LCOE Example

Thursday, March 28, 2024 4:00 PM

Ex. Estimate LCOE given

- $v_{AVE} = 7 m/s$ @ 50 m height
- hub height = 80m
- friction coefficient $\alpha = \frac{1}{7} \rightarrow \frac{v_{AVE}}{7} = \left(\frac{80}{50}\right)^{1/7} \rightarrow v_{AVE} = 7.49 m/s$ @ 80m
- rated power $P_R = 1620$ kW
- rotor diameter $d = 82.5$ m

$CF = 0.087 \times 7.49 - \frac{1620}{82.5} = 0.413$ (tutorial next Tuesday)

- losses = 15%

→ Energy delivered in one year $= 8760 \times P_R \times CF \times$ efficiency $(1 - losses)$

$= 8760 \times 1620 \times 0.413 \times 0.85$

$= 4.99 \times 10^6$ kWh/yr

- Installed capital cost = \$1600/kW
- Payback period = 20 years
- Financing = 9%
- Operating cost = \$60/kW-yr

Capital cost = \$1600/kW × 1620 kW = \$2,592,000

$CRF(i,n) = \frac{i(1+i)^n}{(1+i)^n - 1}$

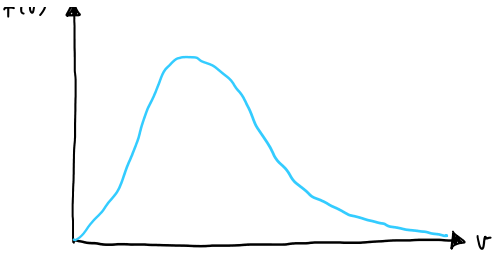
Amortizing $A = \$2,592,000 \times CRF(0.09, 20) = \$283,944/yr$

Operating cost = \$60/kW-yr × 1620 kW = \$97,200/yr

$LCOE = \frac{\$283,944 + \$2,592,000\ [\$/yr]}{4.99 \times 10^6\ [kWh/yr]} = \$0.0765/kWh$

$= \$76.5/MWh$

Wind Statistics



In general, $\boxed{\text{total energy} = 8760 \int_0^\infty \rho(v)\, f(v)\, dv}$