ECEN 460 SPRING 2024 (Birchfield) Quiz 14 26 Mar 2024

Name: _____ UIN: _____ Section: _____ Score: _____

A system has two generators with the following cost curves.

$$C_1(P_1) = 8600 + 14\,P_1 + 0.002\,P_1^2$$
$$C_2(P_2) = 3400 + 10\,P_2 + 0.005\,P_2^2$$

C_1 and C_2 are the generator costs, in \$/hr

P_1 and P_2 are the generator real power outputs, in MW

Each generator must be dispatched within the following limits

$$130 \text{ MW} \le P_1 \le 1250 \text{ MW}$$
$$85 \text{ MW} \le P_2 \le 1340 \text{ MW}$$

If the total system load is 1800 MW, what should be P_1 and P_2 to minimize the total system cost $C_1 + C_2$? Also give the system marginal cost λ. (Remember that for generators not at a limit, the incremental cost (dC/dP) should be equal to λ.)

$$P_1 + P_2 = 1800$$
$$\frac{dC_1}{dP_1} = 14 + 0.004P_1 = \lambda$$
$$\frac{dC_2}{dP_2} = 10 + 0.01P_2 = \lambda$$

Solve three equations for three unknowns: $P_1 = 1000\ MW$, $P_2 = 800\ MW$, $\lambda = 18\ \$/MWh$

Neither generator is exceeding its limit, so this solution is optimal.