



# Day-Ahead Market Enhancements discussion

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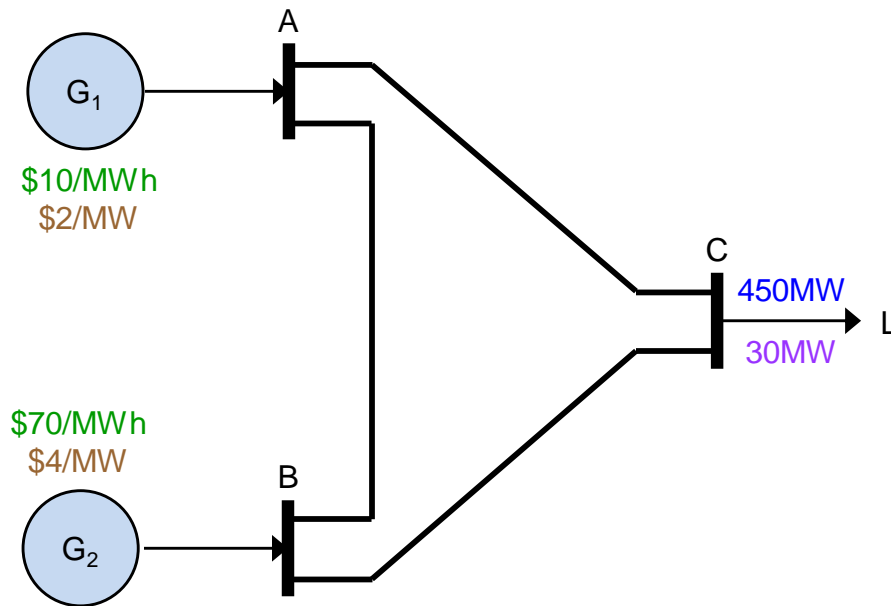
General Session

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ISO PUBLIC

# Local Market Power Mitigation in IFM

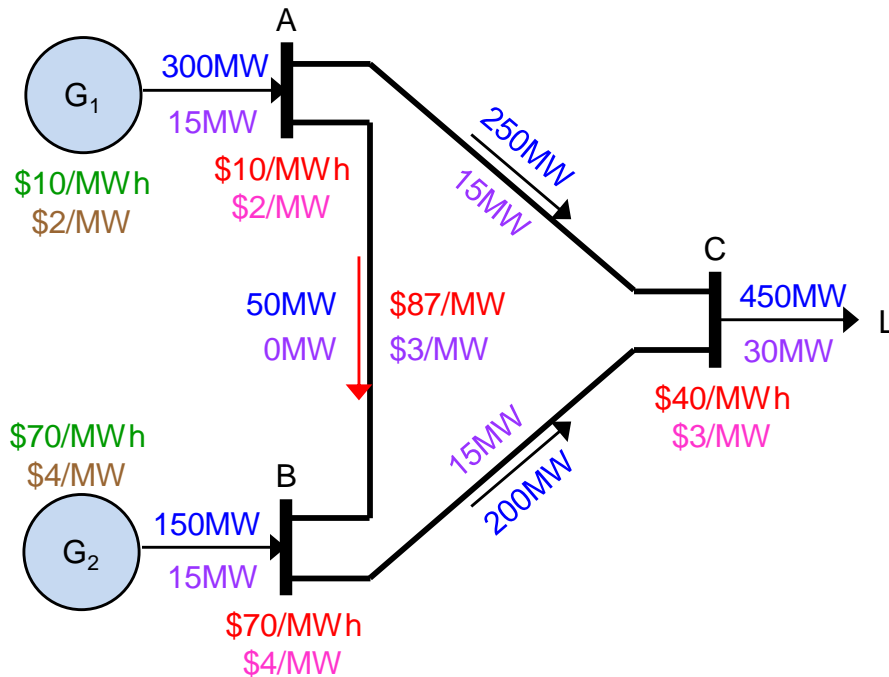
## Example 1: Setup



- $G_1$ 
  - ◆ Energy bid: \$10/MWh
  - ◆ IRU bid: \$2/MW
- $G_2$ 
  - ◆ Energy bid: \$70/MWh
  - ◆ DEB: \$40/MWh
  - ◆ IRU bid: \$4/MW
- L
  - ◆ Energy self-schedule: 450MW
  - ◆ IRU requirement: 30MW
- Line A-B power flow limit: 50MW

# Local Market Power Mitigation in IFM

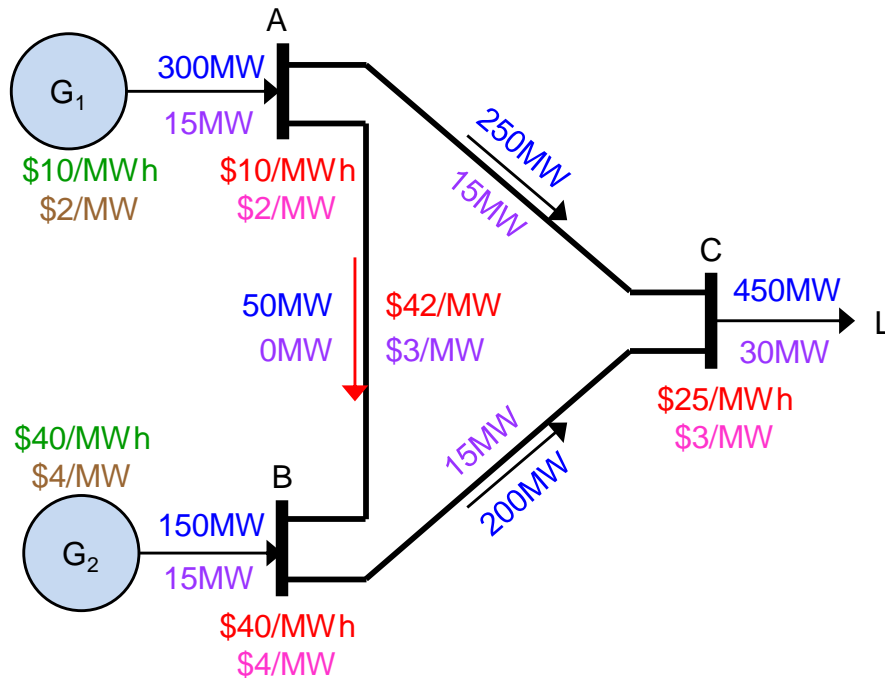
## Example 1: MPM Base and IRU Deployment Scenario



- $G_1$ 
  - ◆ Schedule: 300MW; IRU award: 15MW
- $G_2$ 
  - ◆ Schedule: 150MW; IRU award: 15MW
- Line A-B power flow at limit: 50MW
  - ◆ Shadow prices: \$87/MWh, \$3/MW
- LMPs
  - ◆ A: Energy: \$10/MWh; IRU: \$2/MW
  - ◆ B: Energy: \$70/MWh; IRU: \$4/MW
  - ◆ C: Energy: \$40/MWh; IRU: \$3/MW

# Local Market Power Mitigation in IFM

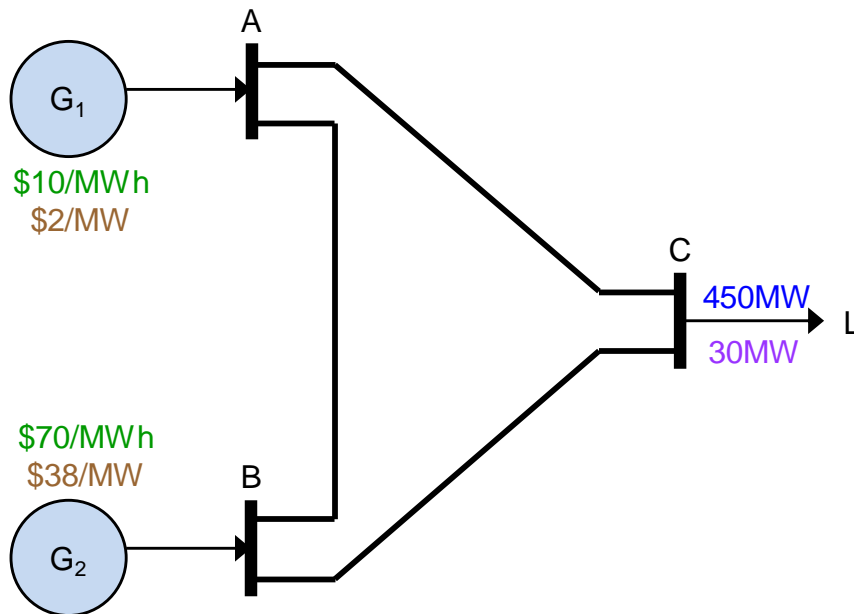
## Example 1: IFM Base and IRU Deployment Scenario



- G<sub>1</sub>
  - ◆ Schedule: 300MW; IRU award: 15MW
- G<sub>2</sub>
  - ◆ Schedule: 150MW; IRU award: 15MW
  - ◆ Energy bid is mitigated to the higher of DEB or competitive LMP (\$40/MWh)
- Line A-B power flow at limit: 50MW
  - ◆ Shadow prices: \$42/MW, \$3/MW
- LMPs
  - ◆ A: Energy: \$10/MWh; IRU: \$2/MW
  - ◆ B: Energy: \$40/MWh; IRU: \$4/MW
  - ◆ C: Energy: \$25/MWh; IRU: \$3/MW
- IRU cost allocated to L: \$90

# Local Market Power Mitigation in IFM

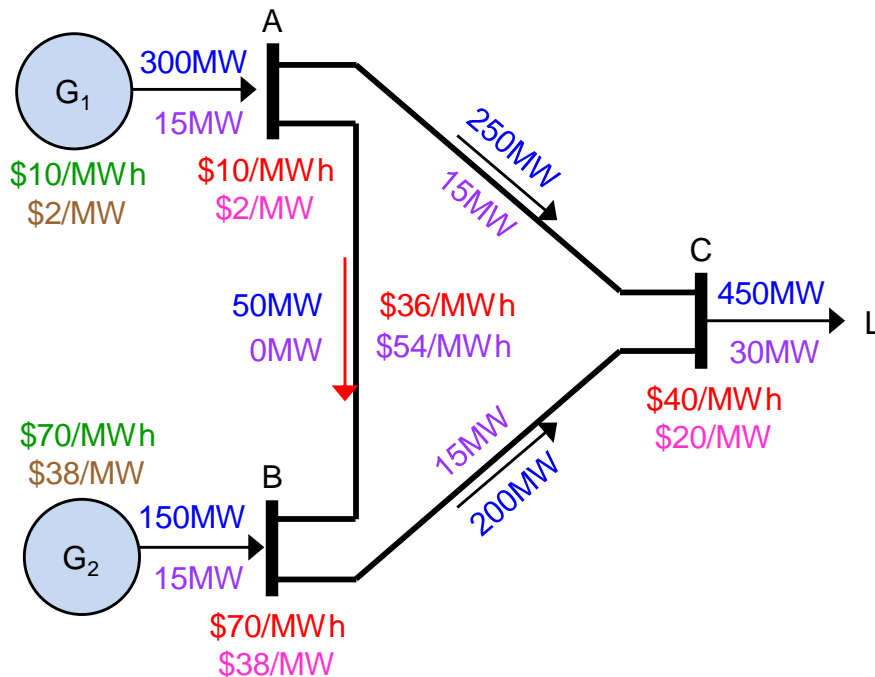
## Example 2: Can $G_2$ exercise market power in IRU?



- $G_1$ 
  - ◆ Energy bid: \$10/MWh
  - ◆ IRU bid: \$2/MW
- $G_2$ 
  - ◆ Energy bid: \$70/MWh
  - ◆ DEB: \$40/MWh
  - ◆ IRU bid: \$38/MW
- L
  - ◆ Energy self-schedule: 450MW
  - ◆ IRU requirement: 30MW
- Line A-B power flow limit: 50MW

# Local Market Power Mitigation in IFM

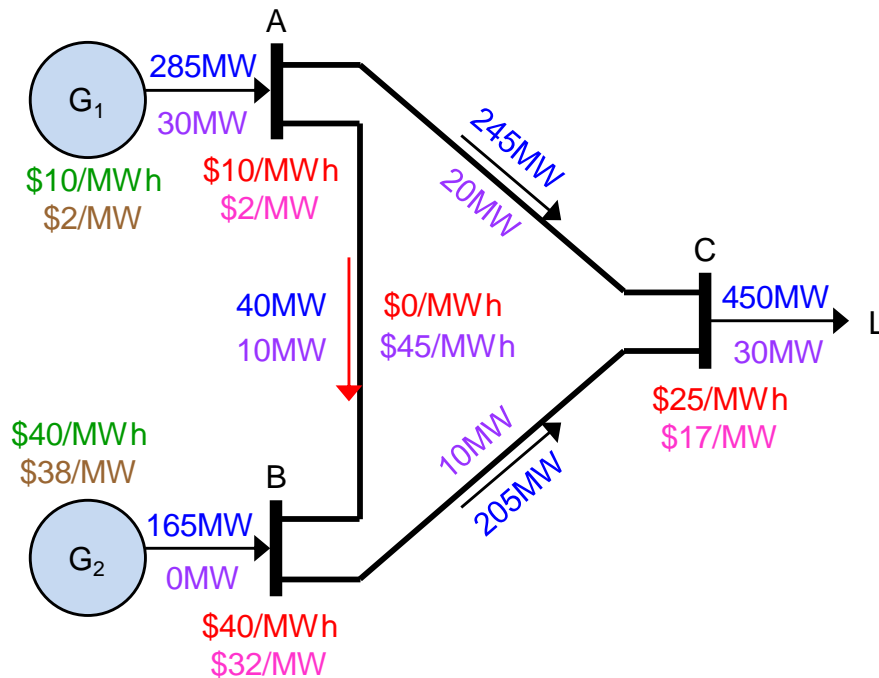
## Example 2: MPM Base and IRU Deployment Scenario



- $G_1$ 
  - ◆ Schedule: 300MW; IRU award: 15MW
- $G_2$ 
  - ◆ Schedule: 150MW; IRU award: 15MW
- Line A-B power flow at limit: 50MW
  - ◆ Shadow prices: \$36/MWh, \$54/MWh
- LMPs
  - ◆ A: Energy: \$10/MWh; IRU: \$2/MW
  - ◆ B: Energy: \$70/MWh; IRU: \$38/MW
  - ◆ C: Energy: \$40/MWh; IRU: \$20/MW
- IRU cost allocated to L: \$60

# Local Market Power Mitigation in IFM

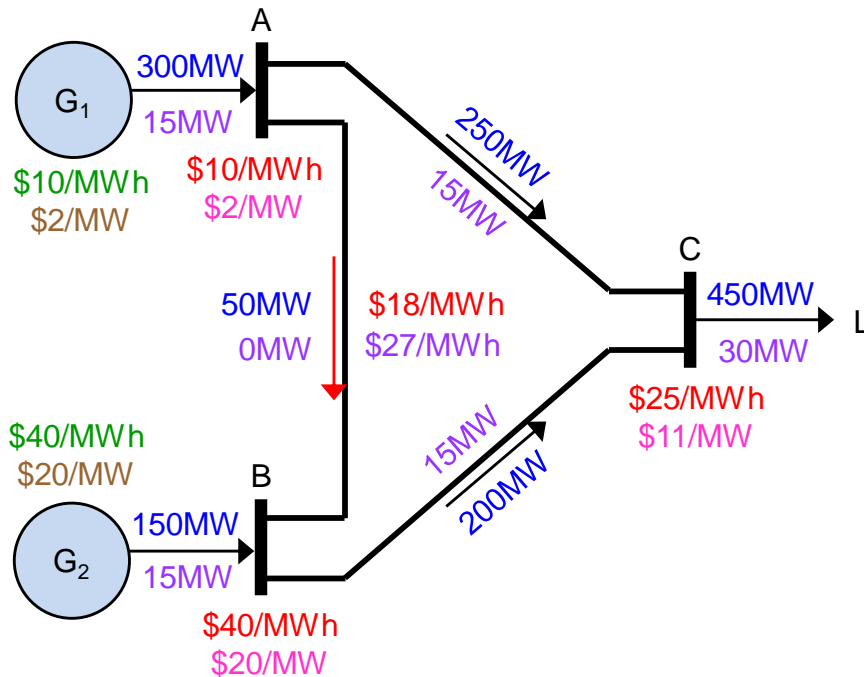
## Example 2: IFM Base and IRU Deployment Scenario



- G<sub>1</sub>
  - ◆ Schedule: 285MW; IRU award: 30MW
- G<sub>2</sub>
  - ◆ Schedule: 165MW; IRU award: 0MW
  - ◆ Energy bid is mitigated to the higher of DEB or competitive LMP (\$40/MWh)
- Line A-B at limit: 40MW + 10MW
  - ◆ Shadow prices: \$0/MWh, \$45/MWh
- LMPs
  - ◆ A: Energy: \$10/MWh; IRU: \$2/MW
  - ◆ B: Energy: \$40/MWh; IRU: \$32/MW
  - ◆ C: Energy: \$25/MWh; IRU: \$17/MW
- IRU cost allocated to L: \$60

# Local Market Power Mitigation in IFM

## Example 2: IFM with both Energy and IRU Mitigation



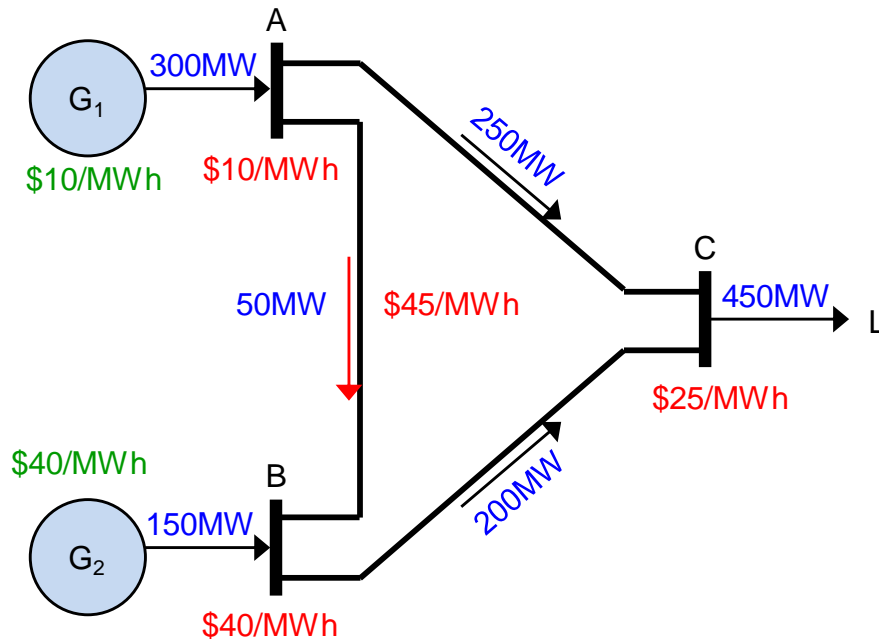
- $G_1$ 
  - ◆ Schedule: 300MW; IRU award: 15MW
- $G_2$ 
  - ◆ Schedule: 150MW; IRU award: 15MW
  - ◆ Energy bid is mitigated to \$40/MWh
  - ◆ IRU bid is mitigated to \$20/MW
- Line A-B power flow at limit: 50MW
  - ◆ Shadow prices: \$18/MWh, \$27/MWh
- LMPs
  - ◆ A: Energy: \$10/MWh; IRU: \$2/MW
  - ◆ B: Energy: \$40/MWh; IRU: \$20/MW
  - ◆ C: Energy: \$25/MWh; IRU: \$11/MW
- IRU cost allocated to L: \$330



# Congestion revenue rights

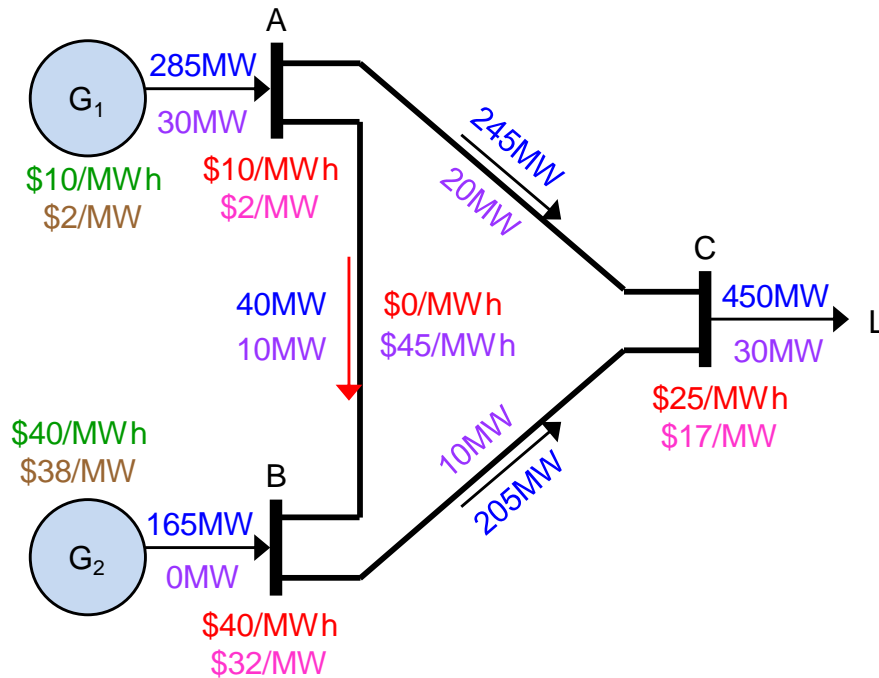
- No changes are proposed to the existing congestion revenue rights (CRRs) nomination and auction processes to account for imbalance reserves.
- Congestion revenue will not be collected on the imbalance reserve flows

# Congestion revenue rights – example 1



- $G_1$ 
  - ◆ Schedule: 300MW
- $G_2$ 
  - ◆ Schedule: 165MW
- Line A-B at limit: 50MW
  - ◆ Shadow price: \$45/MWh
- LMPs
  - ◆ A: Energy: \$10/MWh
  - ◆ B: Energy: \$40/MWh
  - ◆ C: Energy: \$25/MWh
- Congestion revenue: \$2250

# Congestion revenue rights – example 2



- $G_1$ 
  - ◆ Schedule: 285MW; IRU award: 30MW
- $G_2$ 
  - ◆ Schedule: 165MW; IRU award: 0MW
- Line A-B at limit: 40MW + 10MW
  - ◆ Shadow prices: \$0/MWh, \$45/MWh
- LMPs
  - ◆ A: Energy: \$10/MWh; IRU: \$2/MW
  - ◆ B: Energy: \$40/MWh; IRU: \$32/MW
  - ◆ C: Energy: \$25/MWh; IRU: \$17/MW
- Congestion revenue: \$1800

# Congestion revenue rights

- ISO expects the constrained transmission to be consumed mostly by energy
  - Current position is to monitor the issue
- Potential solutions are complex to implement and come with own set of challenges
  - Reserve transmission capacity in the CRR model for imbalance reserve deployment
  - Directly settle the locational imbalance reserve price with load and VERs

# Accounting for energy offer cost in upward capacity procurement

- Market cannot differentiate between two resources with same capacity bid but different energy bid costs when awarding upward capacity products
- Greater concern for IRU/RCU than contingency reserves because there is a higher likelihood of being dispatched for energy in RTM
- Objective is to prevent opportunities for high energy cost resources from routinely being awarded IRU/RCU when the resources will rarely be dispatched for energy in the RTM

## Options considered to date

- Use energy bid cap to limit eligibility or compensation of resources awarded IRU/RCU
- Include energy offer price in bid for imbalance reserves
- Include penalty parameter based on energy offer price in bid for imbalance reserves
- Include a real-time dispatch cost with imbalance reserve bid
- Tiered imbalance reserve products with varying real-time bid caps
- Call option approach with IRU capacity strike price

# Accounting for energy offer cost in upward capacity procurement

- Proposes a real-time energy bid price cap consistent with the expected system marginal price if the entire upward uncertainty requirement materialized (“P97.5 price”) that applies to all resources awarded IRU/RCU
- Resources with energy costs above cap must incorporate financial risk into IRU/RCU bid → higher bids for RCU and IRU → less likely to be awarded → meets policy objective
- Quantity of real-time energy bids subject to the real-time energy bid price cap limited to the MW quantity of IRU/RCU awards

# Accounting for energy offer cost in upward capacity procurement

- Looking to establish general acceptance of the concept before finalizing the P97.5 price methodology
  - Use latest available bid stack from a previous day and clear against upward uncertainty requirements for the applicable trading day
  - Use next-day gas prices to scale previous day's bid stack in order to reflect applicable trading day's conditions
  - One P97.5 price per hour for entire system
  - P97.5 price would be published in advance of DAM close
  - Propose to implement functionality to turn off bid cap during pre-defined tight system conditions



# Glossary

- CRR = Congestion Revenue Right
- DAM = Day Ahead Market
- DEB = Default Energy Bid
- IFM = Integrated Forward Market
- IRU = Imbalance Reserve Up
- LMP = Locational Marginal Price
- MPM = Market Power Mitigation
- RCU = Reliability Capacity Up
- RTM = Real Time Market
- VER = Variable Energy Resource