Economic Dispatch Example 1

A system has two generators with the following cost curves.

$$C_1(P_1) = 5500 + 14\,P_1 + 0.002\,P_1^2$$
$$C_2(P_2) = 2000 + 12\,P_2 + 0.004\,P_2^2$$

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

$$10 \text{ MW} \le P_1 \le 200 \text{ MW}$$
$$50 \text{ MW} \le P_2 \le 500 \text{ MW}$$

If the total system load is 325 MW, what should be P_1 and P_2 to minimize the total system cost $C_1 + C_2$?

Also, what is the incremental cost to supply 1 more MW? How does the solution change if the load goes up to 400 MW? Down to 250 MW? Up to 570 MW? Up to 750 MW?

Economic Dispatch Example 2

Four generators with the following cost equations and limits:

$C_1(P_1) = 0.025\,P_1^2 + 16\,P_1 \qquad 15 \le P_1 \le 115$
$C_2(P_2) = 0.035\,P_2^2 + 9\,P_2 \qquad 30 \le P_2 \le 185$
$C_3(P_3) = 0.004\,P_3^2 + 15\,P_3 \qquad 8 \le P_3 \le 325$
$C_4(P_4) = 14\,P_4 \qquad 0 \le P_4 \le 250$

1. Make a table with five values of λ (system marginal cost): 9, 12, 15, 18, 21 $/MWh. Calculate $P_1,\ P_2,\ P_3, P_4,$ and total system P for each of these λ's. (Remember, $\lambda = dC_i/dP_i$ for each generator *i* not at a limit.)

λ ($/MWh)	P_1	P_2	P_3	P_4	P_{total}
9					
12					
15					
18					
21					

2. If we want to serve a total of 500 MW of load, what is the optimal dispatch ($P_1,\ P_2,\ P_3, P_4$), the system marginal cost λ, and total cost?