Renewable Energy Technologies I
529 0193-00L
Prof. A. Wokaun
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Exercise: Wind and Ocean Energy (Answers/Questions)

Solutions will be put online: 15.11.2016
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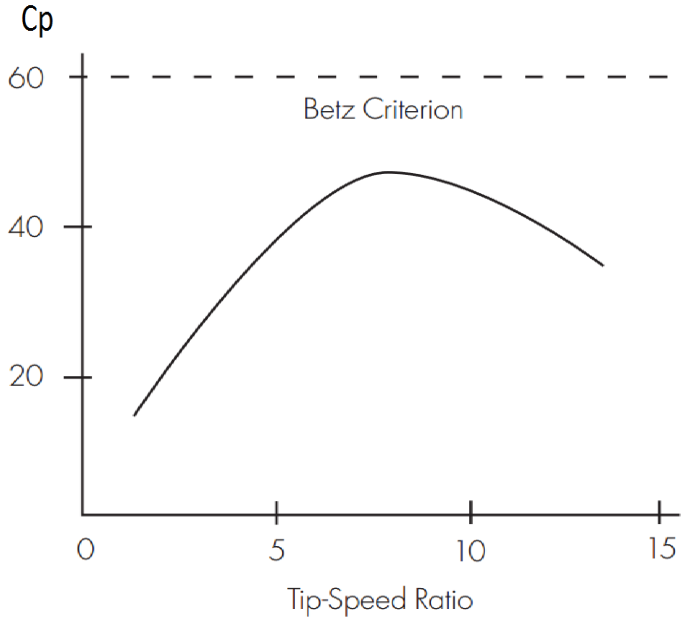
1. Wind energy

1.1 If the wind speed is 11.5m/s and the speed after the turbine is 8m/s, what is the power extraction coefficient of this wind turbine? (air density 1.225 kg/m^3)

1.2 The rated output power for a turbine model at 15 m/s is 3 MW. The rotor diameter is 90m. The rotor rotates at a constant frequency of 0.198 Hz. Please calculate the tip to speed ratio and power conversion coefficient of this model.

1.3 Based on the figure below, what do you expect about the power extraction coefficient of the model in question 1.2 when the wind speed is at 8 m/s? In addition, what do you expect about the output power at this wind speed? Is it more than the output power at 15m/s? The rotor rotates at the constant frequency. Give your arguments.



2. Tidal energy

The Bay of Funday is known for having the highest tidal range in the world. The tidal range could approach 17m in extremity. About 110 billion tons of water flow into and out of the bay in one cycle. Calculate the total potential tidal energy of the Bay of Funday in this extreme case in one year by using **bidirectional** turbines. (Gravity acceleration 9.8 m/s^2)

3. Wave energy

Based on the figure below, deduce the the wave power per unit length.

Suppose crest-to-trough height of wave is h, wavelength is λ, wave period is T, and the wave shape follows the sine function.

Given: surface wavelength $\lambda = \frac{gT^2}{2\pi}$