California ISO
Shaping a Renewed Future

Contingency Modeling Enhancements

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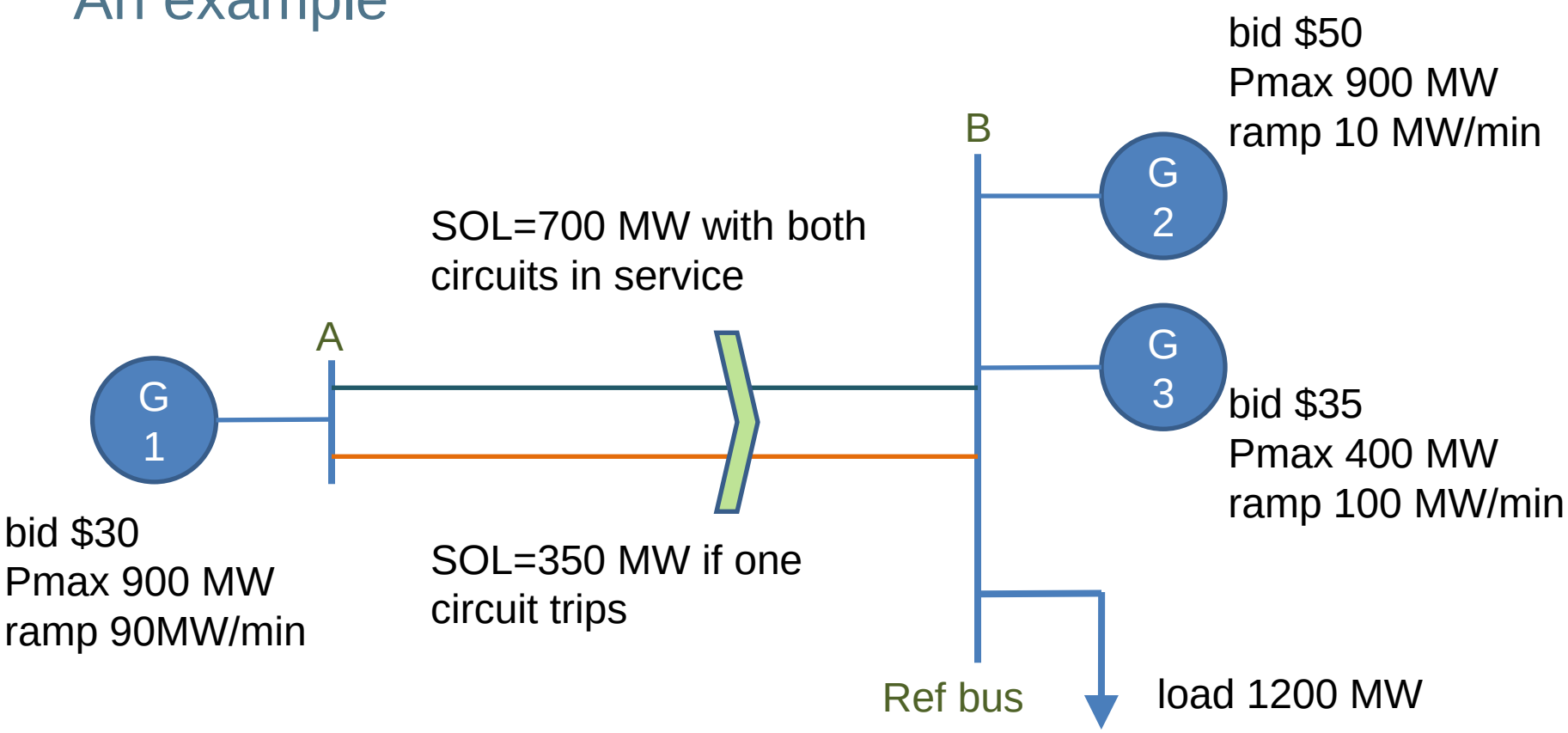
Background

- Contingency modeling enhancements initiative introduces a preventive-corrective constraint to reduce exceptional dispatch and minimum online commitment constraints
- The preventive-corrective constraint is proposed because:
  - It can model post-contingency need in market optimization (rather than determining need on a static basis pre-contingency)
  - Compensates affected generators through LMP and potentially through a separate capacity payment when applicable
  - Is a framework that can consider both post-contingency preventive-corrective constraints and generation contingencies

An example



- Compare two models
  - Weak preventive model (ISO's current model)
  - Preventive-corrective model: co-optimizes pre contingency dispatch and post contingency re-dispatch

Weak preventive model solution

Gen	Dispatch	LMP^{EN}	LMP^{CONG}	LMP	Bid cost	Revenue	Profit
G1	700	$50	–$20	$30	$21,000	$21,000	$0
G2	100	$50	$0	$50	$5,000	$5,000	$0
G3	400	$50	$0	$50	$14,000	$20,000	$6,000
total	1,200	N/A	N/A	N/A	$40,000	$46,000	$6,000

- Merit order:G1 (constrained by SOL), G2 (constrained by Pmax), G3
- A-B congestion shadow price $20
- If contingency occurs, within 20 minutes
  - G1 will ramp down to 350 MW
  - G2 will ramp up to 300 MW limited by ramp rate
  - G3 stays at 400 MW
  - 350+300+400 = 1,050 MW < 1,200 MW load, so the system is short of 150 MW upward corrective capacity at location B

Preventive-corrective model solution

	Energy					Corrective capacity		
Gen	MW	LMP	Bid cost	Revenue	Profit	Re-dispatch	LMCP | opp. cost	Profit LMCP | opp. cost
G1	700	$30	$21,000	$21,000	$0	–350	$0 | $0	$0 | $0
G2	250	$50	$12,500	$12,500	$0	200	$15 | $0	$3,000 | $0
G3	250	$50	$8,750	$12,500	$3,750	150	$15 | $15	$2,250 | $2,250
total	1,200	N/A	$42,250	$46,000	$3,750	0	N/A	$5,250 | $2,250

- G3 being dec'ed down to 250 MW to provide the 150 MW corrective capacity, and has an opportunity cost $15
- LMCP at location B reflects G3's opportunity cost
- G2 does not have opportunity cost, but its corrective capacity is as valuable as G3's corrective capacity. Should G2 be compensated?

General questions on compensation

- Is it appropriate to provide compensation to generators for corrective capacity?
- If so, on what should the compensation be based? Would it be based on a movement to create the corrective capacity or the corrective capacity created?
- Should the compensation be akin to a market clearing price (LMCP) or pay as bid (opportunity cost)?
- What are the cost implications to load over the short-term? Over the long-term?
- What are the compensation implications to generation over the short-term? Over the long-term?
- How can compensation incentivize real-time performance?