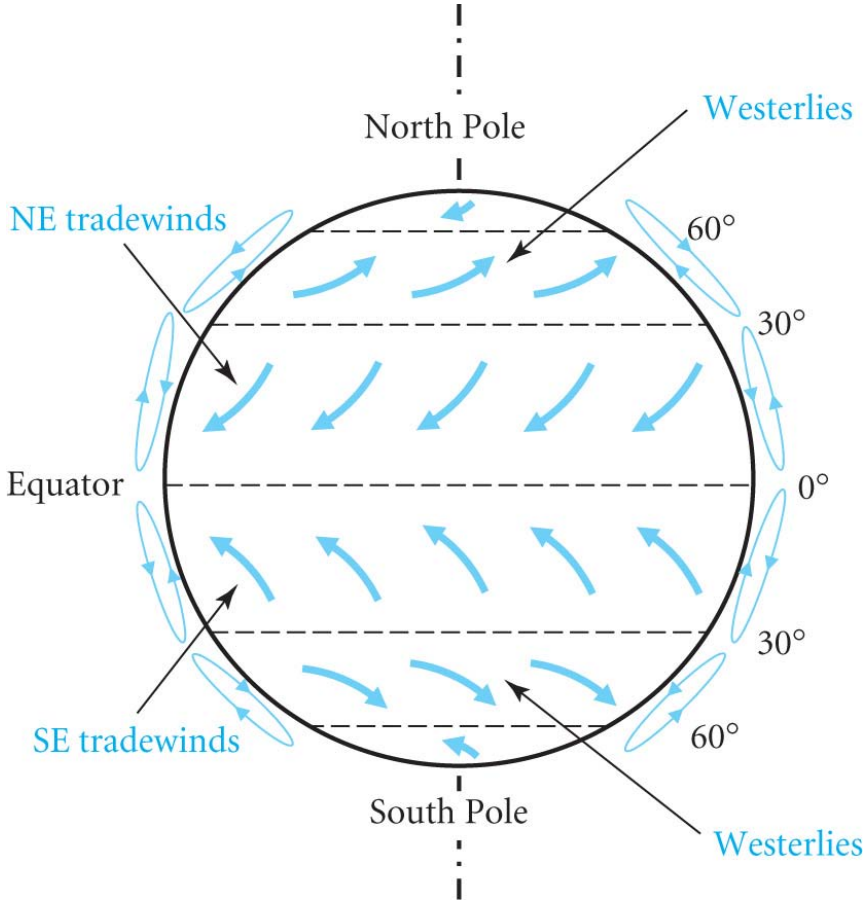
Spring Semester, 2011
Energy Engineering
에너지공학

Fluid mechanics for energy conversion

Ref. ch.3

1. Basic physical properties of fluids

Density (ρ): mass per unit volume of a fluid. Kgm^{-3}. ($\rho_{water} \sim 10^3\ kgm^{-3}$ & $\rho_{air} \sim$

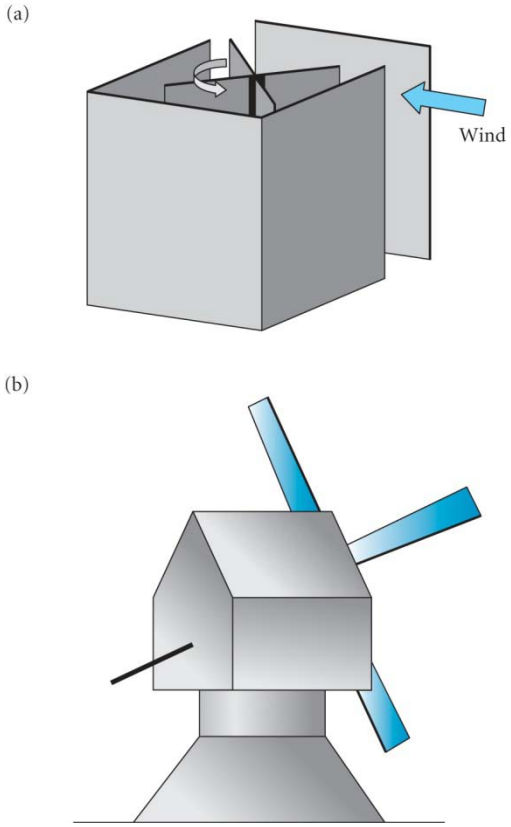


3. Mass continuity

Conservation of mass (or mass continuity): one of fundamental laws of fluid mechanics → mass flow per second is constant along the stream tube

$$\rho u A = \text{const.}$$

u: speed of fluid, A: cross-sectional area



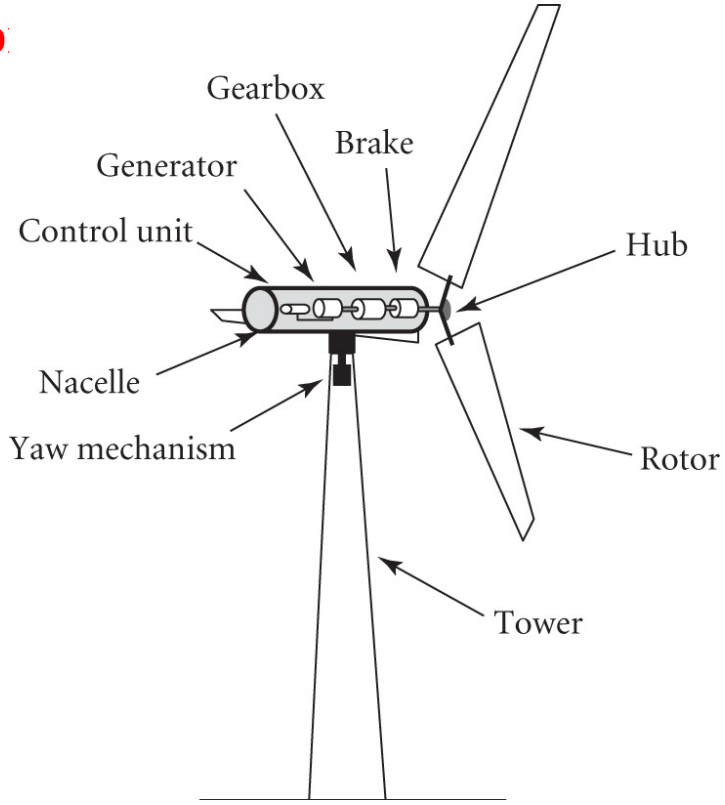
4. Energy conservation in an ideal fluid: Bernoulli's equation

$$p/\rho + gz + \tfrac{1}{2}u^2 = \text{const.}$$

z: a given depth

For a stationary fluid, u = 0 → $p/\rho + gz = co$

Derivation:

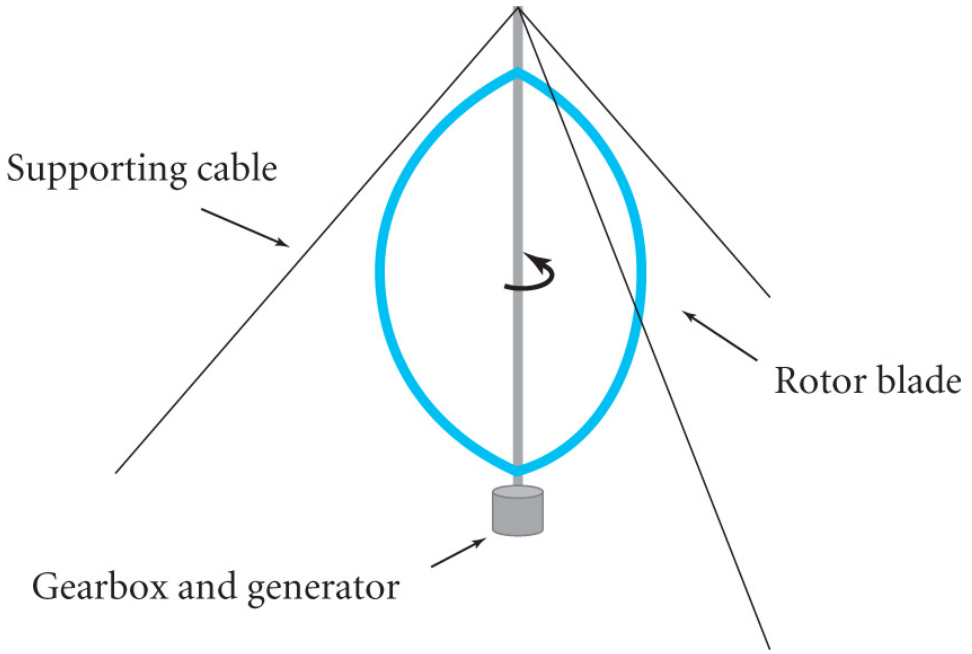


Bernoulli’s equation: the pressure in a moving fluid decreases as the speed increases

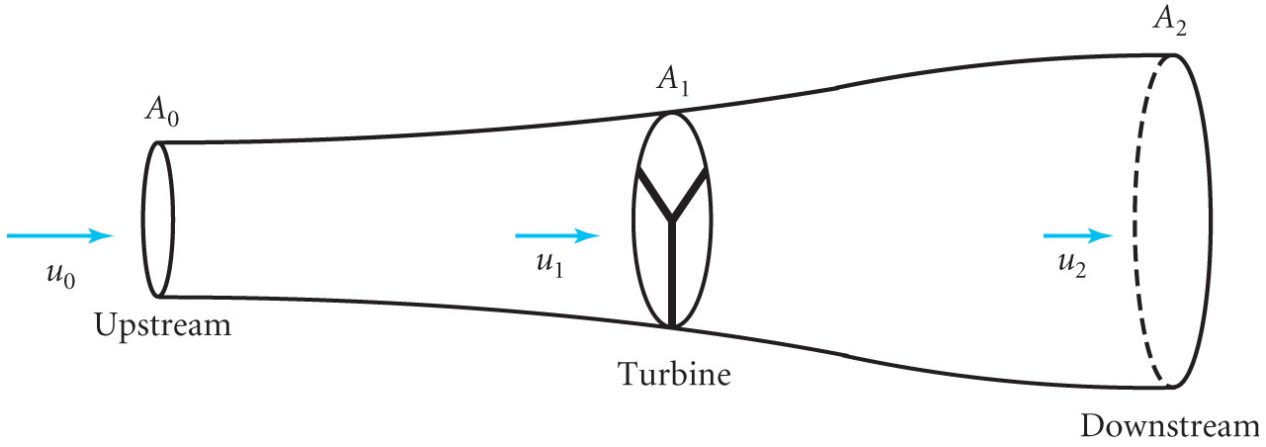
e.g. 3.2

e.g. 3.3

e.g. 3.4

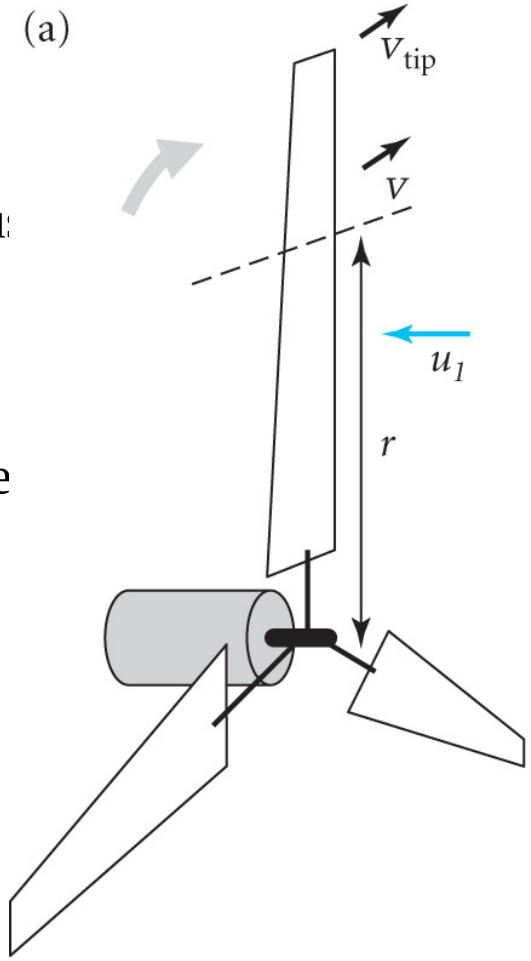


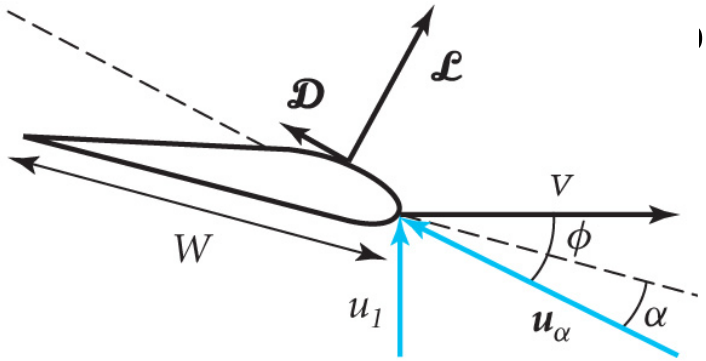
e.g. 3.5



5. Dynamics of a viscous fluid

Laminar viscous flow between parallel plates in relative motion





The viscou ...city gradient

μ: coefficie

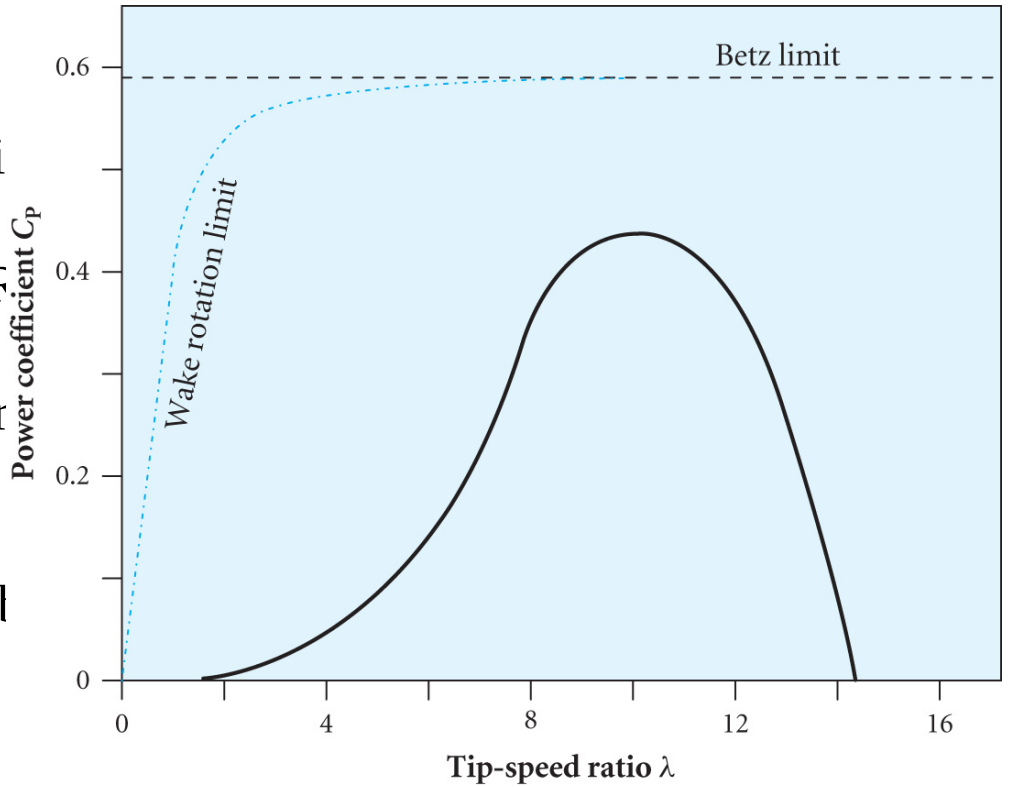
Laminar flow(층류) & turbulent flow(난류)

Flow regime depends on the rati
number)

Where U, L, ν = μ/ρ are the char
the kinematic viscosity

Small Re: laminar; large Re: turl

e.g. 3.6



Basic knowledge of fluid mechanics for hydropower, wave power, and wind power

1. Basic physical properties of fluids

Density (ρ): mass per unit volume of a fluid. Kgm^{-3}. ($\rho_{water} \sim 10^3\ kgm^{-3}$ & $\rho_{air} \sim 1.2\ kgm^{-3}$ at T = 20 ℃ and p = 1 atm)

Pressure (p): force per unit area in a fluid (수직방향의 힘). Pascal or Nm^{-2}. (1 atmosphere ~ 1 bar = $10^5\ Nm^{-2} = 10^5$ Pa)

Viscosity: force per unit area due to int
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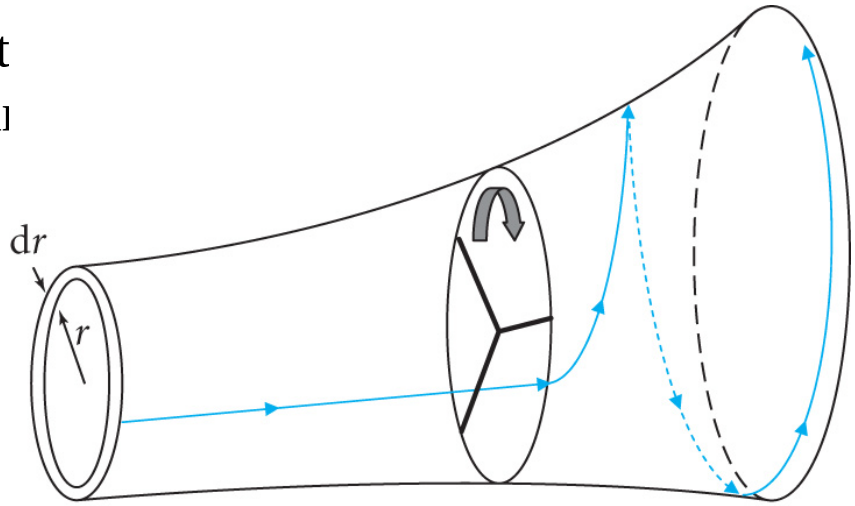

Turbine

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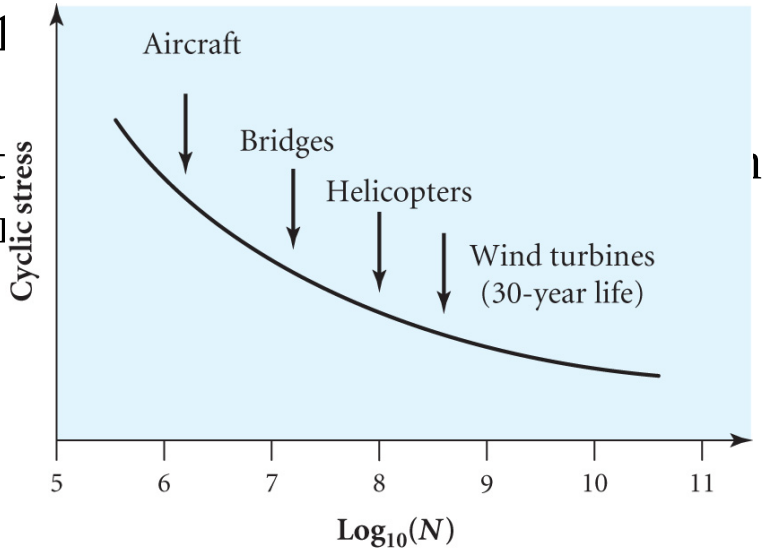

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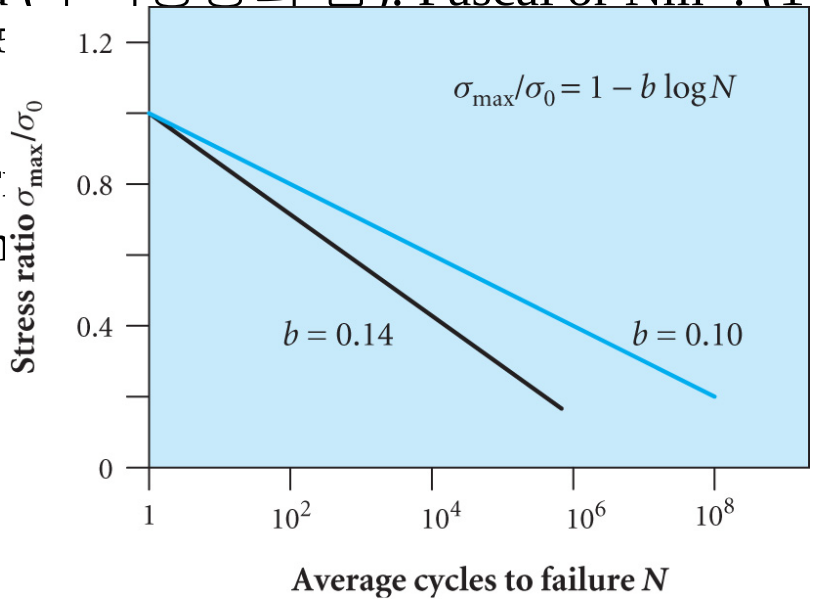

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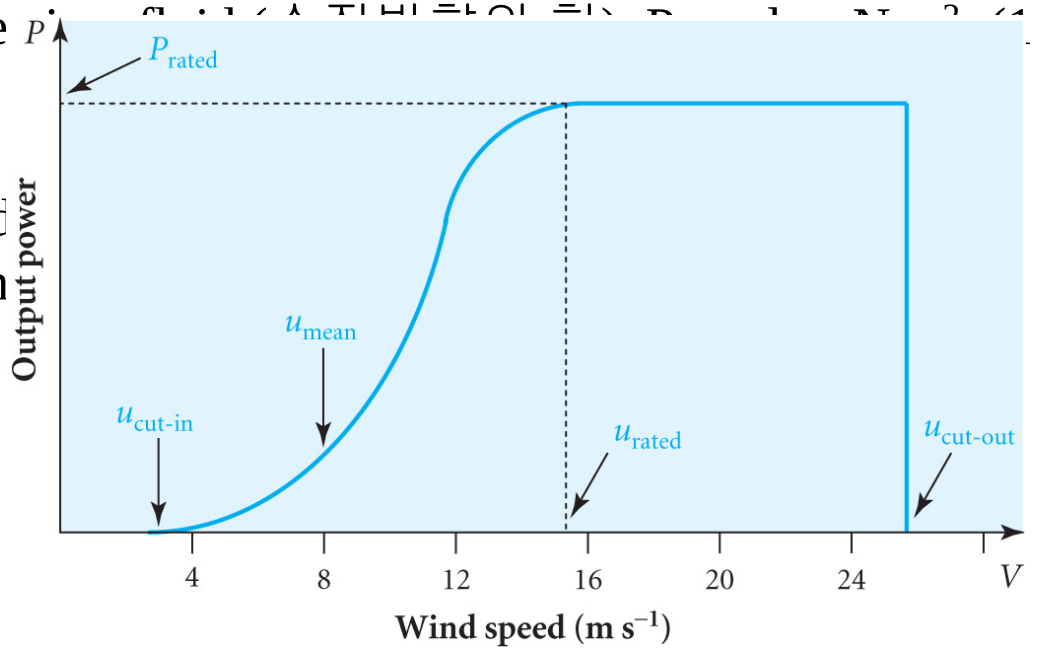

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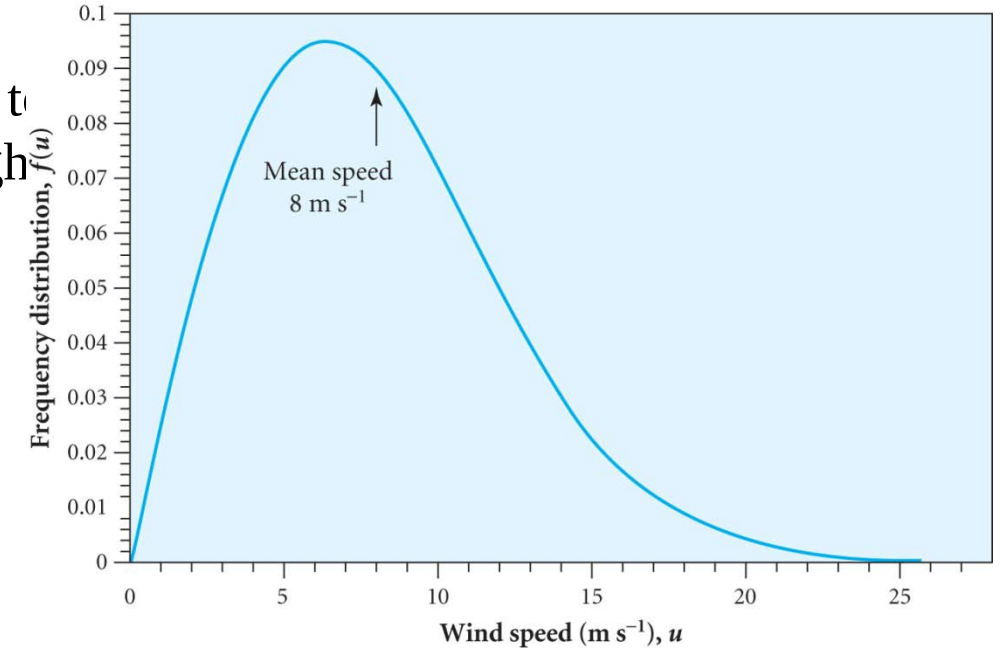

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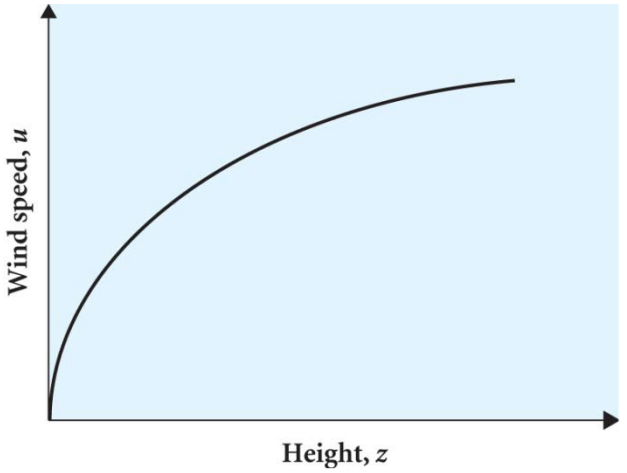

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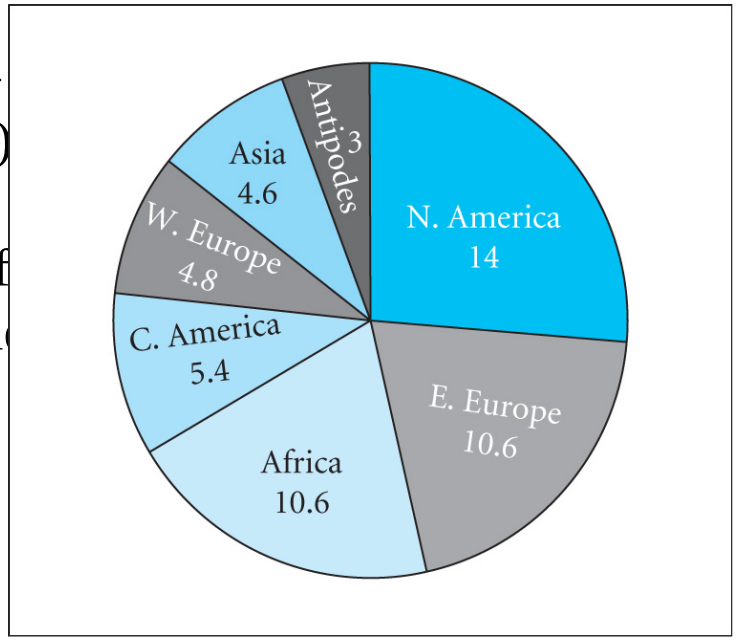

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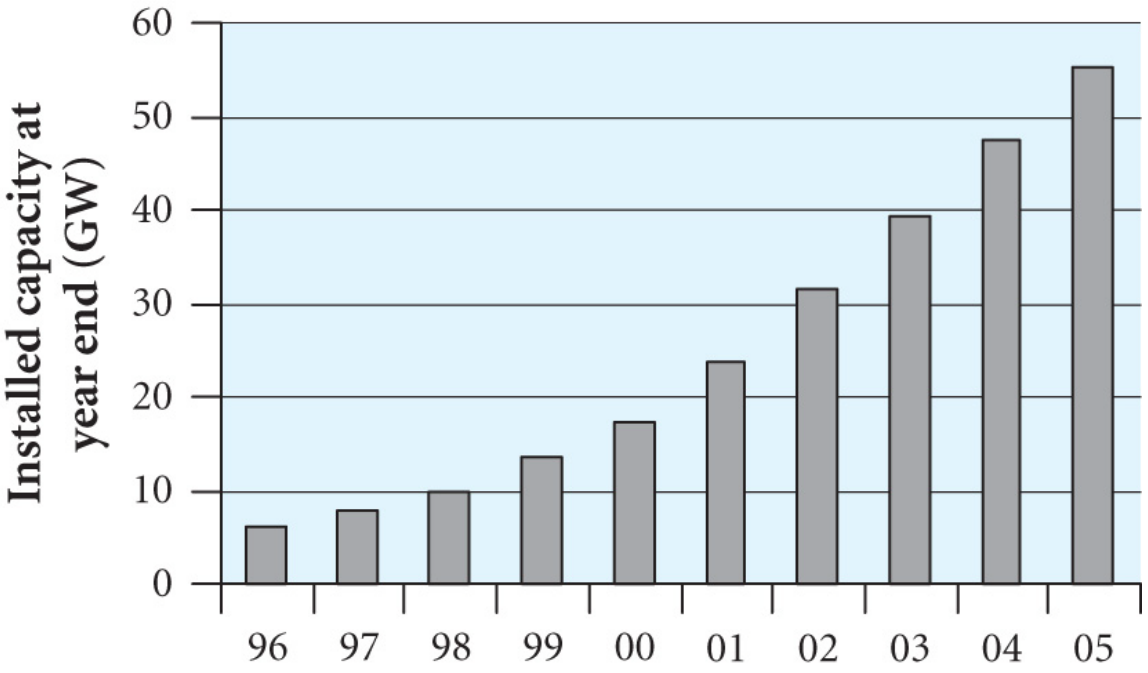

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