Penalty Prices and Scheduling Priorities in CAISO Market

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Background

- Based on the market performance observed in August 2020, CAISO implemented a business practice change through a Business Practice Manual (BPM) language change

- This was an emergency change that took effect on September 5, 2020

- BPM language changes can be either standard or emergency changes

- The Emergency BPM change still follows the process of review and comments

- This BPM change originated multiple questions about the process, the original business practice, and the need for the change

Background

- CAISO implemented an emergency BPM change (PRR1282) to take effect for trading date September 5

- Change 1: Use schedules from scheduling run in the Day-ahead Residual Unit Commitment (RUC) process instead of schedules from Pricing run

- Change 2: Use RUC schedules for exports as the reference for self schedules into real-time markets

Background

- The BPM changes raised questions about the CAISO's existing market functionality

- In light of discussions in the BPM change process, the ISO is taking the opportunity to socialize existing market practices

- CAISO is providing workshops to refresh existing practices and level participants' understanding

- CAISO will propose additional BPMs changes after these workshops, and possibly even tariff

Objective of this workshop

- Introduce the current market functionality in key areas related to the practice change reflected in the BPM language change

- Provide an opportunity for all participants to gain a uniform understanding of current functionality and practices

- Address any questions arising from the BPM language change process

- Gain insights from participants to asses additional BPM language

- We will consider policy and practice changes in subsequent workshops and initiatives as necessary.

Roadmap to Tariff Parameters and Scheduling Priorities -

- Section 27.4.3 contains the scheduling and pricing parameters
    - 27.4.3.1 – IFM scheduling run parameter ($5,000/MWh), RTM ($1,500/MWh) and RUC ($1,250/MWh)
        - relaxing a *Transmission Constraint* rather than adjusting non-prices quantities specified in 31.3.1.3, 31.4 and 34.12 re-dispatch
    - 27.4.3.2 – pricing parameters that determine the price when transmission constraint is relaxed in IFM, RUC and RTM (based on bid cap $1,000/MWh and $250)
    - 27.4.3.3 – IFM pricing run if supply cannot meet self-scheduled demand (Bid cap)
    - 27.4.3.4 – RTM power balance constraint relaxation pricing parameter (bid cap)
    - 27.4.3.5 – Protection of ETCs and TORs
    - 27.4.3.6 – effectiveness threshold – 2%

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Con't

- Separate scheduling priorities for IFM (Section 31.4) and RTM (34.12)
  - Define export priorities relative to internal load
    - Gives load and *exports explicitly identified in a Resource Adequacy Plan to be served by Resource Adequacy Capacity explicitly identified and linked in a Supply Plan to the exports,* and *Self-Schedules of exports at Scheduling Points explicitly sourced by non-Resource Adequacy Capacity*

- Tariff does not specify priorities in RUC

- Additional rules of enforcement of constraints at the interties in 31.8

- DAM results in RTM are protected and used as inputs in the RTM – Section 34.1.1

How does the CAISO markets implement the provisions of priorities for schedules and constraints relaxation?

Scheduling priorities

Constraint priorities

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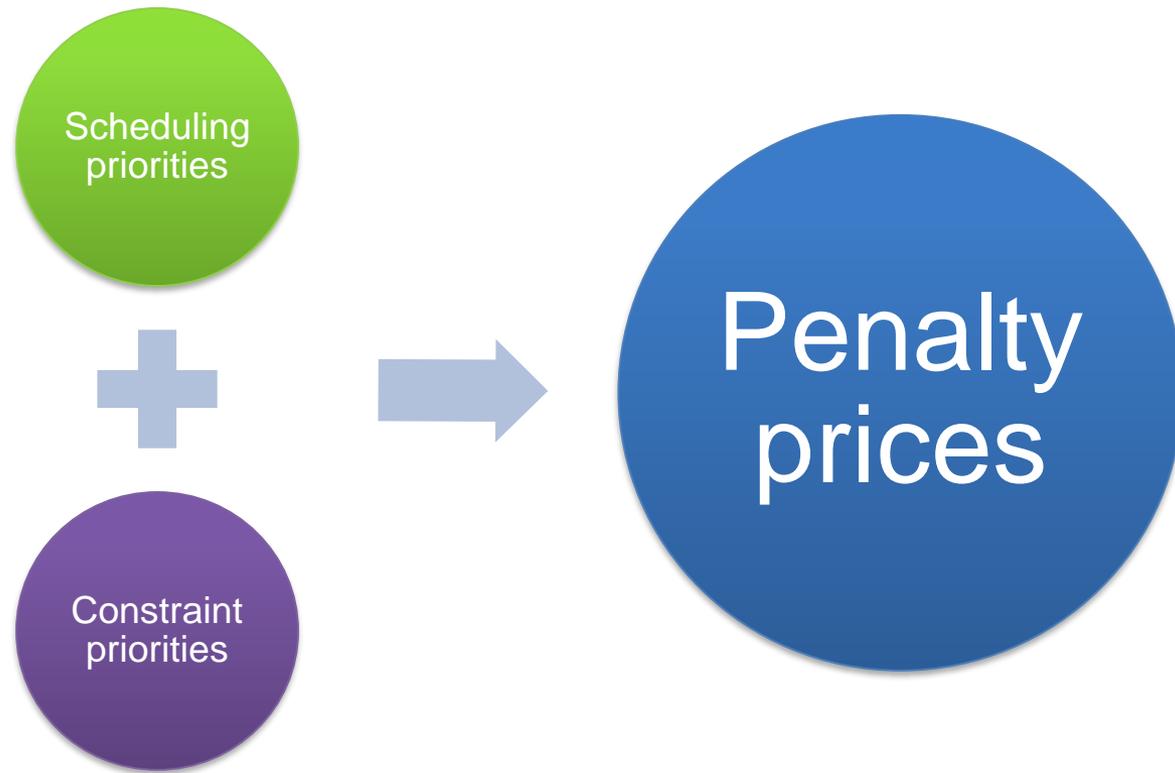
Penalty prices

Penalty prices are the vehicle used in the market application to effectuate the expected priorities

What is a penalty price?

Bids in the market reflect the willingness to participate; they have a bid price and a bid quantity
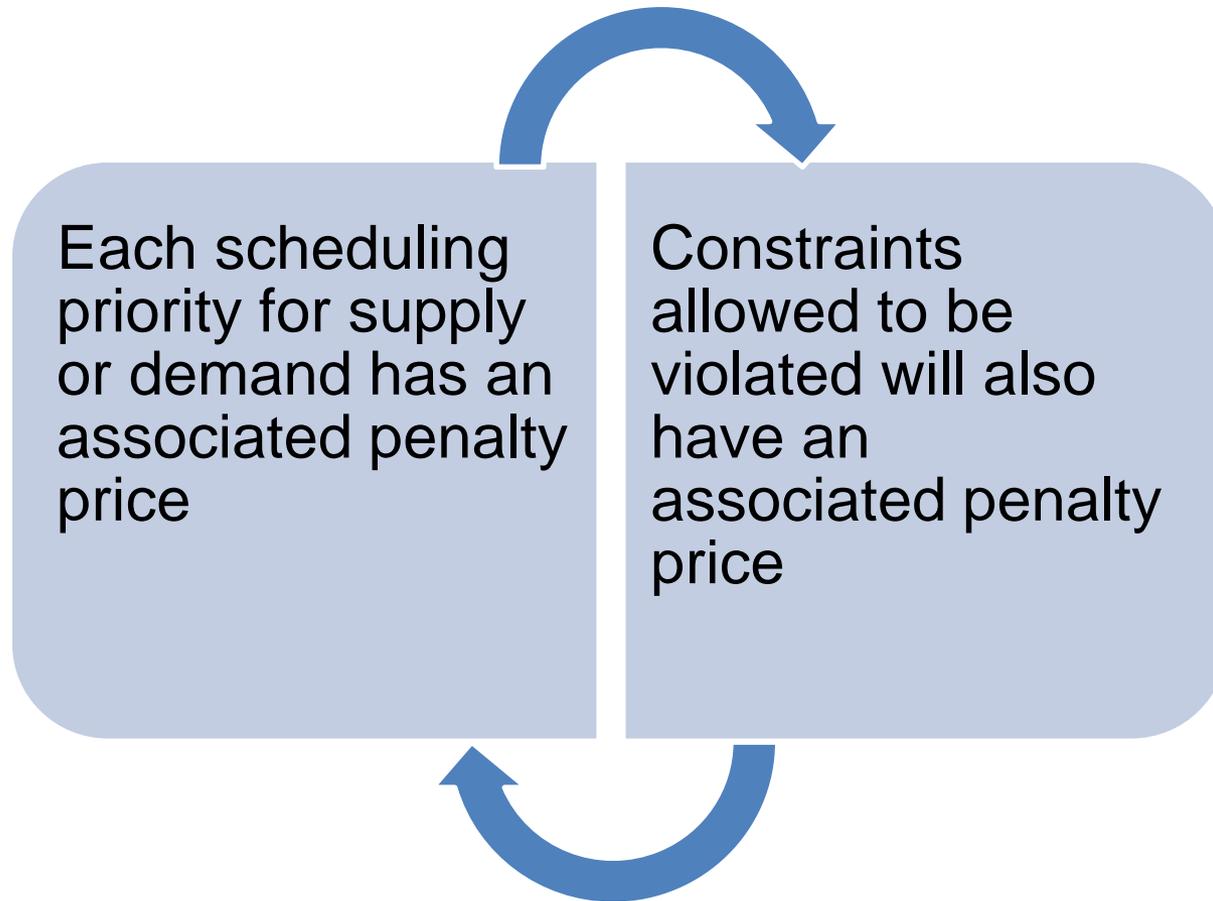
Economical energy bids can be submitted between the bid floor -$150/MWh and the bid cap $1000/MWh

A penalty price is an artificial bid price use to give relative priority

A penalty price represents an uneconomical signal utilized only in the market optimization

It "penalizes" market solutions to avoid the movement of schedules and constraints outside the economical range

How are penalty prices used in the markets?

Each scheduling priority for supply or demand has an associated penalty price

Constraints allowed to be violated will also have an associated penalty price

All penalty prices are carefully coordinated and synchronized

Penalty prices are utilized to set up priorities for supply and demand resources

Demand Self schedule

Bid Cap: $1,000MWh

Economical range

Bid Floor: -$150MWh

Supply Self schedule

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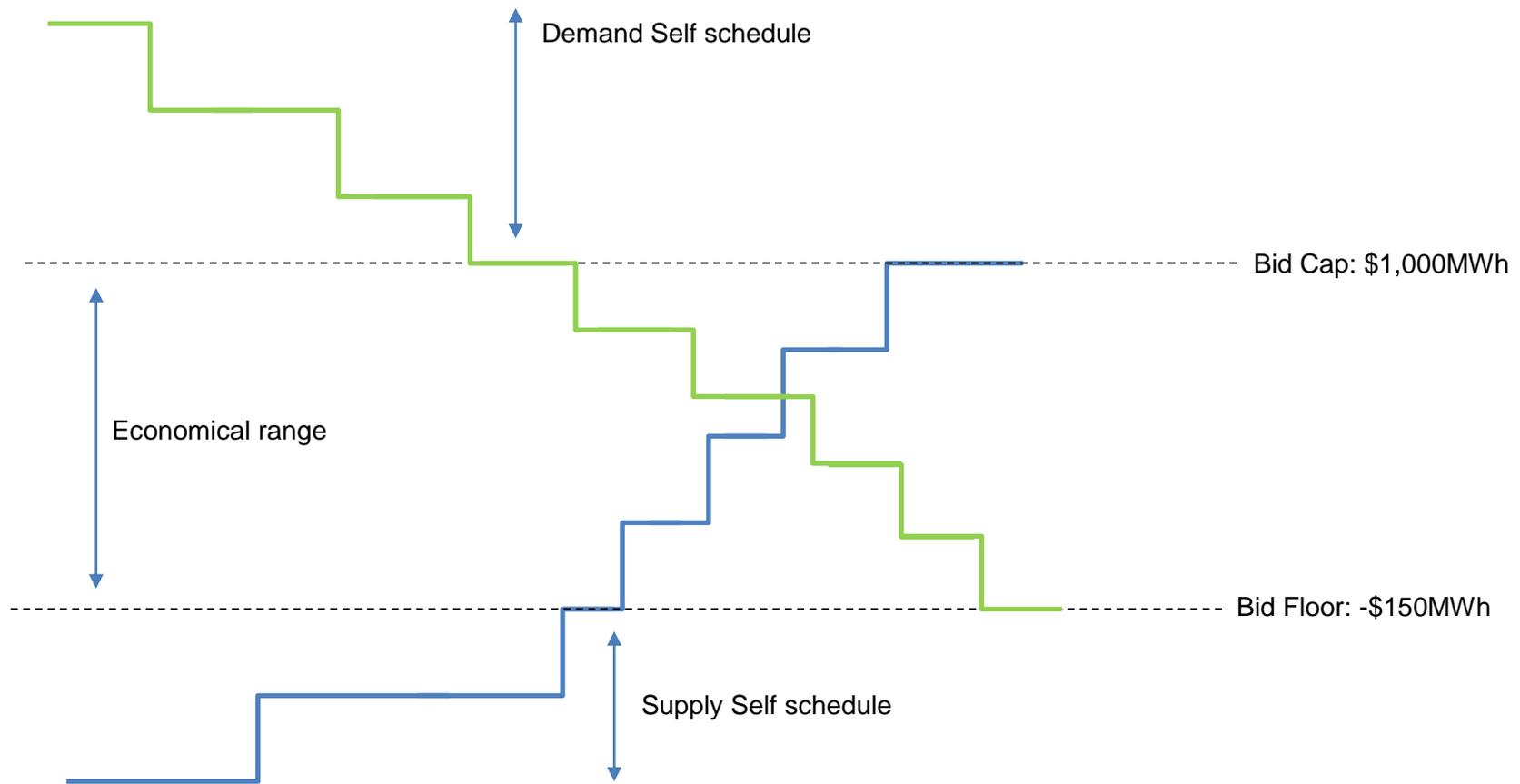
Penalty Prices used in the CAISO market application are listed in the BPM for Market operations

- Section 6.6.5 of the BPM for market operations lists sets of penalty prices
- Given specific conditions and features of each market, there is a set of penalty prices for each market
- The lists include the main penalty prices that relate to the scheduling and constraint priorities
- CAISO has identified a series of updates needed for the current BPM list of penalty prices
  - * Indicates a difference between the BPM and what the market penalty price is using
  - # Indicates a penalty price that is used in the market that is not currently identified in the BPM

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Scheduling Priority for resource self schedules for Energy-IFM

- ## Supply self schedules

Supply side Self Schedules	Penalty Prices	
	Scheduling Run	Pricing Run
PT-Price Taker	($400)*	($150)
RMT-Reliability Must Take	($1,350)	($150)
Pseduo-tie layoff energy	($4,000)	($150)
ETC-Existing Transmission Contract	($5,100)	
	($5,900)	($150)
TOR-Transmission Ownership Right	($5,900)	($150)
LRMR-Legacy Relibility Must Run	($6,000)	($150)

- ## Demand self schedules

Demand side Self Schedules	Penalty Prices	
	Scheduling Run	Pricing Run
TOR-Transmission Ownership Right	$5,900	$1,000
ETC-Existing Transmission Contract	$5,900	
	$5,100	$1,000
Self-scheduled CAISO demand	$1,800	$1,000
PT Export-Resource supported Export	$1800	$1,000
LPT Export-Lower Priority SS not resoruce supported Export	$1,150*	$1,000

Constraint-based penalty prices-IFM

Supply Side

Supply side requirement Penalty Price	Penalty Prices	
	Scheduling Run	Pricing Run
EN-Slack variable Over-generation	($4,900)#	($150)

Demand Side

Demand side requirement Penalty Price	Penalty Prices	
	Scheduling Run	Pricing Run
EN-Slack variable Under-generation	$4,900	$1,000
AS-Regulation Up minimum requirement	$2,500	$250
AS-Spin Reserve minimum requirement	$2,250	$250*
AS-Non-Spin Reseve minimum requirment	$2,200	$250*

Penalty prices for schedules and constraints -IFM

Supply side bid and requirement priority

Supply side penalty prices	Penalty Prices	
	Scheduling Run	Pricing Run
PT-Price Taker	($400)*	($150)
RMT-Reliability Must Take	($1,350)	($150)
Pseduo-tie layoff energy	($4,000)	($150)
EN-Slack variable	($4,900)	($150)
ETC-Existing Transmission Contract	($5,100) ($5,900)	($150)
TOR-Transmission Ownership Right	($5,900)	($150)
LRMR-Legacy Relibility Must Run	($6,000)	($150)

Demand side bid and requirement priority

Demand side penalty prices	Penalty Prices	
	Scheduling Run	Pricing Run
TOR-Transmission Ownership Right	$5,900	$1,000
ETC-Existing Transmission Contract	$5,900 $5,100	$1,000
EN-Slack variable	$4,900	$1,000
AS-Regulation Up Min Req	$2,500	$1,000
AS-Spin Reserve minimum requirment	$2,250	$1,000
AS-Non-Spin Reseve minimum requirment	$2,200	$1,000
Self-scheduled CAISO demand	$1,800	$1,000
PT Export-Resoruce supported Export	$1800	$1,000
LPT Export-Lower Priority SS not resoruce supported Export	$1,150*	$1,000

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Energy based-flow and Inter-tie scheduling penalty prices -IFM

Flow and scheduling based penalty prices	Penalty Prices	
	Scheduling Run	Pricing Run
Branch (Base & Contingency)	$5,000	$1,000
Corridor (Base & Contingency)	$5,000	$1,000
Nomogram	$5,000	$1,000
Gas Burn Nomogram	$5,000	$1,000
Transmission Constraints-Intertie scheduling	$5,000	$1,000

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Each CAISO's market uses two optimization runs to attain a final market solution

- The scheduling run sets the uneconomical adjustments and relaxations based on predefined priorities

- Pricing run uses prices based on bid cap and floor to clear at economically meaningful prices

- Each optimization run produces schedules and prices consistent on their own

- Prices cleared in the scheduling run reflect penalty prices, which are not economically meaningful

- Prices cleared in the pricing run rely on the bid floor and cap to produce more economically meaningful

Example of Uneconomical Adjustments

- ## Set-up for Scheduling run

Price Curve of G1 in Scheduling Run
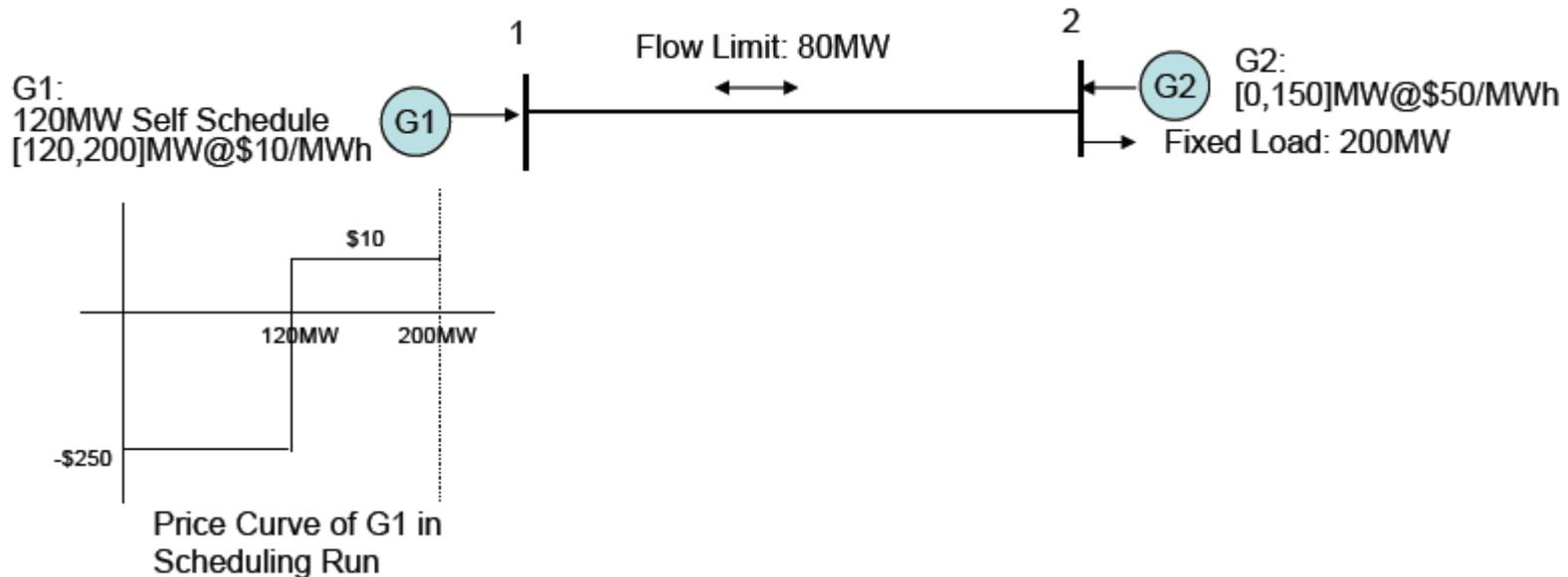
- Self schedule is protected from curtailment with a penalty price that gives higher priority over economical segment

- Assume the penalty price for this self schedule is $250 and there are no losses; assume transmission constraint is a hard constraint.

Scheduling Run Solution

- With no transmission constraint, G1 could fully supply all the load

- Self schedule creates a conflicts with the transmission constraint

- Self schedule is curtailed to resolve transmission overload and attain a feasible solution

- Price at node one is -$250/MWh in the scheduling run

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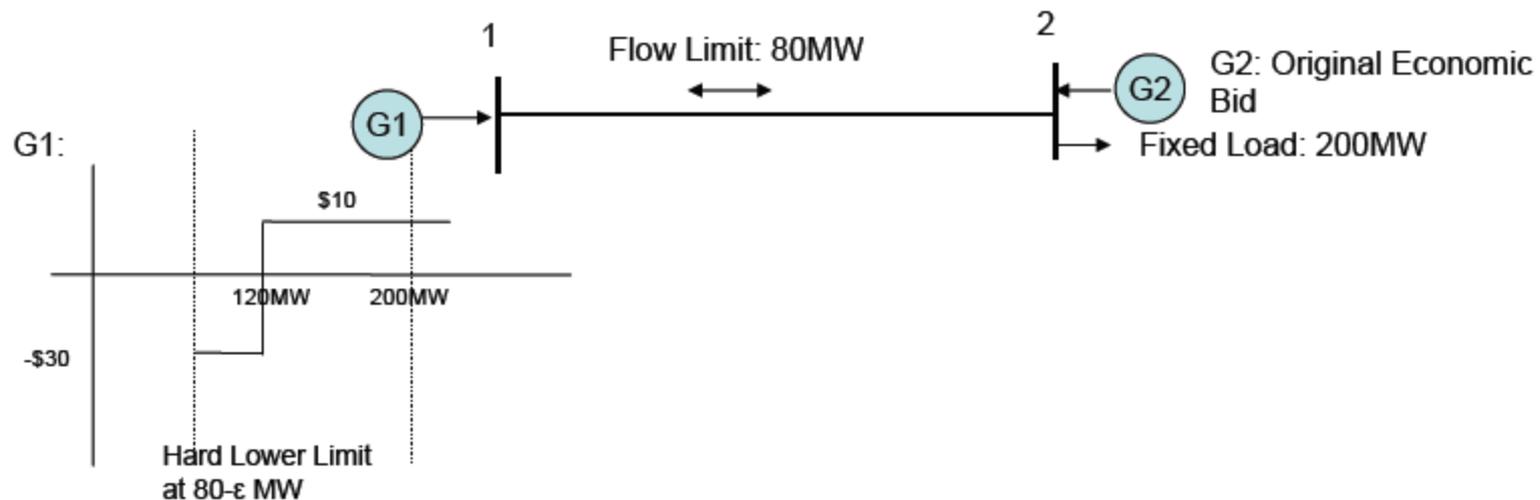
Pricing Run Set-up

- The bid floor of -$30 is now used in the pricing run for the curtailed self schedule of G1

- MW lower bound for G1 set around scheduling dispatch and expanded by ε

- Epsilon (ε) is a mathematical artifact to ensure feasibility

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Pricing Run Solution

G1=80 MW
LMP1 = -$30

1

Flow = 80MW

Shadow Price = $80

G2 = 120MW
LMP2 = $50
Fixed Load: 200MW
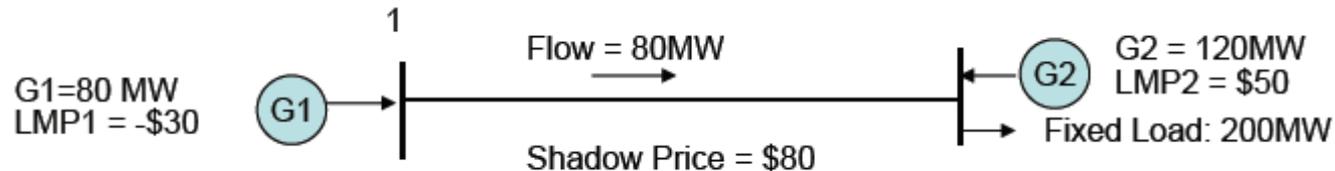
- G1 is marginal at -$30 for 80 MW

- LMP at node 1 is set by the bid floor and originated by the curtailment

- Scheduling run solution for G1: 80MW at -$250/MWh
- Pricing run solution for G1: 80MW at -$30/MWh

Scheduling run versus pricing run

- When converging to a numerical solution, the optimization accounts for all economical bids and all schedules with penalty prices

- Under tight and stressed conditions, the solution may converge to a point at which multiple penalty prices play a role

- Schedules and prices between scheduling and pricing solutions may vary (be inconsistent)

- This is mainly when multiple penalty prices are concurrently at play and the relative priority enforced in the scheduling run is no longer in place when using bid floor and caps in pricing run

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PIME functionality

- Since implementation of Price Inconsistency Market Enhancements (PIME) policy, schedules and prices are based from pricing run

- PIME logic was intended to address mainly differences between schedules and aggregated prices for Default Load Aggregation Point (DLAP) and Trading (TH) in the integrated forward market and real-time market

- For consistency the feature was applied to all markets

- DLAP and THs prices in RUC are not relevant since they are not financially binding. Only specific resources with RUC awards will be exposed to binding RUC prices

Transitioning from IFM to RUC

- **RUC Role**
  - Clear incremental capacity to meet forecast
  - Over-generation in RUC results in $0 price
  - IFM schedules used as a base (starting point)
- **RUC constraints**
  - VER-Uses forecast instead of bids IFM
  - RUC net short
  - No De-commitments (includes downward transitions of MSG)
- **IFM schedules bid priorities in RUC**
  - Supply side adder -$250 adder limited to bids below $250
  - Demand side adder (exports) $300 adder

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How does RUC use IFM bids and awards?

IFM Bid

- Resource Pmax=100 MW
- Resource bid

IFM Bid
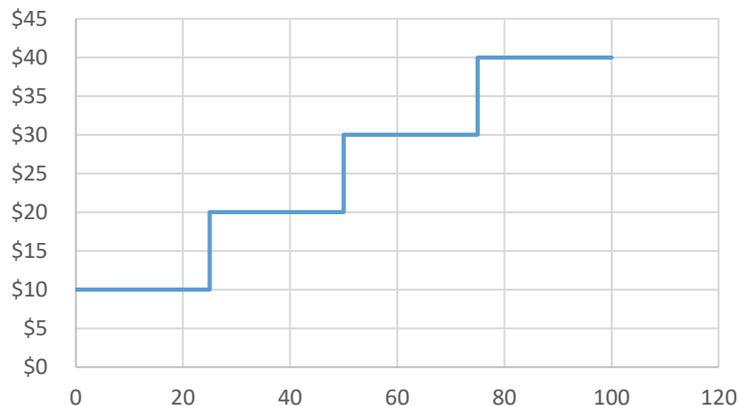
Resultant RUC bid

- Assume RA is at resource Pmax

RUC Bid
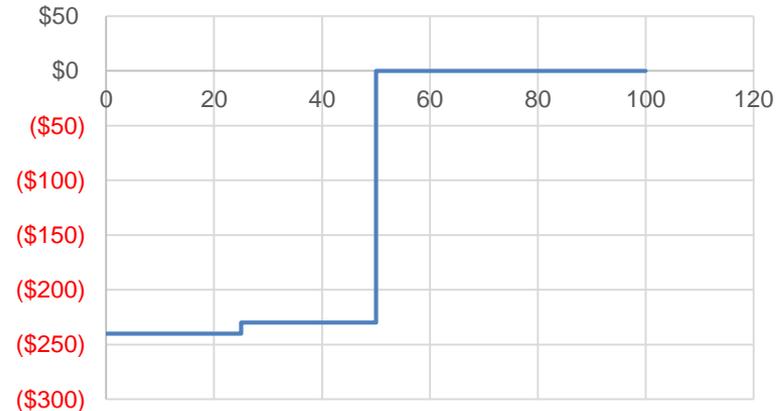
- IFM cleared at 50 MW

RUC treatment of demand self schedule (export)

IFM Bid

- 75 MW bid
- IFM cleared 50 MW
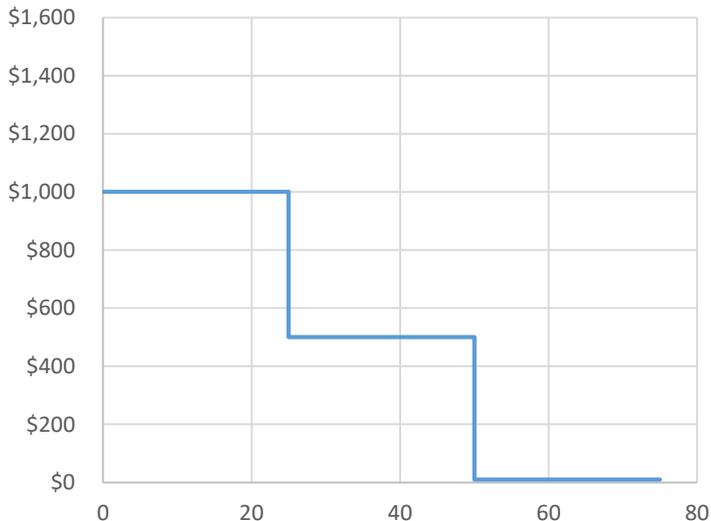
Resultant RUC bid
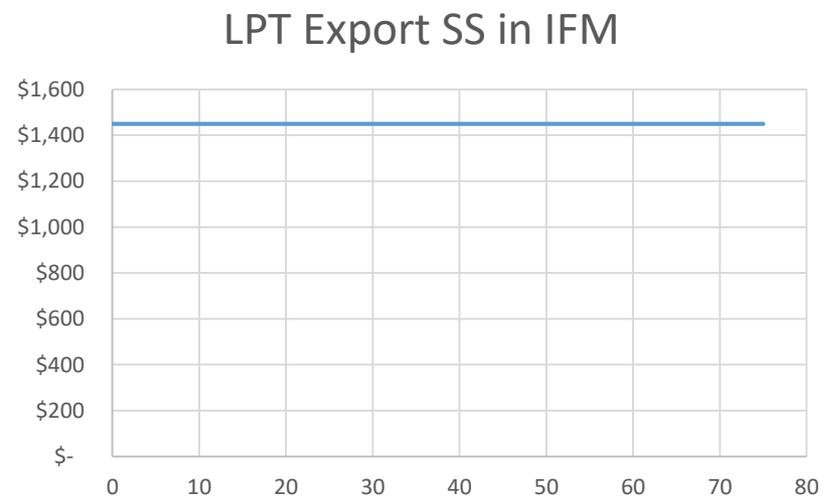
- Upper limit set to IFM cleared value

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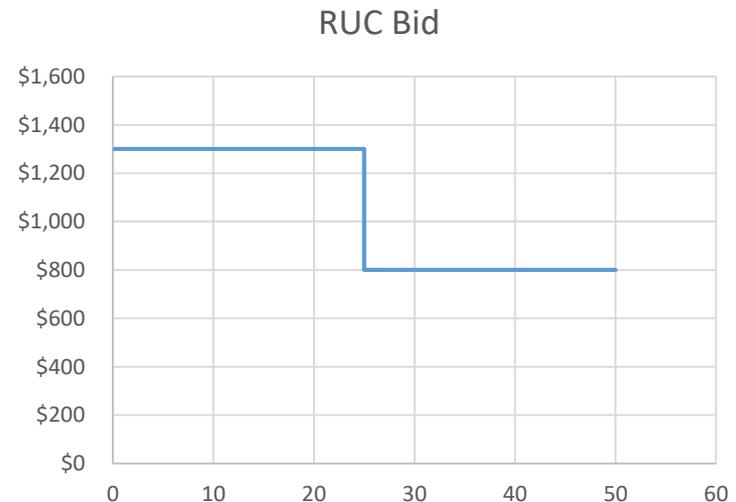
RUC treatment of demand self schedule (export)

IFM Bid

- 75 MW LPT self schedule
- 75 MW cleared in IFM

Resultant RUC bid

LPT Export SS in IFM

LPT Export SS in IFM

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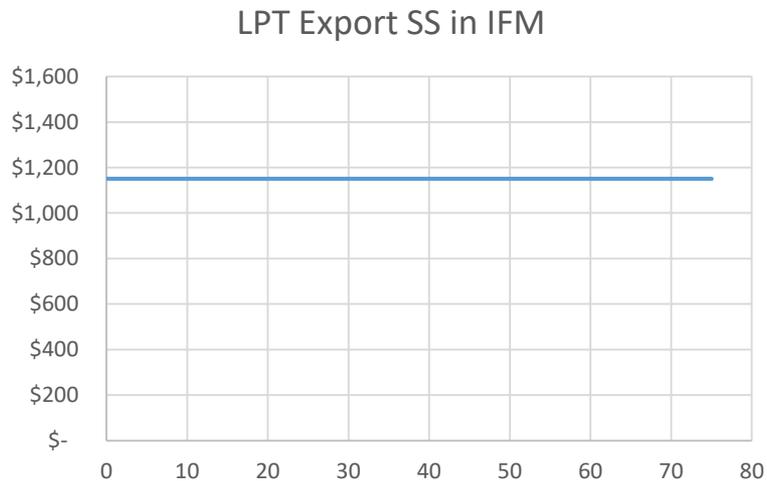
Schedules and constraint penalty prices-RUC

Supply side bid and requirement priority

Supply side penalty prices	Penalty Prices	
	Scheduling Run	Pricing Run
PT-Price Taker	($650)*	$0
RMT-Reliability Must Take	($1,600)	$0
Pseduo-tie layoff energy	($4,250)	$0
EN-Slack variable	($4,900)	$0
ETC-Existing Transmission Contract	($5,350) ($6150)	$0
TOR-Transmission Ownership Right	($6150)	$0
LRMR-Legacy Relibility Must Run	($6250)	$0

Demand side bid and requirement priority

| Demand side Self Schedules	Penalty Prices	
	Scheduling Run	Pricing Run
TOR-Transmission Ownership Right	$6,200	$250
ETC-Existing Transmission Contract	$6,200 $5,400	$250
EN-Slack variable	$1,600	$250*
PT Export-Resource supported Export	$1600#	$250
LPT Export-Lower Priority SS not resoruce supported Export	$1,450	$250

RUC Two Bus Example –Economical solution
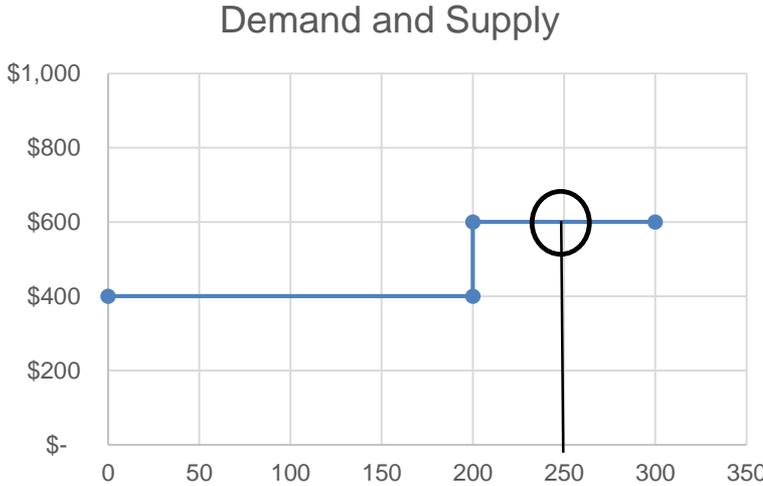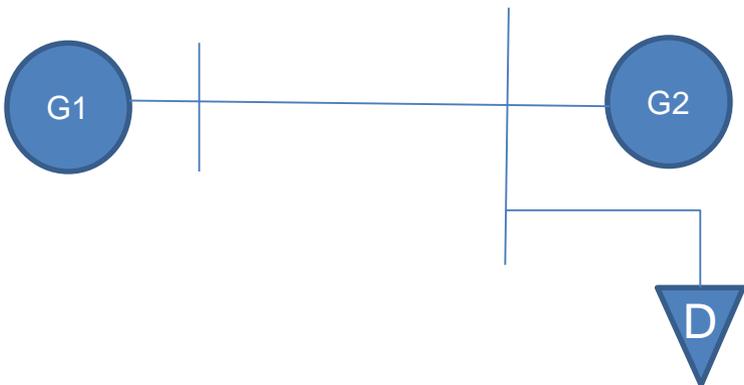
Demand and Supply

Resource	Bid
G1	200@$400/MWh
G2	**100 @600/MWh**

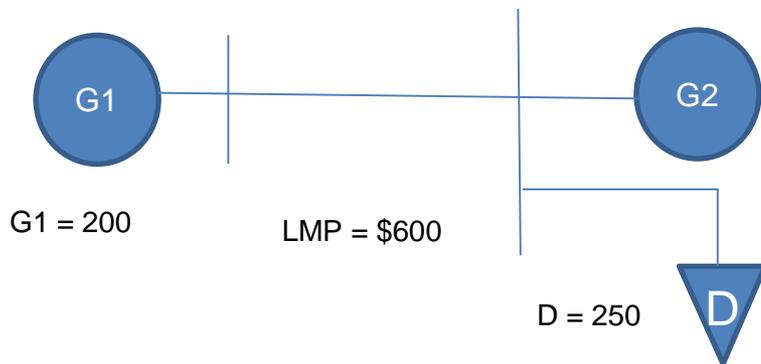| Demand	Quantity
D	250 (fixed)

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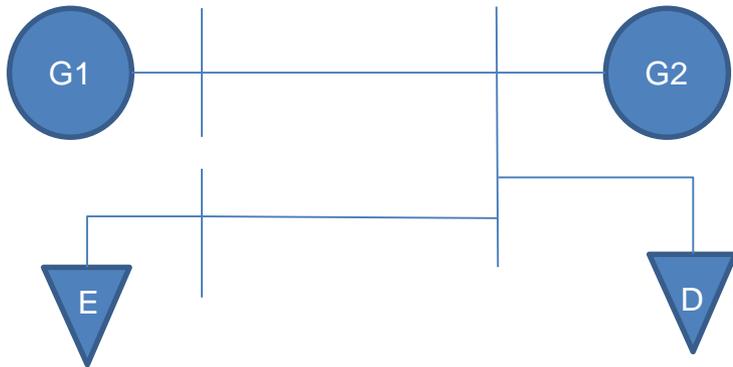# RUC Two Bus Example –Solution Summary

Demand and Supply
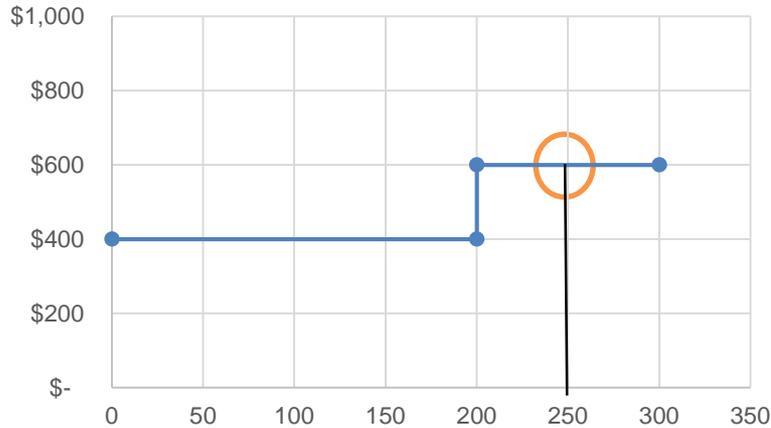
- Total Bid in Supply of 300 MW

- Fixed demand of 250 MW

- At the equilibrium 250 MW supply clears against 250 MW demand

- Marginal price set at $600/MWh by the supply bid
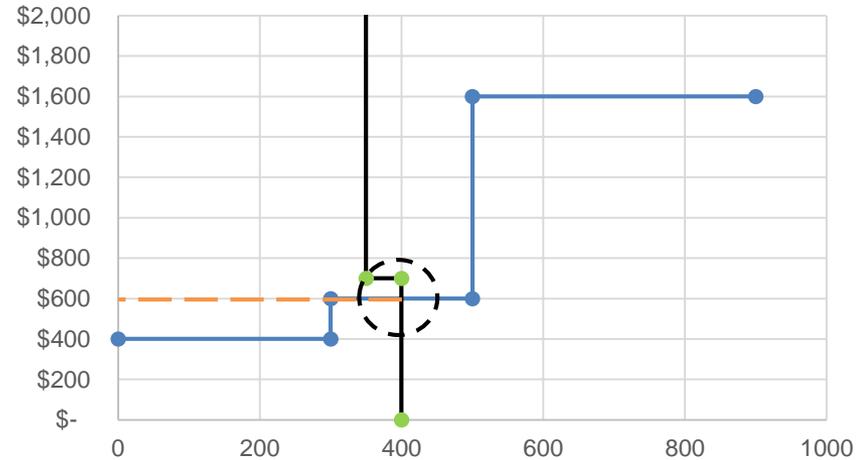

G2 = 50

G1 = 200

LMP = $600

D = 250

RUC Two Bus Example with Economic Export and Power balance consideration

Demand and Supply

Resource	Bid
G1	300MW@$400/MWh
G2	**200MW@ $ 600/MWh**
Slack [Power balance-under procurement]	300 MW@ $1600/MWh

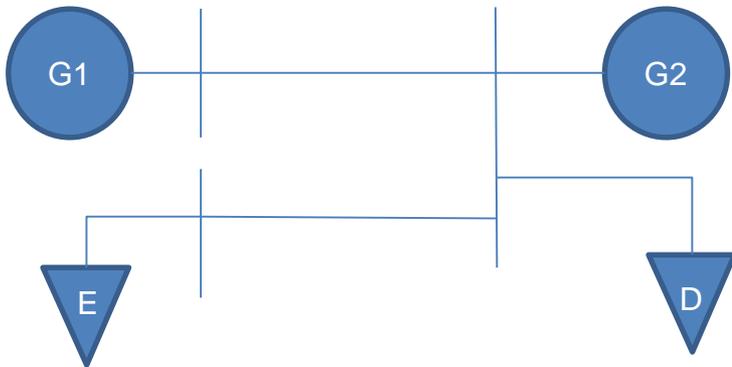| Demand/Export	Quantity/Self-Schedule
D (demand)	350 (Fixed)
E (Export)	**50@ $700/MWh**

Economic Bid

RUC Two Bus Example with Economic Export and Power balance consideration – Solution Summary


Demand and Supply
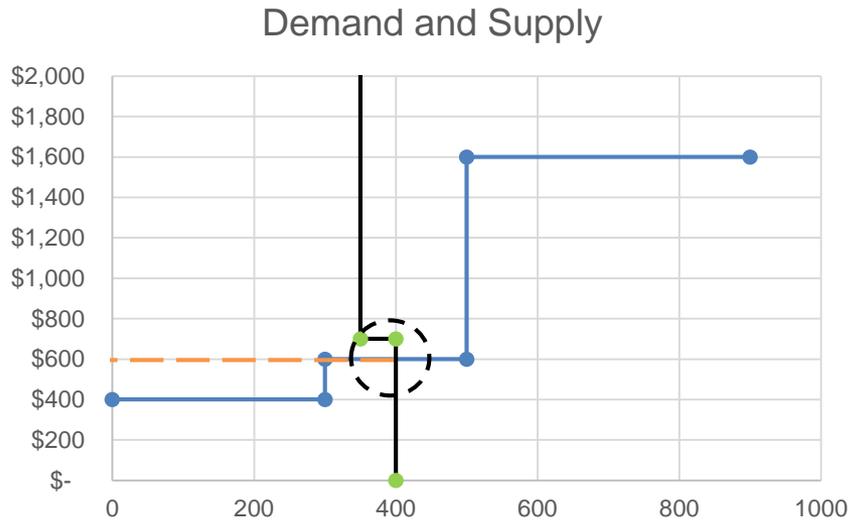
- Total bid in supply of 500 MW
- Fixed demand of 350 MW and 50 MW export with economic bid
- Slack of 300 MW at $1600. The $1600 penalty price represents the Market Energy Balance under procurement.
- At the equilibrium 400 MW supply clears against 350 MW demand and 50 MW of export
- Marginal price set at $600/MWh by the supply bid

G2 = 100

G1

G2

G1 = 300

LMP = 600

E

D

E = 50

D = 350

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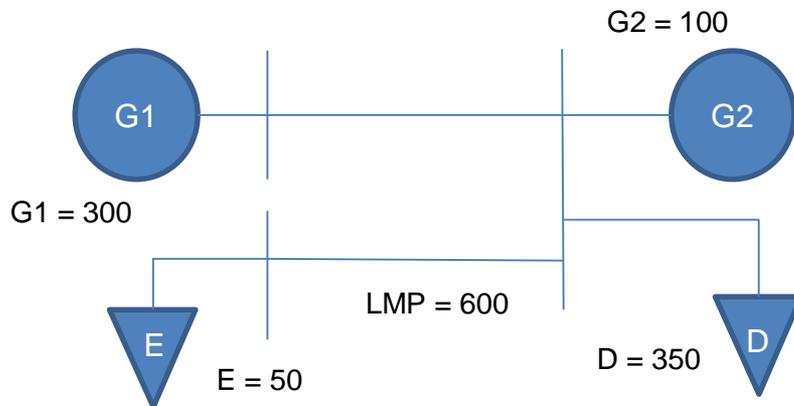
RUC Two Bus Example with Export Self-Schedule Curtailment

Demand and Supply
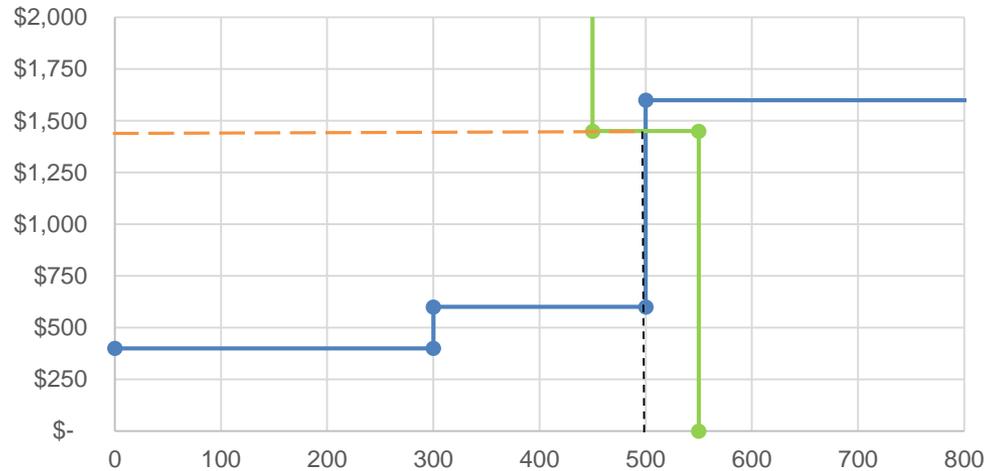
Resource	Bid
G1	300MW @ $400/MWh
G2	200MW @ $ 600/MWh
Slack	300 MW @ $1600/MWh

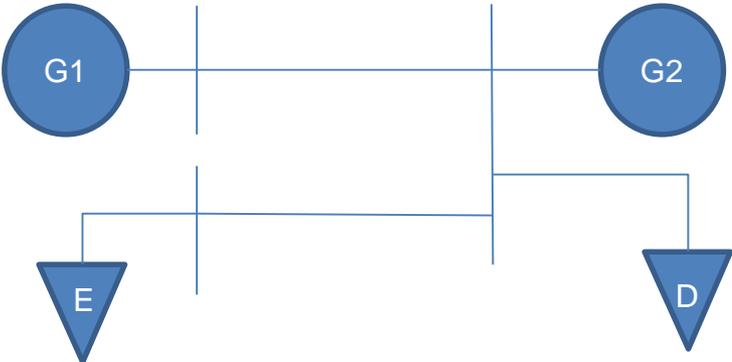| Demand/Export	Quantity/Self-Schedule
D (demand)	**450 (Fixed)**
E (Export)	**100@ 1450/MWh**

← Self-Schedule

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RUC Two Bus Example with Export Self-Schedule Curtailment – Solution Summary
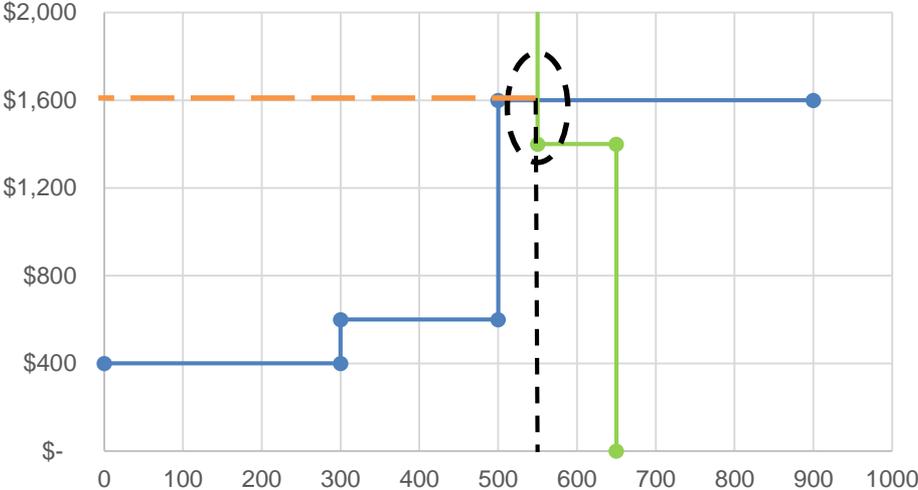
Demand and Supply
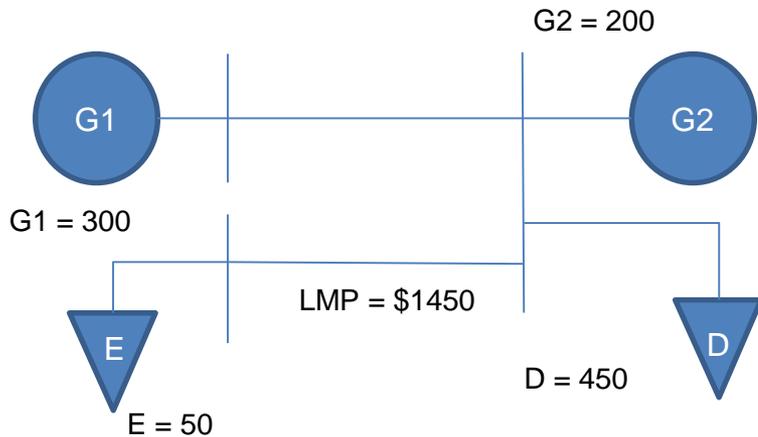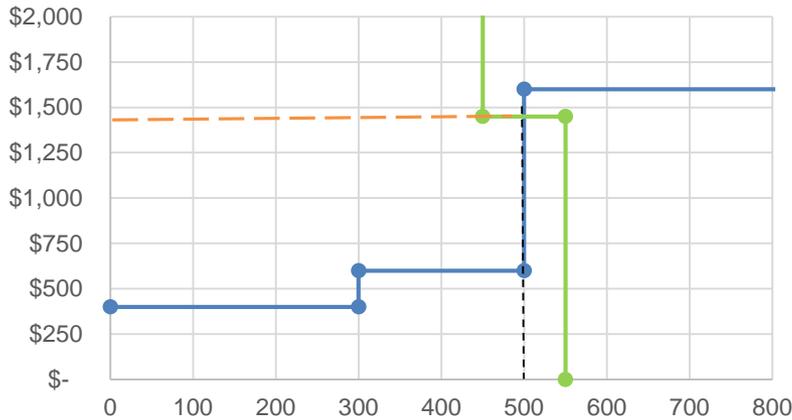
- Total Bid in Supply of 500 MW
- Fixed demand of 450 MW and 100 MW Export Self-Schedule
- Export (LPT) self-schedule with no non-RA supporting resource has 100 MW IFM award
- The 100 MW LPT self-schedule has penalty price of $1450 ($1150+$300) in RUC
- At the equilibrium 500 MW supply clears against 450 MW demand and 50 MW of export.
- 50 MW Export is curtailed.
- Marginal price set at $1450/MWh by the export self-schedule in Scheduling run

G2 = 200

G1

G2

G1 = 300

LMP = $1450

E

D

D = 450

E = 50

Two Bus Example with Export Self-Schedule and Power Balance Relaxation

Demand and Supply

Resource	Bid
G1	300MW @ $400/MWh
G2	200MW @ $ 600/MWh
Slack	300 MW @ $1600/MWh

Demand/Export	Quantity/Self-Schedule
D (demand)	550 (Fixed)
E (Export)	100 @ 1450/MWh

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Two Bus Example with Export Self-Schedule and Power Balance Relaxation

Demand and Supply
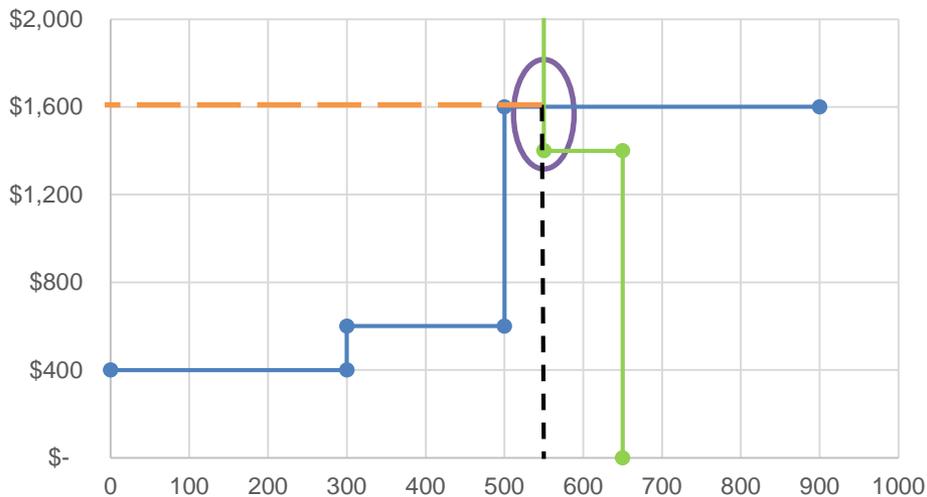
- Total Bid in Supply of 500 MW

- Fixed demand of 550 MW and 100 MW (LPT) Export Self-Schedule

- 300 MW Slack at $1600

- At the equilibrium 500 MW supply and 50 MW Slack clears against 550 MW demand.

- Marginal price set at $1600/MWh in the scheduling run

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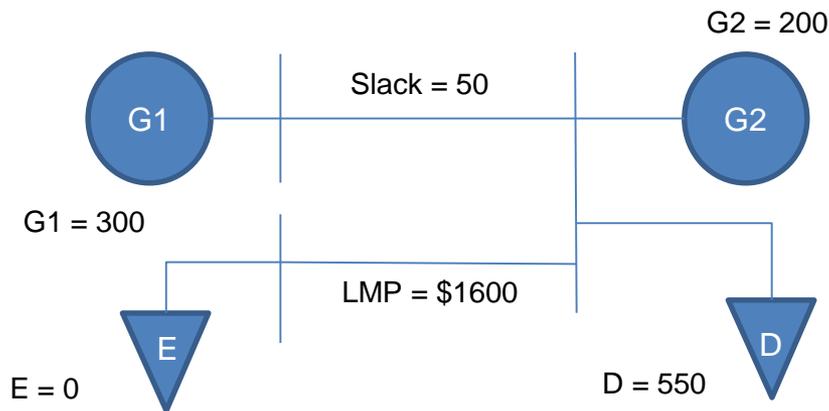
Transitioning from Day-ahead to HASP markets

- Role
  - Hour Ahead Scheduling Process (Market Operations BPM -7.5)
  - Issue pre-dispatch instructions to hourly block energy and Ancillary Service bids.

- Inputs
  - CAISO Demand Forecast
  - DAM cleared and Self-schedule supply and demand
  - Economic and Self-schedule supply and exports
  - VER Forecast

- Constraints
  - Multi-Interval SCUC Optimization similar to other Fifteen Minute Markets
  - Power Balance Constraint
  - Inter-Tie scheduling constraints
  - Transmission Security Constraints
  - Use Self-schedule Priorities

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Market Timeline - HASP

HASP Start @ T-71.5

Trading Hour

TH-1

TH

T-75

T-60

T

T+60

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Bid For TH

Binding Hourly
System Resource
Schedules
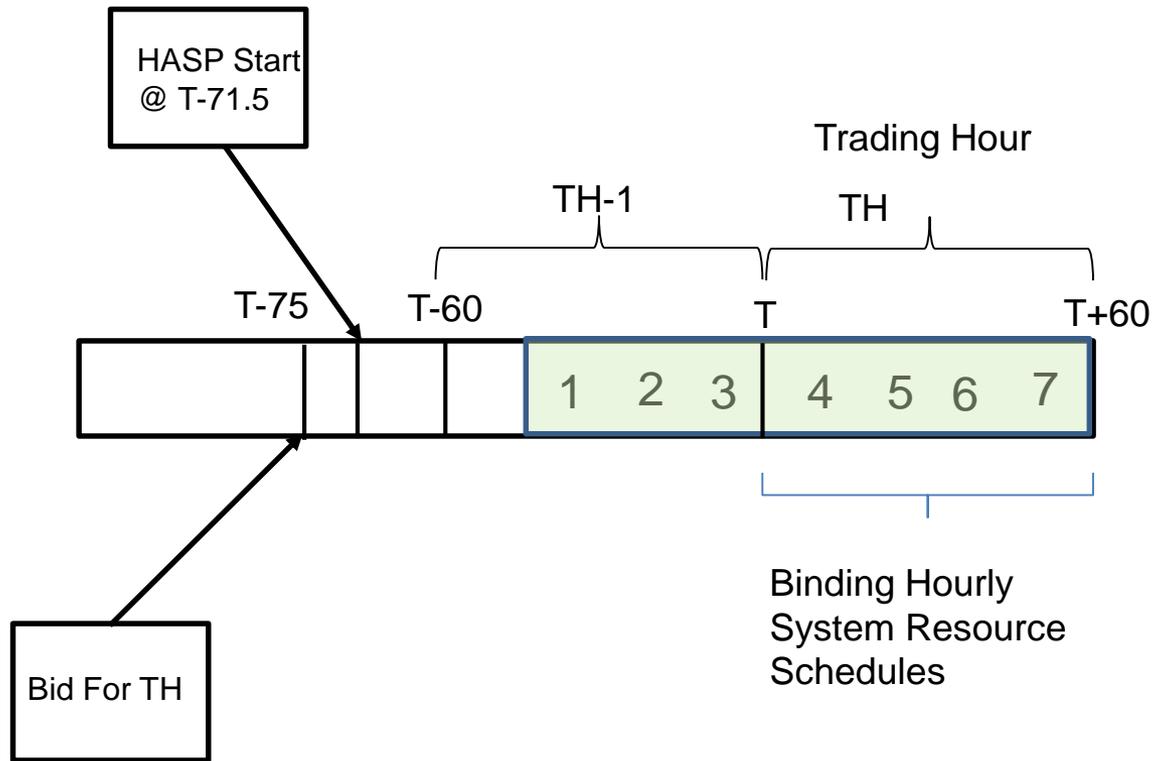
Requirement and Resource based penalty prices-HASP

Supply side bid and requirement priority

Supply side penalty prices	Penalty Prices	
	Scheduling Run	Pricing Run
PT-Price Taker	($400)	($150)
EN-Slack variable	(1450#)	($150)
RMT-Reliability Must Take	($1,600)	($150)
Pseduo-tie layoff energy	($1,500)	($150)
	($5,100)	
ETC-Existing Transmission Contract	($5,900)	($150)
TOR-Transmission Ownership Right	($5,900)	($150)
LRMR-Legacy Relibility Must Run	($6,000)	($150)

Demand side bid and requirement priority

Demand side Self Schedules	Penalty Prices	
	Scheduling Run	Pricing Run
TOR-Transmission Ownership Right	$5,900	$1,000
ETC-Existing Transmission Contract	$5,900	$1,000
	$5,100	$1,000
DA Market Cleared Award	$1500#	$1,000
EN-Slack variable	$1,450	$1,000
PT Export-Resoruce supported Export	$1,450	$1,000
LPT Export-Lower Priority SS not resoruce supported Export	$1,150	$1,000

Intertie Constraint Enforcement in RUC – Section 31.8 Added with Order No. 764 and Fifteen Minute Market

- **31.8.1 Scheduling Constraints** – In the IFM and RTM we enforce a constraint at each ISO Intertie that ensures the physical imports net of physical exports are less than or equal to the scheduling limit at the scheduling point in the applicable direction

- In RUC we enforce a constraint at each Intertie so that physical imports net of physical exports are less than or equal to the scheduling limit at the scheduling point in the applicable direction

  - This does not curtail self-schedules in RUC but it determines what Day-Ahead Schedules (*i.e.,* the output of the IFM) can have an E-Tag submitted Day-Ahead

Intertie Constraint Enforcement in RUC – Section 31.8 Added with Order No. 764 and Fifteen Minute Market

- **31.8.2 Physical Flow Constraints**

We may also enforce a physical flow constraint limit at each internal and Intertie location in the IFM taking into account the total power flow contributions, which include internal schedules, which can be physical or virtual, import/export schedules, and the ISO's estimates of unscheduled flow at the Interties

- When implemented in 2014, CAISO discussed with participants about this expectation through. This was memorialized in a Q&A document

 https://www.caiso.com/Documents/FAQ_TaggingRequirements_May1.pdf

HASP- BPM Change

- The day-ahead market consist of the financial (IFM) market, and the residual (RUC) market. Each one produces schedules.

- IFM schedules are used to settle energy; RUC schedules above IFM schedules settle for capacity procured (RUC awards).

- Participants with a day-ahead position can use self schedules to secure their day-ahead position in the real-time market.

- Tariff section 31.8 requires market Export schedules up to the cleared RUC schedule determine what part of the day-ahead schedule is feasible

- The BPM change (PRR 1282, effective trade date September 5, 2020) clarifies that going forward the ISO will provide the day-ahead priority to Exports based on the RUC supported amounts in the real-time market

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HASP Before BPM change

- RUC assesses the need to curtail exports and may curtail export schedules below IFM award

- In the HASP market, Self-schedule up to IFM award would have day-ahead priority

- The market utilizes the defined priorities and consider uneconomical adjustment from lower to highest priority

- If an Inter-Tie (transaction or registered system resource) received an IFM award but no RUC award and if the SC did not submit a real-time bid for the Inter-Tie (transaction or registered system resource) , SIBR would create a self-schedule equal to the IFM schedule.

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# Treatment of exports in HASP Before BPM change - Example
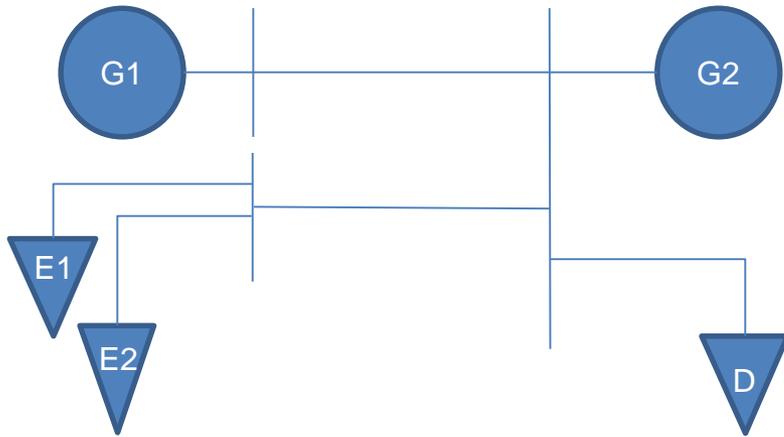
Demand and Supply
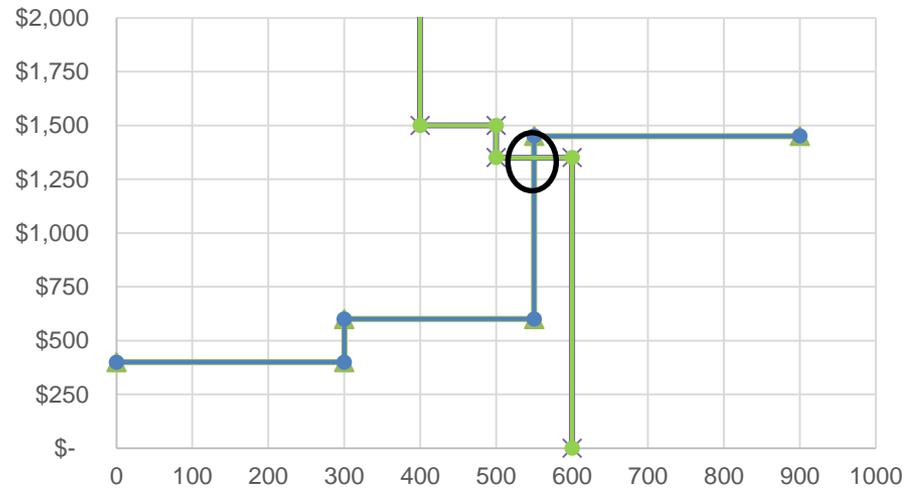
Resource	Bid
G1	300MW@$400/MWh
G2	250MW@ $ 600/MWh
Slack	300 MW@ $1450/MWh

Demand/Export	Quantity/Self-Schedule
D (demand)	**400 (Fixed)**
E1 (IFM -Export)	**100@ 1500/MWh**
E2 (RT – LPT)	**100@ 1150/MWh**

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Treatment of exports in HASP Before BPM change – Solution Summary

Demand and Supply

G1 = 300

G1 = 250

G1
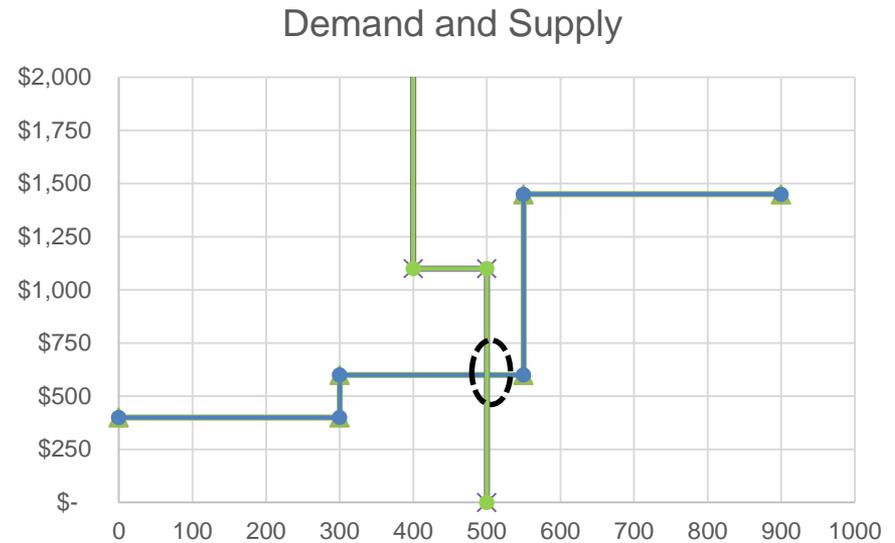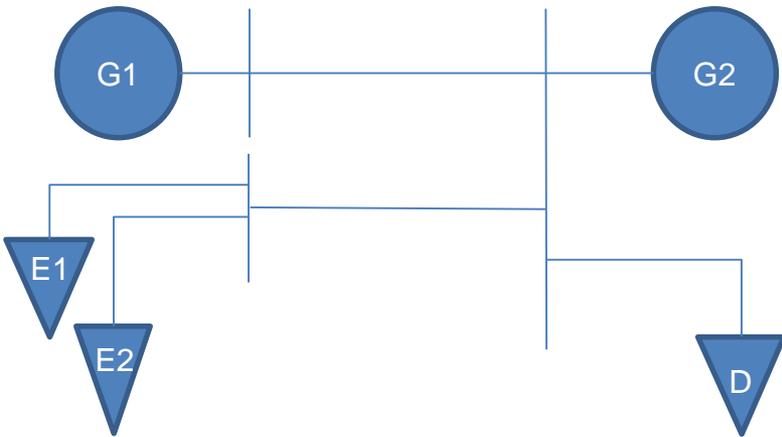
G2

E1 = 100

LMP = $1150

E1

E2   E2 = 50

D

D = 400
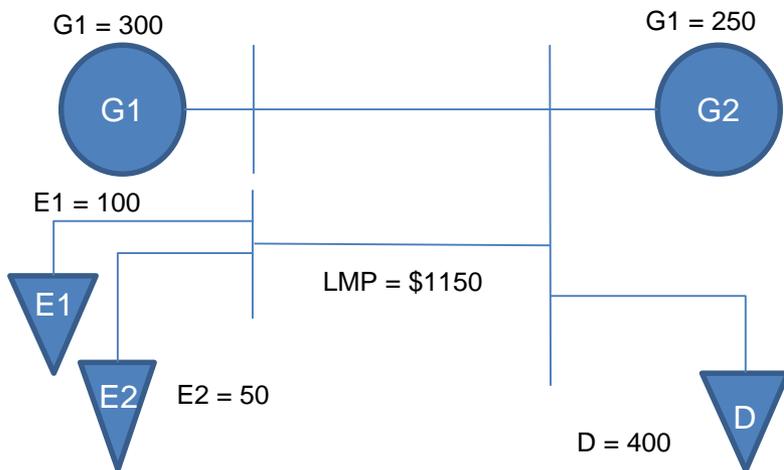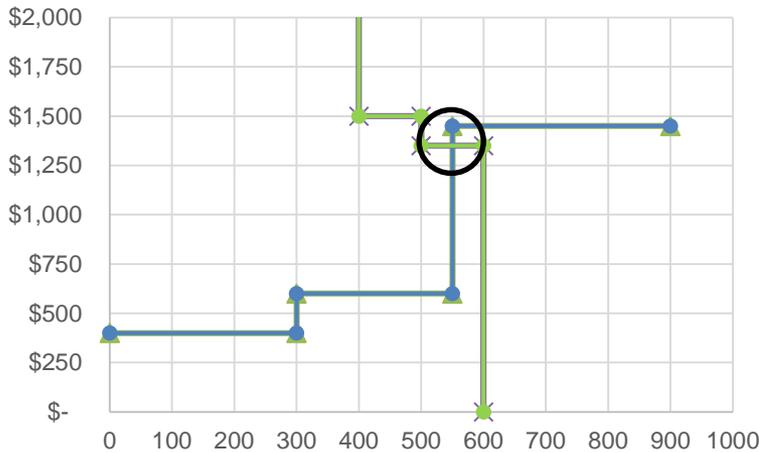
- Total Bid in Supply of 550 MW
- Fixed demand of 400 MW and two 100 MW export self-schedules
- E1 has100 MW IFM award and 0 MW RUC award. SC does not submit a bid, SIBR creates 100 MW self-schedule with DA priority which has penalty price of $1500
- E2 has no IFM or RUC award.
- E2 submit a Real-Time Self-Schedule of LPT priority which has penalty price of $1150
- 300 MW Slack at $1450
- $1150 < $1450 < $ 1500
- At the equilibrium 550 MW supply clears against 400 MW demand, 100MW export with IFM award and 50 MW of LPT Export.
- Marginal price set at $1150/MWh in the scheduling run

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HASP After BPM Change

- RUC assesses the physical feasibility of the DAM solution, including the need to curtail schedules, like exports, below IFM award

- In the HASP market, Self-schedule up to **RUC** award would have day-ahead priority

- If an Inter-Tie (transaction or registered system resource) received an IFM award but no RUC award and if the SC did not submit a real-time bid for the Inter-Tie (transaction or registered system resource), SIBR would not create a self-schedule for Imports equal to the IFM Schedule, for Exports it would create a self-schedule equal to the RUC schedule.

- SC can either submit self-schedules or economic bids for exports in Real-Time

HASP After BPM change – Example 1

Demand and Supply

Resource	Bid
G1	300MW@$400/MWh
G2	250MW@ $ 600/MWh
Slack	300 MW@ $1450/MWh

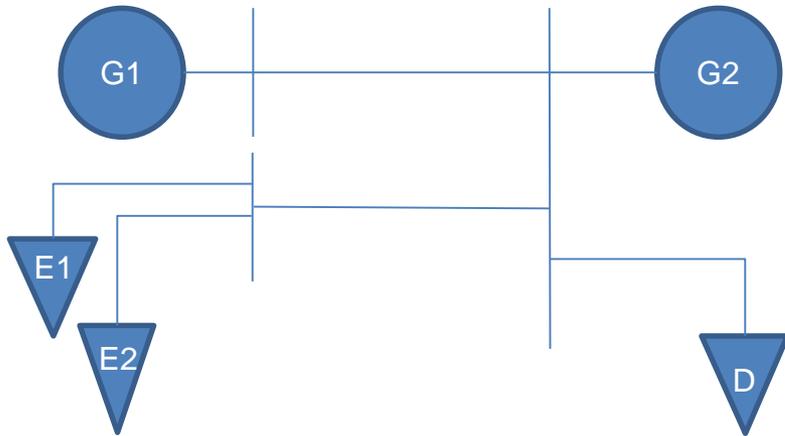| Demand/Export	Quantity/Self-Schedule
D (demand)	**400 (Fixed)**
E1 (IFM -Export)	**0**
E2 (RT – LPT)	**100@ 1150/MWh**

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HASP After BPM change – Example 1

Demand and Supply
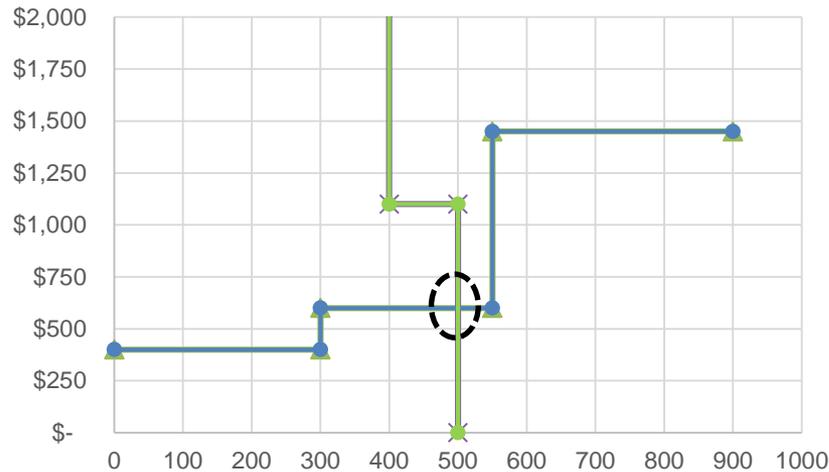
- Total Bid in Supply of 550 MW
- Fixed demand of 400 MW and two export self-schedules (0 MW,100 MW)
- E1 has100 MW IFM award and 0 MW RUC award. SC does not submit a bid, SIBR creates 0 MW self-schedule with DA priority which has penalty price of $1500
- E2 has no IFM or RUC award.
- E2 submit a Real-Time Self-Schedule of LPT priority which has penalty price of $1150
- 300 MW Slack at $1450
- At the equilibrium 500 MW supply clears against 400 MW demand, 100 MW LPT export
- Marginal price set at $600/MWh in the scheduling run
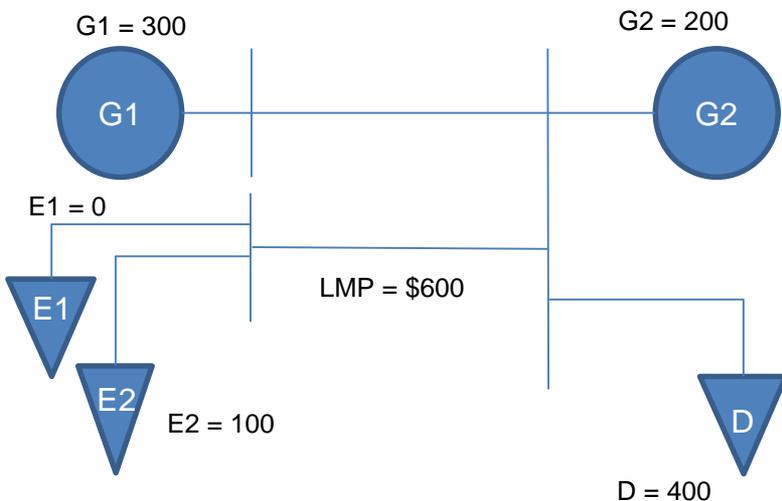
G1 = 300

G2 = 200

G1

G2

E1 = 0

LMP = $600

E1

E2

E2 = 100

D

D = 400

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HASP After BPM change – Example 2

Demand and Supply

Resource	Bid
G1	300MW@$400/MWh
G2	250MW@ $ 600/MWh
Slack	300 MW@ $1450/MWh
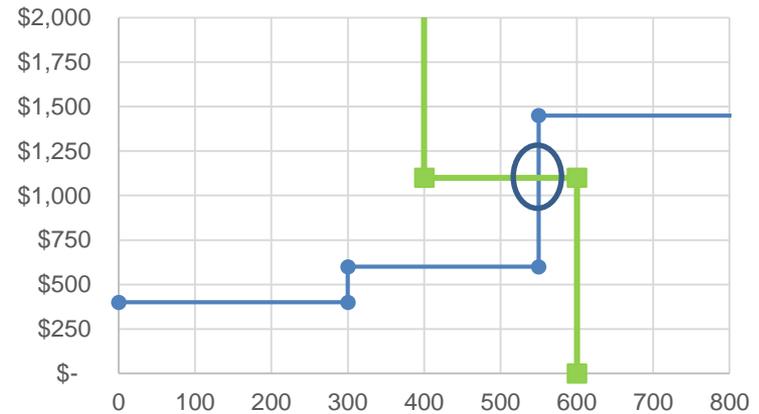
Demand/Export	Quantity/Self-Schedule
D (demand)	**400 (Fixed)**
E1 (IFM -Export)	**100@ 1150/MWh**
E2 (RT – LPT)	**100@ 1150/MWh**

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HASP After BPM change – Example 2

Demand and Supply
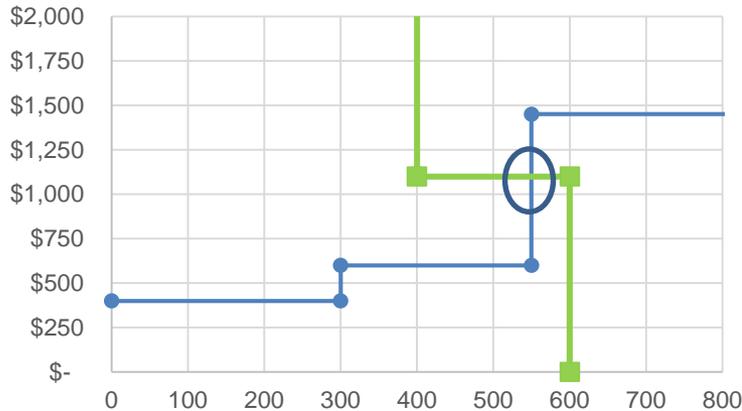
- Total Bid in Supply of 550 MW
- Fixed demand of 400 MW and two export self-schedules (100 MW,100 MW)
- E1 has100 MW IFM award and 0 MW RUC award. SC submits 100 MW Real-Time self-schedule with LPT Priority
- E2 has no IFM or RUC award.
- E2 submit a Real-Time Self-Schedule of LPT priority
- LPT priority has a penalty price of $1150
- 300 MW Slack at $1450
- At the equilibrium 550 MW supply clears against 400 MW demand and 150 MW LPT export
- For both E1 and E2 25 MW export is curtailed
- Marginal price set at $1150/MWh in the scheduling run
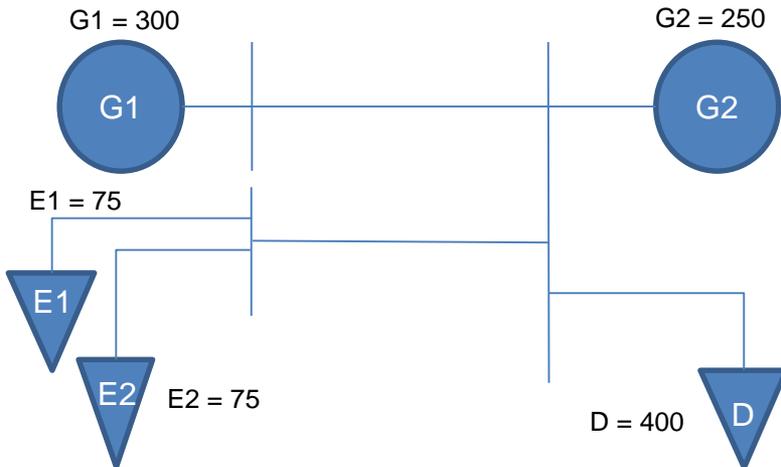
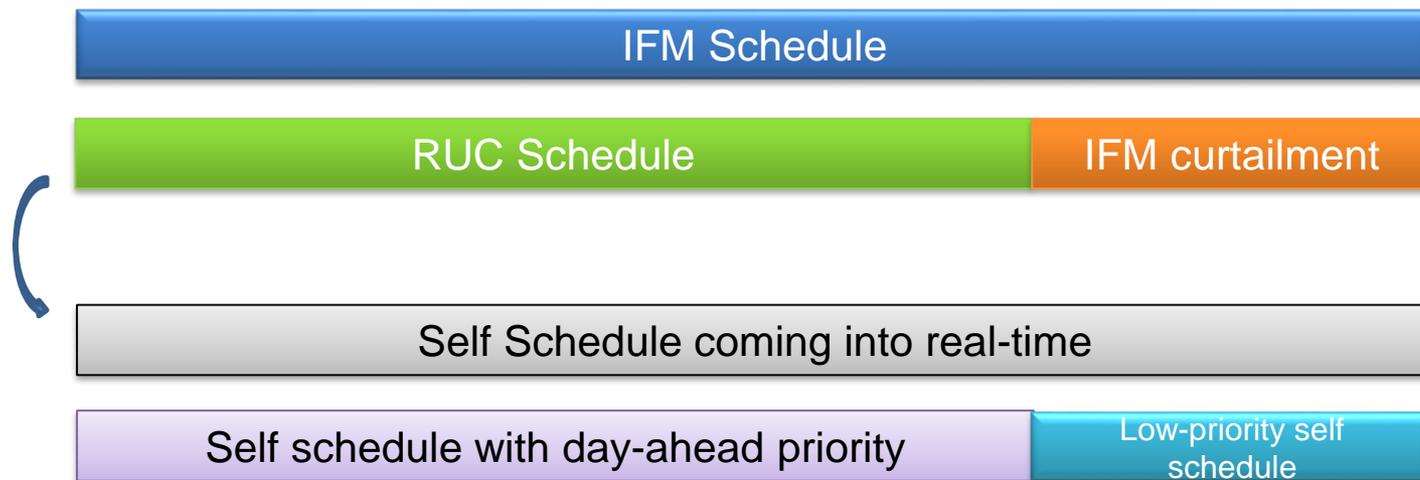# BPM Change: Use of schedules from scheduling run better reflect intended uneconomical adjustments for exports

- Schedule differences led to export cuts in scheduling run that were not realized in pricing run.

- When the ISO implemented PIME, it also applied it the RUC process for consistent treatment across all markets

- One of the consequences of using PIME is that the CAISO uses the schedules from pricing run

- RUC process includes enforcement of a physical interchange constraint

- The CAISO determined that it is more effective to use the scheduling run in RUC to ensure export curtailments are reflected correctly in the total day-ahead market solution

- The BPM change clarifies that going forward, the CAISO will use the schedules from scheduling run and prices from pricing run for the RUC process. This allows the solution to reflect better the potential export cuts in RUC results.

- This does not affect the MPM,IFM and real-time markets, which are material for the energy settlements and remain under PIME logic

With this change, any day-ahead exports self scheduled into real-time will have a day-ahead priority only up to the RUC schedule

- Prior to this change the self schedule had a day ahead priority up to the IFM schedule.

- When RUC assesses the need to curtail exports, RUC schedules will be lower than IFM schedules

IFM Schedule

RUC Schedule	IFM curtailment

Self Schedule coming into real-time

Self schedule with day-ahead priority	Low-priority self schedule

- Any self schedule above RUC level will not have a day-ahead priority. If not supported by non-RA, it will have the lowest priority

Appendix- Tariff references

California ISO

IFM Scheduling Priorities

- adjustment sequence for the IFM from highest priority (last to be adjusted) to lowest priority (first to be adjusted), is as follows:
  - Reliability Must Run (RMR) Generation pre-dispatch reduction;
  - Day-Ahead TOR Self-Schedules reduction (balanced demand and supply reduction);
  - Day-Ahead ETC and Converted Rights Self-Schedules reduction; different ETC priority levels will be observed based upon global ETC priorities provided to the CAISO by the Responsible PTOs;
  - Internal Transmission Constraint relaxation for the IFM pursuant to Section 27.4.3.1;

Continued priorities highest to lowest…

- Other Self-Schedules of CAISO Demand reduction subject to Section 31.3.1.3, *exports explicitly identified in a Resource Adequacy Plan to be served by Resource Adequacy Capacity explicitly identified and linked in a Supply Plan to the exports*, and *Self-Schedules of exports at Scheduling Points explicitly sourced by non-Resource Adequacy Capacity*;

- Self-Schedules of exports at Scheduling Points *not* explicitly sourced by non-Resource Adequacy Capacity, except those exports explicitly identified in a Resource Adequacy Plan to be served by Resource Adequacy Capacity explicitly identified and linked in a Supply Plan to the exports as set forth in Section 31.4(d);

- Day-Ahead Regulatory Must-Run Generation and Regulatory Must-Take Generation reduction;

- Other Self-Schedules of Supply reduction.

IFM Reductions in self-scheduled Load Aggregation Point Demand – Section 31.3.1.3

- If cannot resolve a non-competitive Transmission Constraint using Effective Economic Bids and must reduce self-scheduled load at the LAP level will adjust Non-priced Quantities using the parameters in 27.4.3

- Priority starting with the first type of Non-priced Quantity to be adjusted is:

  - Schedule the Energy from Self-Provided Ancillary Service Bids from capacity that has an energy must-offer obligation

  - Relax the constraint consistent with Section 27.4.3.1, and establish prices consistent with Section 27.4.3.2

  - Do not relax intertie constraints with adjacent BAAs

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Priorities in the RTM

- DAM results in RTM are protected and used as inputs in the RTM – Section 34.1.1
  - Tariff does not specify how this is done, but these inputs are protected in the RTM through non-priced parameters above RTM priorities
- RTM self-Schedule priorities similar to the IFM, but take into consideration DAM output
- These priorities are honored through the market systems but the operator can adjust them as necessary to ensure reliable operations
- The tariff does not specify the priorities the operators would follow, but these priorities are honored to the extent feasible

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RTM priorities

- Section 34.12.1 - Increasing Supply from higher to lower priority:
  - Non-Participating Load reduction, exports explicitly identified in a Resource Adequacy Plan to be served by Resource Adequacy Capacity explicitly identified and linked in a Supply Plan to the exports, or Self-Schedules for exports at Scheduling Points in the RTM served by Generation from non-Resource Adequacy Capacity or from non-RUC Capacity;
  - Self-Schedules for exports at Scheduling Points in the RTM not offered by Generation from non-Resource Adequacy Capacity or not offered by Generation from non-RUC Capacity, except those exports explicitly identified in a Resource Adequacy Plan to be served by Resource Adequacy Capacity explicitly identified and linked in a Supply Plan to the exports as set forth in Section 34.12.1(a); and
  - Contingency Only Operating Reserve if activated by Operator to provide Energy (as indicated by the Contingency Flag and the Contingency condition).
- Section 34.12.2 - Decreasing Supply from higher to lower priority are as follows:
  - Non-Participating Load increase;
  - Reliability Must Run (RMR) Schedule (Day-Ahead manual pre-dispatch or Manual RMR Dispatches or Dispatches that are flagged as RMR Dispatches following the MPM, for Legacy RMR Units and Exceptional Dispatch for RMR Resources process);
  - Transmission Ownership Right (TOR) Self-Schedule;
  - Existing Rights (ETC) Self-Schedule;
  - Regulatory Must-Run and Regulatory Must-Take (RMT) Self-Schedule;
  - Participating Load increase;
  - Day-Ahead Supply Schedule; and
  - Self-Schedule Hourly Block.