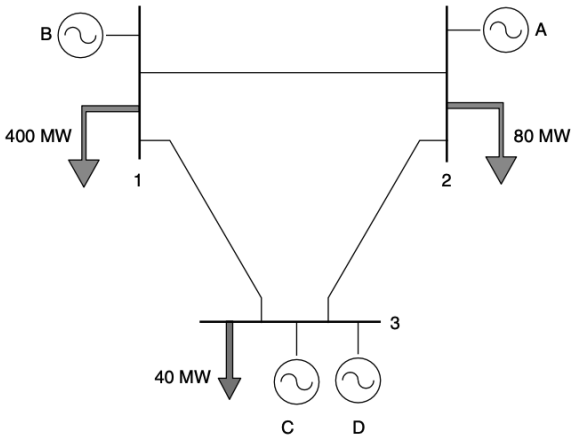
HW10

Tuesday, November 18, 2025 4:10 PM

6.5



6.5

$P_L = 520\,MW;\ P_D = 400\,MW$

→ Gen D is cheapest

$P_L - P_D = 120\,MW$

* second cheapest gen at bus C

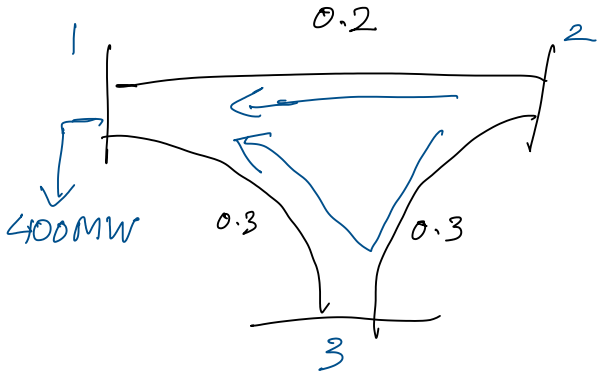
$\therefore P_C = 120\,MW$, and $P_A = P_B = 0\,MW$

Nodal Price, $\pi_1 = \pi_2 = \pi_3 =$ \$10/MWh

6.6

Gen D → Bus 1:

- $F_{3-1} = \frac{0.5}{0.8} \times 400 = 250\,MW$
- $F_{3-2-1} = \frac{0.3}{0.8} \times 400 = 150\,MW$

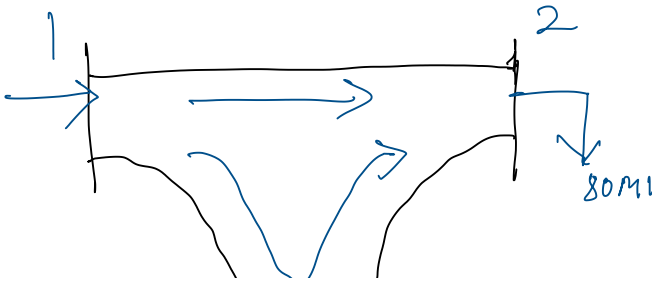


Gen C → Bus 2:

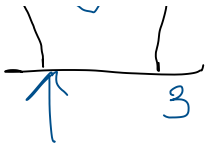
- $F_{3-2} = \frac{0.5}{0.8} \times 80 = 50\,MW$
- $F_{3-1-2} = \frac{0.3}{0.8} \times 80 = 30\,MW$

Gen C → Bus 3:

- $F_{3-1} = 250 + 30 = 280\,MW$ (Over-loaded)
- $F_{3-2} = 150 + 50 = 200\,MW$
- $F_{2-1} = 150 - 30 = 120\,MW$



F_{3-1} = over-loaded by 30 MW.



6.7

Method 1:

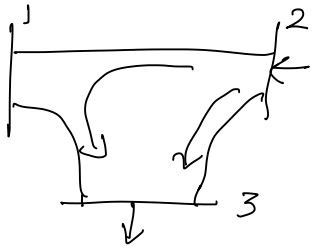
$$\Delta P = \frac{0.5}{0.8} = 250$$

$\Delta P = 400$ MW

→ Decrease power from 480 → 400 at bus 3.

option 1

increase Gen A, decrease gen C to avoid (F_{13})



(1-3) $\Delta F_A = \frac{0.3}{0.9} \times \Delta P_A$

ΔF_A = 30 MW OVER

$\Delta P_A = 30 \times \frac{8}{3} = 80$MW increase to decrease P_C.

$P_A = 80$MW

$P_B = 0$ MW

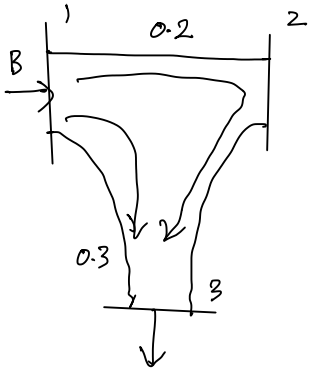
$P_C = (120-80) = 40$MW

$P_D = 400$ MW

$C = 12 \times 80 + (0+40\times10) + 400 \times 8 = 4560$

option2

increase Gen B, decrease Gen C



(1-3) $\Delta F_B = \frac{0.5}{0.8} \times \Delta P_B \rightarrow \Delta P_B = \frac{8}{5} \times 30 = 48$ MW

$P_C = 120 - 48 = 72$ MW

$P_A = 0$, $P_D = 400$ MW

$C = 0 + (48\times12) + (72\times10) + (8\times400) = 4640$

Option 1 has a lower price compared to option 2.
Option 1 is preferred.

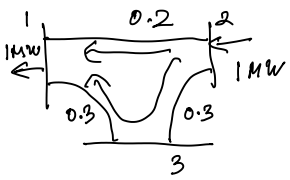
6.8

Nodal price → cheapest way to increase 1 MW at each bus.

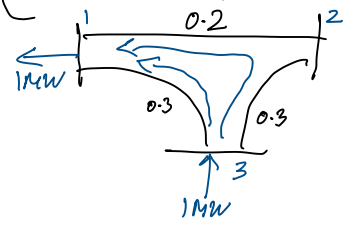
Bus 3 → $\pi_3 = \$10/MWh$ G_C not at limit

Bus 2 → π_2 \$12/MWh G_A not at limit

Nodal Price at Bus 1; { Provided by bus 2
Provided by bus 3



$1 \times \frac{0.2}{0.8} = 0.25$



$1 \times \frac{0.5}{0.8} = 0.625$

$$P_2 + P_3 = 1$$
$$0.25P_2 + 0.625P_3 = 0$$
$$\rightarrow \begin{cases} P_2 = 5/3 \\ P_3 = -2/3 \end{cases}$$

$$\pi_1 = (12)(5/3) - 2/3(10) = 13.33\$/MWh$$