Market clearing with network constraints

$$\underset{p_g^{\mathrm{G}},\ p_d^{\mathrm{D}},\ \theta_n}{\text{Maximize}} \quad \sum_d U_d\ p_d^{\mathrm{D}} - \sum_g C_g\ p_g^{\mathrm{G}}$$

subject to:

$$0 \leq p_d^{\mathrm{D}} \leq \overline{P}_d^{\mathrm{D}} \quad : \underline{\mu}_d^{\mathrm{D}}, \overline{\mu}_d^{\mathrm{D}} \quad \forall d$$

$$0 \leq p_g^{\mathrm{G}} \leq \overline{P}_g^{\mathrm{G}} \quad : \underline{\mu}_g^{\mathrm{G}}, \overline{\mu}_g^{\mathrm{G}} \quad \forall g$$

$$\sum_{d \in \Psi_n} p_d^{\mathrm{D}} + \sum_{m \in \Omega_n} B_{n,m}(\theta_n - \theta_m) - \sum_{g \in \Psi_n} p_g^{\mathrm{G}} = 0 \quad : \lambda_n \quad \forall n$$

$$-F_{n,m} \leq B_{n,m}(\theta_n - \theta_m) \leq F_{n,m} \quad : \underline{\eta}_{n,m}, \overline{\eta}_{n,m} \quad \forall n, \forall m \in \Omega_n$$

$$\theta_{(n=ref)} = 0 \quad : \gamma$$

KKTs

$$-U_d + \lambda_{n:d\in\Psi_n} - \underline{\mu}_d^{\mathrm{D}} + \overline{\mu}_d^{\mathrm{D}} = 0 \quad \forall d$$

$$C_g - \lambda_{n:g\in\Psi_n} - \underline{\mu}_g^{\mathrm{G}} + \overline{\mu}_g^{\mathrm{G}} = 0 \quad \forall g$$

$$\sum_{m\in\Omega_n} B_{n,m}(\lambda_n - \lambda_m + \overline{\eta}_{n,m} - \overline{\eta}_{m,n}) + (\gamma)_{n=ref} = 0 \quad \forall n$$

$$\sum_{d\in\Psi_n} p_d^{\mathrm{D}} + \sum_{m\in\Omega_n} B_{n,m}(\theta_n - \theta_m) - \sum_{g\in\Psi_n} p_g^{\mathrm{G}} = 0 \quad \forall n$$

$$\theta_{(n=ref)} = 0$$

$$0 \leq p_g^{\mathrm{G}} \perp \underline{\mu}_g^{\mathrm{G}} \geq 0 \quad \forall g$$

$$0 \leq [\overline{P}_g^{\mathrm{G}} - p_g^{\mathrm{G}}] \perp \overline{\mu}_g^{\mathrm{G}} \geq 0 \quad \forall g$$

$$0 \leq p_d^{\mathrm{D}} \perp \underline{\mu}_d^{\mathrm{D}} \geq 0 \quad \forall d$$

$$0 \leq [\overline{P}_d^{\mathrm{D}} - p_d^{\mathrm{D}}] \perp \overline{\mu}_d^{\mathrm{D}} \geq 0 \quad \forall d$$

$$0 \leq [F_{n,m} + B_{n,m}(\theta_n - \theta_m)] \perp \underline{\eta}_{n,m} \geq 0 \quad \forall n, \forall m \in \Omega_n$$

$$0 \leq [F_{n,m} - B_{n,m}(\theta_n - \theta_m)] \perp \overline{\eta}_{n,m} \geq 0 \quad \forall n, \forall m \in \Omega_n$$