

Allocation of CRR Revenue Shortfalls

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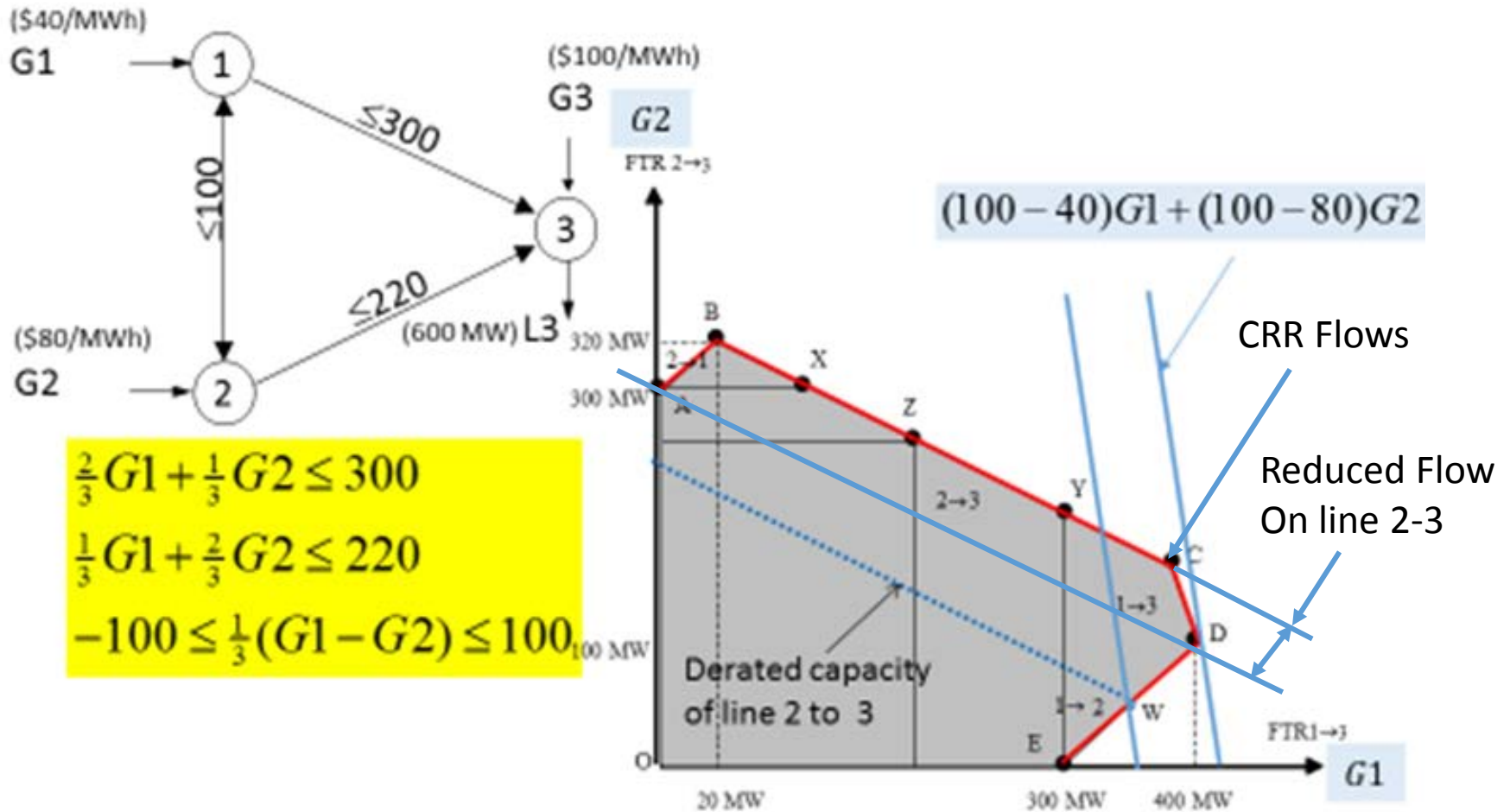
Revenue Adequacy by Constraint

- If there is no topology variation between the CRR SFT and the constrained dispatch, revenue adequacy is guaranteed for the network (Hogan 1992)
 - Optimal dispatch minimizes cost and maximizes congestion rents
 - CRR auction solution is a feasible dispatch where congestion rents equal FTR settlements
 - Congestion rents at optimal dispatch is at least as high as at CRR auction solution
- This is a network-wide guarantee, not a constraint by constraints guarantee
- Economic dispatch may result in congestion revenue redistribution among constraints which produces revenue surplus on the whole but may produce revenue shortfalls on some constraints

Proposed Shortfall Allocation

- Allocate revenue shortfall to constraints based on flow reduction from Auction solution to DA dispatch
- Distribute allocated constraint shortfall to FTRs based on impact of constraint on FTR as specified by shift factors
- Or require FTR holders to buy back oversold capacity on derated constraints in proportion to their holdings of the constraint capacity at prevailing shadow prices?
- **How do we measure oversold capacity?**
 - **Using flow reduction between auction outcome and DA dispatch is problematic**

Example



Example: Case 1

- Say FTR auction yields point C on nomogram i.e. 380MW FTR 1-3, 140MW FTR 2-3 (Constraints 2-3 and 1-3 binding)
- But DA Dispatch is at point D: G1 400MW, G2 100MW, G3 100MW (Constraint 1-3 and 1-2 binding)
- LMPs: N1 \$40/MWh, N2 \$80/MWh, N3 \$100/MWh
- Dispatch flow on line 2-3 is reduced **compared to CRR auction flow** from 220 to 200MW but constraint is nonbinding, so no revenue shortfall is allocated (since the shadow price on constraint is zero)
- Flow on constraint 1-3 is at limit as in CRR auction so congestion rent equals settlement
- Constraint 1-2, which was not binding in CRR auction, is binding in DA dispatch with a congestion revenue surplus
- Total congestion rent $400 \times 60 + 100 \times 20 = \$26,000/h$, and the FTR settlement is $380 \times 60 + 140 \times 20 = \$25,600$, which yield a revenue surplus of \$400/h

Example Case 2

- Generation cost as in Case 1 but line 2-3 is derated from 220MW to 150MW.
- DA Economic Dispatch is G1 350MW; G2 50MW; G3 200 MW
- LMPs the same (40, 80, 100)
- FTR settlement \$25,600 as before.
 - However, the congestion rents are now $350 \times 60 + 50 \times 20 = \$22,000/\text{h}$ resulting in a revenue shortfall of \$3600/h
- Constraint 1-3 not binding so no shortfall allocated
- Constraint 1-2 has **unchanged** flow so no shortfall allocated
- Constraint 2-3 is binding with shadow price \$80/h and flow reduction from CRR Auction to DA is 70 MW:
 - So \$5600/h is allocated if based on FTR → DA flow reduction
 - More than \$3600/h shortfall, so \$2000/h economic dispatch surplus
 - **Only 50MW out of the 70MW flow reduction is due to derating. So if allocated shortfall was based on 50MW it would be \$4000/h**
 - Which still produces the \$400/h economic dispatch surplus after covering the shortfall
- **Flow reduction based on difference between CRR flow and DA flow may inflate revenue shortfall on constraint and result in over-collection**

Remedy Options

- Track actual flow reduction due to derating – **Impractical**
- True up allocation to match actual revenue shortfall by prorating allocations. This will allocate the surplus on constraints with increased flow to offset shortfall on derated constraints – **Not perfect but eliminates over collection**