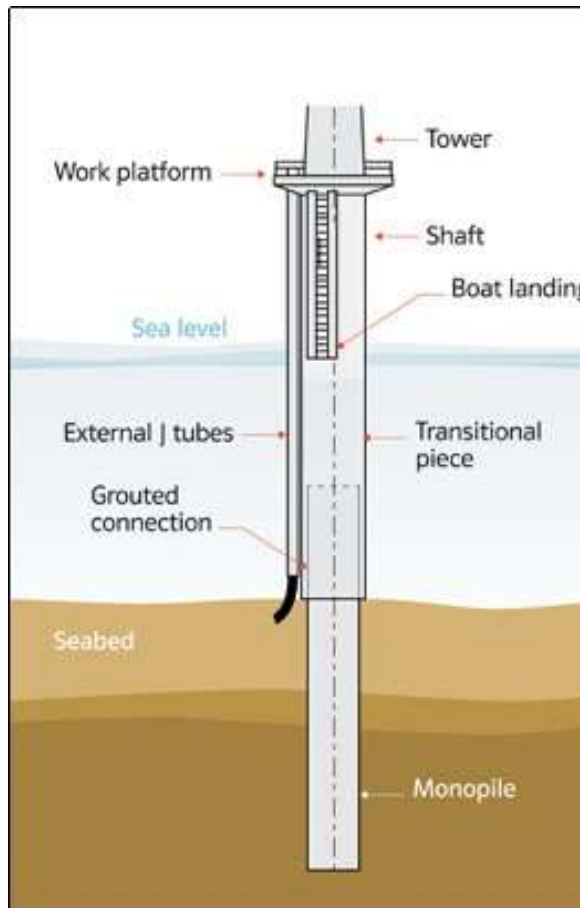


Wind farms

Different foundations for offshore turbines

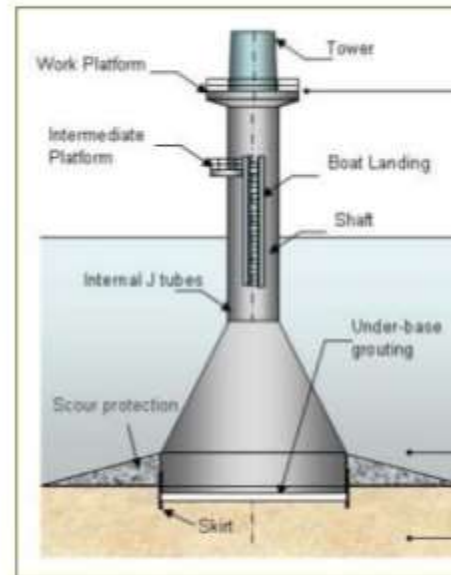


Foundation Types



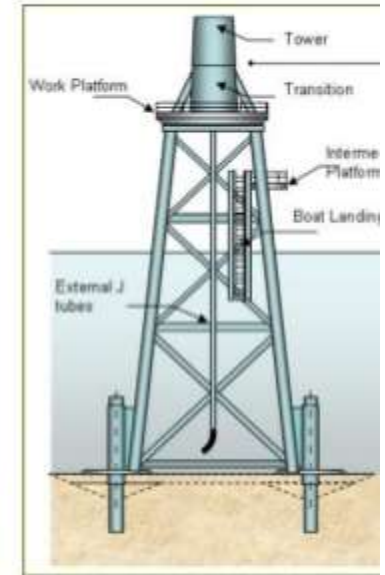
Monopile

- Medium water depths
- Medium size turbines
- Sand – clay seabed
- Environmental sensitivities



Gravity base structure

- All water depths
- Larger turbines
- Higher load-bearing capacity
- Seabed preparation required

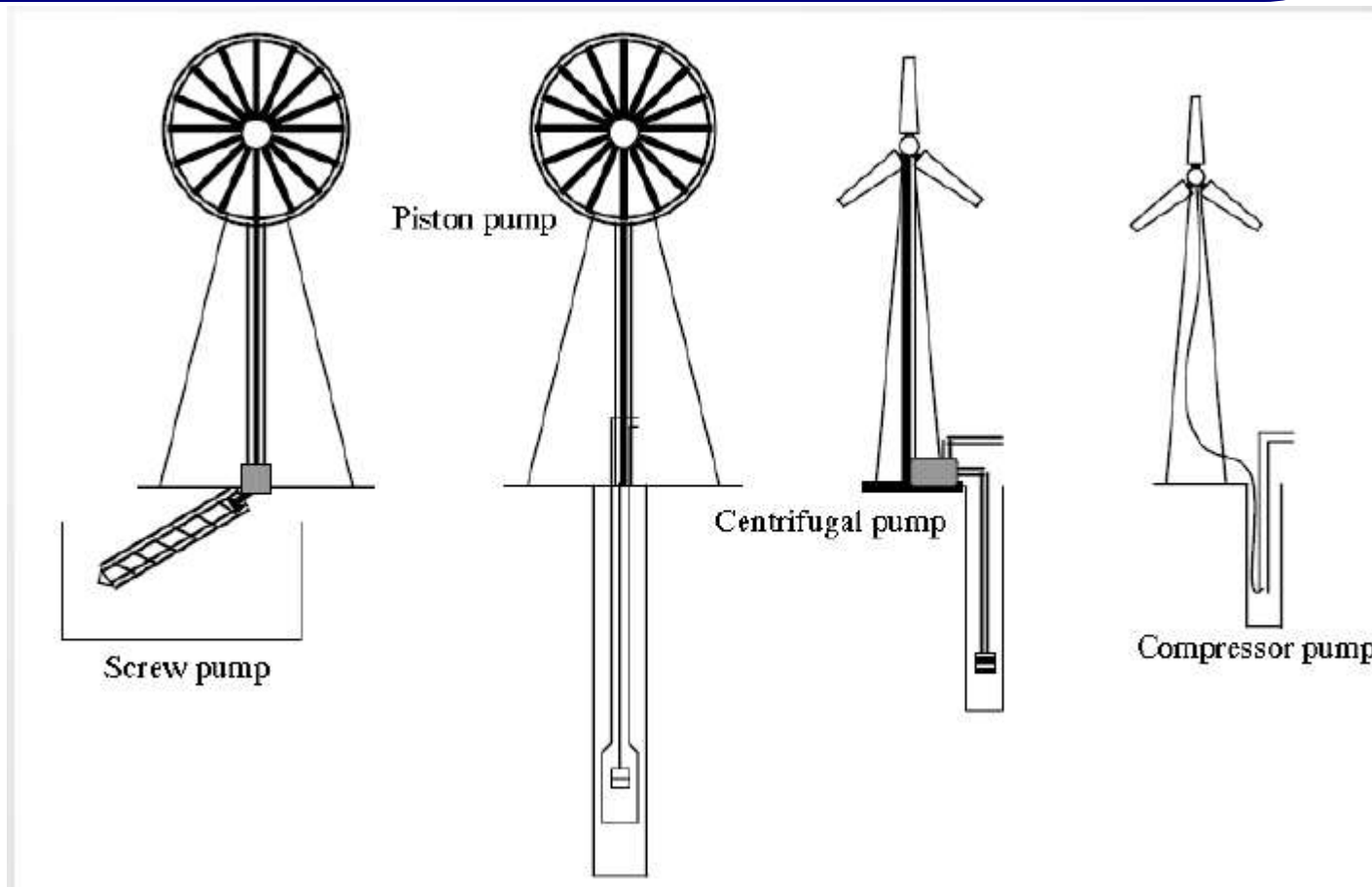


Jacket structures

- Deeper water depths
- Larger turbines
- Suitable for different sea conditions



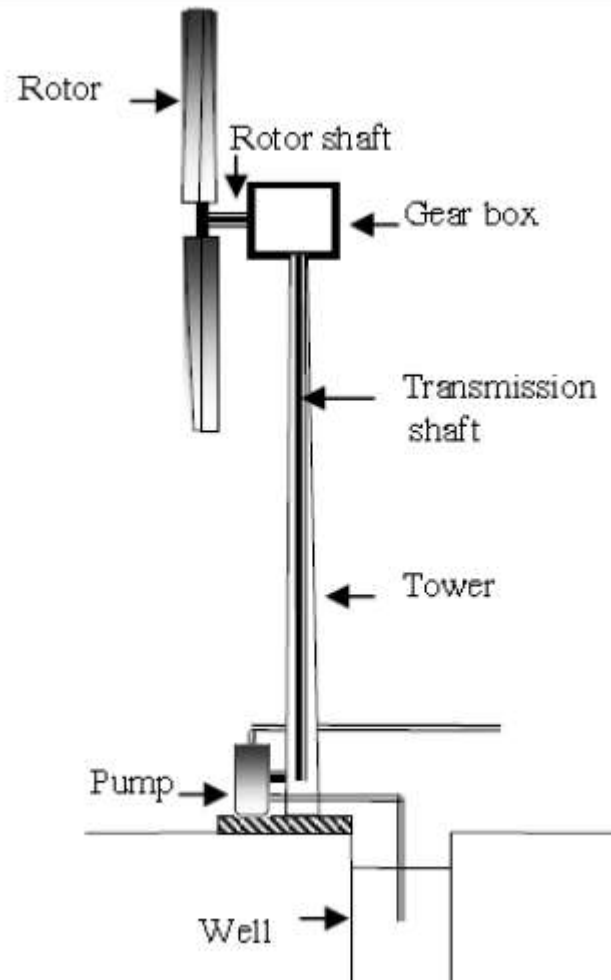
Wind pumps



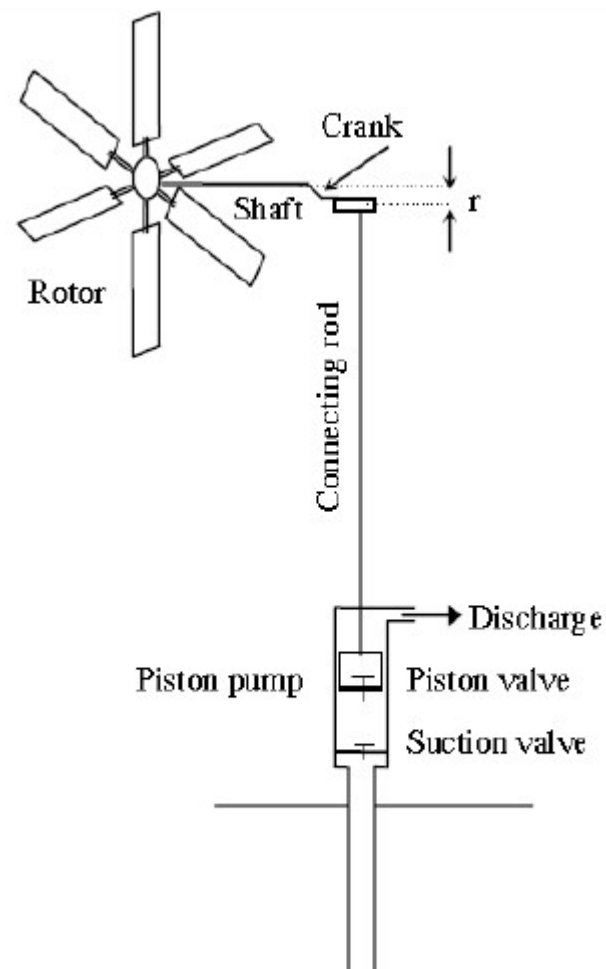
Different pumps coupled mechanically to wind rotors



Wind pumps



wind driven roto-dynamic pump



Wind driven piston pump

