BPA's Public Engagement for Establishing a Policy Direction on Potential Day Ahead Market (DAM) Participation - Workshop 6

May 8, 2024

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Agenda

- Review of BPA's Staff Recommendation on Day-Ahead Market Participation
  - Update on BPA's decision process and timeline for calendar year 2024
- Baseline Process and Scenario Discussions

BPA's Staff Recommendation on Day-Ahead Market Participation

BPA's Staff Recommendation on Day-Ahead Market Participation

- BPA released a staff recommendation on April 4, 2024:
  - Staff recommend joining a day-ahead market
  - Staff currently recommend that BPA pursue participation in Markets+
  - Note: This is NOT a final decision; the staff recommendation provided greater insight into BPA's analysis to date
  - Staff will continue analysis as market designs and footprints evolve

BPA's Staff Recommendation on Day-Ahead Market Participation

- End of August 2024:
  - BPA will release a draft policy on DAM participation that includes an evaluation of topics including governance, costs and benefits, and market design features such as proposed greenhouse gas frameworks, etc.
  - BPA will open a public comment period to solicit input on the draft policy.

- End of November 2024:
  - BPA will release a final DAM policy and record of decision (ROD) in late November

- After November 2024:
  - Further details regarding potential BPA market participation would be subject to final decisions made in the Provider of Choice contracts, and rates and tariff proceedings.
  - BPA would continue to engage with customers regarding DAM development and implementation.

BPA's Staff Recommendation on Day-Ahead Market Participation

- BPA will continue to assess the business case for DAM participation based on the its evaluation principles:
  - Statutes, Reliability, Business, Strategy, Governance, Customer, Greenhouse Gas
- Based on stakeholder feedback, staff also considered the below market attributes for potential DAM participation:
  - Firmness of Power Supply
  - Certainty of Delivery
  - Environmental Attributes

BPA's Staff Recommendation on Day-Ahead Market Participation

- BPA's Staff Recommendation on day-ahead market participation discusses:
  - Bonneville Participation in the CAISO EDAM and SPP Markets+ Processes
  - Preliminary Business Case
  - Governance
  - Ensuring Adequate Supply
  - Price Formation and Market Power Mitigation
  - Transmission and Congestion Rent
  - Greenhouse Gas Accounting
  - Seams
  - Potential RTO Formation
  - West-Wide Governance Pathways Initiative
  - West-Wide Market Formation
  - Bonneville Staff's Recommended Day-Ahead Market Option

BPA's Staff Recommendation on Day-Ahead Market Participation

- We encourage stakeholders to submit feedback to techforum@bpa.gov with the subject "DAM Staff Recommendation Letter Feedback."

BPA's Preliminary Legal Assessment

- Preliminary Legal Assessment:
  - Briefly discusses BPA's statutory authority to participate in organized markets, ability to meet its preference and Northwest Power Act section 5(b) firm power sales obligations, policy regarding environmental attributes, transmission authorities, rate-setting directives, tariff revision processes, and environmental obligations.
  - Based on day-ahead market tariff offerings to date, Bonneville has not identified legal barriers to satisfying its statutory obligations while participating in a day-ahead market.

BPA's Staff Recommendation on Day-Ahead Market Participation

- Preliminary Business Case:
  - BPA's DAM participation must be supported by a sound business rationale.
  - Initial analysis focused on results from E3's WMEG study, discussed in previous Workshops.
  - An evaluation of financial impacts and qualitative factors will accompany the final ROD.

- WMEG study results justify DAM participation recommendation:
  - Primary benefits come from projected increased revenue from more efficient marketing and reduced costs to load from reduced production costs.
  - Bonneville is projected to receive increased benefits in four of six study cases, ranging from $18.1 million to $134.7 million annually.
  - In two study cases, Bonneville is projected to experience potential reductions in revenue.
  - Market footprints significantly impact benefits; Bonneville will pay close attention to the composition of potential day-ahead market footprints as neighboring entities make decisions regarding participation.

BPA's Staff Recommendation on Day-Ahead Market Participation

- BPA Participation in EDAM and Markets+ Processes:
  - EDAM
    - BPA has engaged in commercial activity with CAISO for decades, and CAISO currently serves as BPA's Reliability Coordinator.
    - BPA was significantly involved in the formation of the WEIM
    - BPA dedicated substantial resources since 2018 to engage w/CAISO's EDAM and DAM Enhancement design processes, including participating in initial discussions, workshops, comment submissions, and having an executive serve on the Governance Review Committee.
  - Markets+
    - BPA has worked with SPP since 2019 on the Western Resource Adequacy Program (WRAP).
    - BPA has been engaged in the Markets+ stakeholder processes and have provided input on governance, market design elements including resource adequacy, price formation, transmission, and GHG market design.

BPA's Staff Recommendation on Day-Ahead Market Participation

- BPA Staff's Recommended Day-Ahead Market Option:
  - Of the utmost importance to BPA in evaluating available day-ahead market options is ensuring that operational control and benefits of the Federal Columbia River Power System (FCRPS) remain with Bonneville, the Bureau of Reclamation, and the Pacific Northwest.
  - From BPA's current perspective, SPP's Markets+ is the preferred day-ahead market to meet these objectives based on its governance structure and market design features.

BPA's Staff Recommendation on Day-Ahead Market Participation

- Governance:
  - BPA believes that the lack of independent governance and CAISO's obligations to the State of California will result in BPA's customers being placed in a competitive and governance disadvantage.
  - BPA gained confidence in SPP's participant-driven model for the Markets+ tariff design. Staff believe that the participant-driven model is preferrable to CAISO's staff-driven model for EIM and EDAM.
  - BPA will continue to monitor West-Wide Governance Pathways Initiative developments.

BPA's Staff Recommendation on Day-Ahead Market Participation

- Governance:
  - Independent market governance is paramount to BPA participation in any day-ahead market; this will ensure market decisions are made with consideration of all market participants interests.
  - Staff believe that Markets+ has developed a structure and process that is more likely to result in equitable market outcomes and fair consideration of BPA's interests.
  - Markets+ has demonstrated successful independent governance with the MPEC, IMIP, and their workgroups and task forces.

BPA's Staff Recommendation on Day-Ahead Market Participation

- Ensuring Adequate Supply:
  - If participating in a DAM, BPA's primary goal will be to provide firm power supply in the most economical, efficient and reliable manner.
  - As a prerequisite to joining Markets+, Load Responsible Entities (LREs) are required to participate in WRAP, a regional resource adequacy program. Through WRAP requirements, Markets+ supports sufficient power supply and long-term planning in each participant's BA.
  - EDAM does not propose a uniform adequacy metric or require EDAM entities to participate in a resource adequacy program. Bonneville staff prefers the clear and consistent requirement that all Markets+ LREs must participate in WRAP, which better supports regional reliability.

BPA's Staff Recommendation on Day-Ahead Market Participation

- Price Formation and Market Power Mitigation (MPM):
  - EDAM MPM utilizes an extension of the existing WEIM methodology via a dynamic competitive path assessment to evaluate whether available generation within the participating BAA can competitively meet its own demand without additional transfer imports.
  - Under the pivotal supplier assessment for market power mitigation, entities on constrained paths are more likely to face price mitigation measures due to the nature of their structural location, leading to potential over-mitigation.
    - BPA appreciates that CAISO is reviewing this aspect of the market design in its Price Formation Enhancements initiative.

BPA's Staff Recommendation on Day-Ahead Market Participation

- Price Formation and Market Power Mitigation (MPM):
  - Markets+ leverages conduct and impact framework for MPM which is used in other organized markets. The conduct test evaluates whether a resource offer is significantly higher than the reference cost of energy, and the impact test determines whether that offer would significantly impact market prices. If market suppliers fail conduct and impact tests, mitigation can be applied.
  - BPA views Markets+ conduct and impact approach as more effective because it does not mitigate based on market power potential, but on exercise of observed market power.

BPA's Staff Recommendation on Day-Ahead Market Participation

- Transmission and Congestion Rent:
  - Generally, overall transmission design is similar between EDAM and Markets+; the primary difference is physical congestion modeling and congestion rent design.
  - Congestion Rent design varies significantly between markets:
    - EDAM congestion revenue is allocated to the BAA where the constraint is modeled. Congestion rent design can present undue complexity for customers.
    - Markets+ plans to use a market model that more accurately reflects transmission operations in the Pacific NW

BPA's Staff Recommendation on Day-Ahead Market Participation

- Transmission and Congestion Rent:
  - Markets+ utilizes a common methodology across all participating BAAs, with allocations based on constraint-level congestion.
  - BPA staff prefer the Markets+ design due to:
    - Better physical congestion transmission system modeling
    - Constraint-level congestion rents allocation
    - Congestion rent allocation directly to long-term transmission rights holders, which provides consistency across the entire footprint.

BPA's Staff Recommendation on Day-Ahead Market Participation

- Greenhouse Gas Accounting:
  - CAISO's design may result in energy contracted to utilities outside of WA or CA being attributed to WA or CA, which could undermine the ability for customers in other states such as OR to claim energy from the federal system for GHG purposes.
  - CAISO's design does not explicitly enable forward contractual commitments to ensure clean energy attribution.

BPA's Staff Recommendation on Day-Ahead Market Participation

- Greenhouse Gas Accounting:
  - Bonneville believes that Markets+ design will result in greater assurance that energy from the federal system will be attributed to WA for BPA's contracted customers.
  - The design of Markets+ gives BPA the ability to manage how much energy from the federal system can be attributed to a GHG zone.
  - Markets+ best honors forward contractual commitments for clean energy and affords critical flexibility to market participants.
  - The Markets+ stakeholder process will result in fair GHG accounting outcomes across all market participants.

BPA's Staff Recommendation on Day-Ahead Market Participation

- Seams:
  - BPA recognizes that two day-ahead markets would present coordination challenges.
  - Both CAISO and SPP have experience managing seams, and BPA has a long history of proactively working to manage market seam issues.
    - BPA has previously worked with CAISO to manage WEIM seams
  - BPA will continue working to ensure seams issues are effectively addressed.
  - BPA encourages CAISO and SPP to develop coordination agreements to proactively address seams issues.

BPA's Staff Recommendation on Day-Ahead Market Participation

- Potential RTO/West-Wide Market Formation:
  - Markets+ offers more potential to integrate into an Regional Transmission Organization (RTO). BPA has not seen a similar pathway for CAISO to support a full, West-wide RTO that includes BAA consolidation.
  - Bonneville recognizes that the formation of a West-wide market deserves consideration and will consider aggregate benefits and distribution of benefits when considering DAM participation.
  - Bonneville would assess any potential RTO participation in future processes if there are changes in the regional landscape

Key dates for CY24

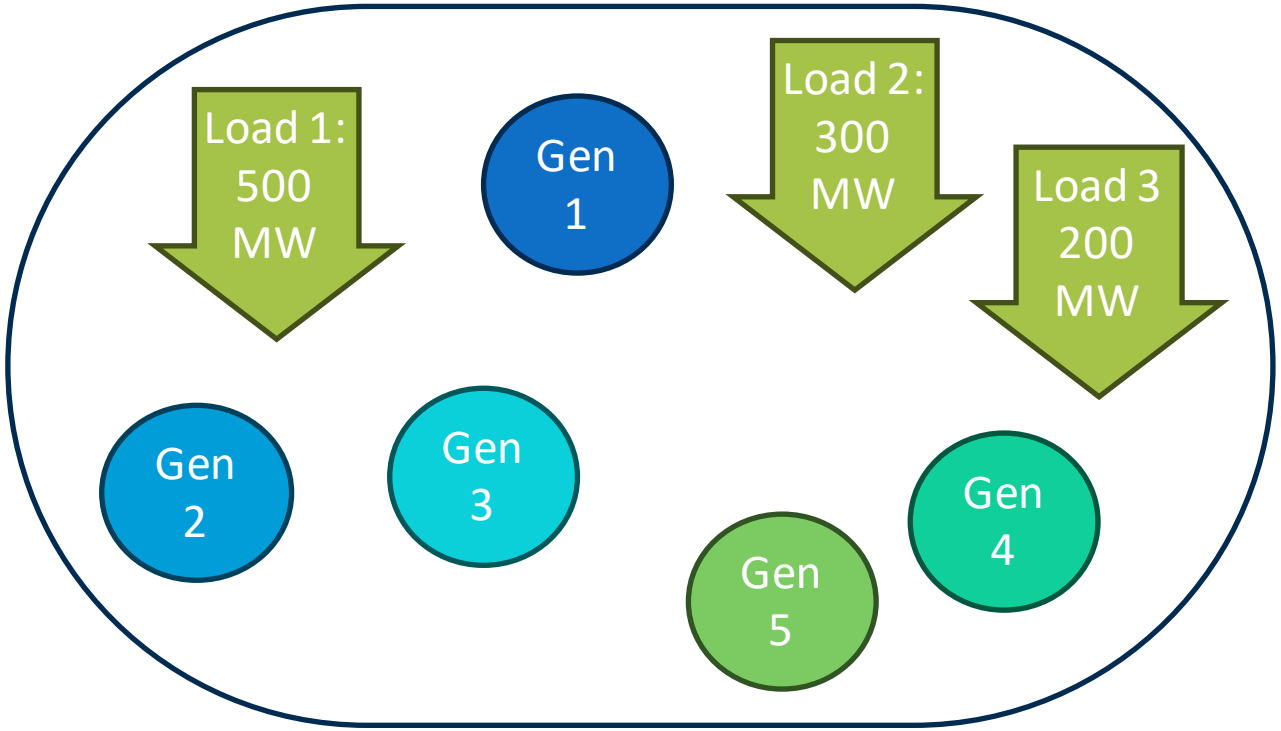
- June through September
  - Additional workshop dates:
    - June 3
    - July 8
    - August 5-6
    - September 19
  - The June, July and August workshops will discuss DAM related scenarios and BPA's evaluation of governance, financial impacts, etc.
  - The September workshop will walk through the Draft DAM Policy to address any requests for clarification

What is BPA's DAM Decision timeline for CY24?

Baseline Process and Scenario Discussions

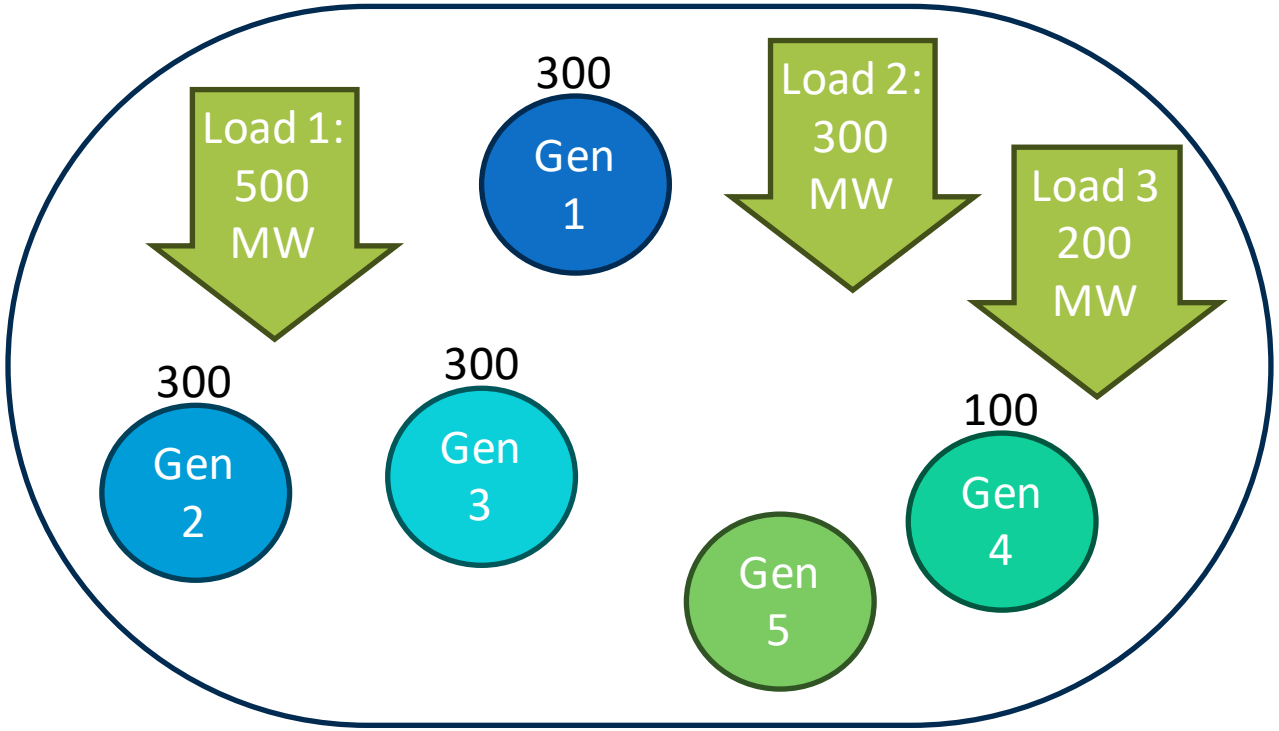
Market Optimization Illustration

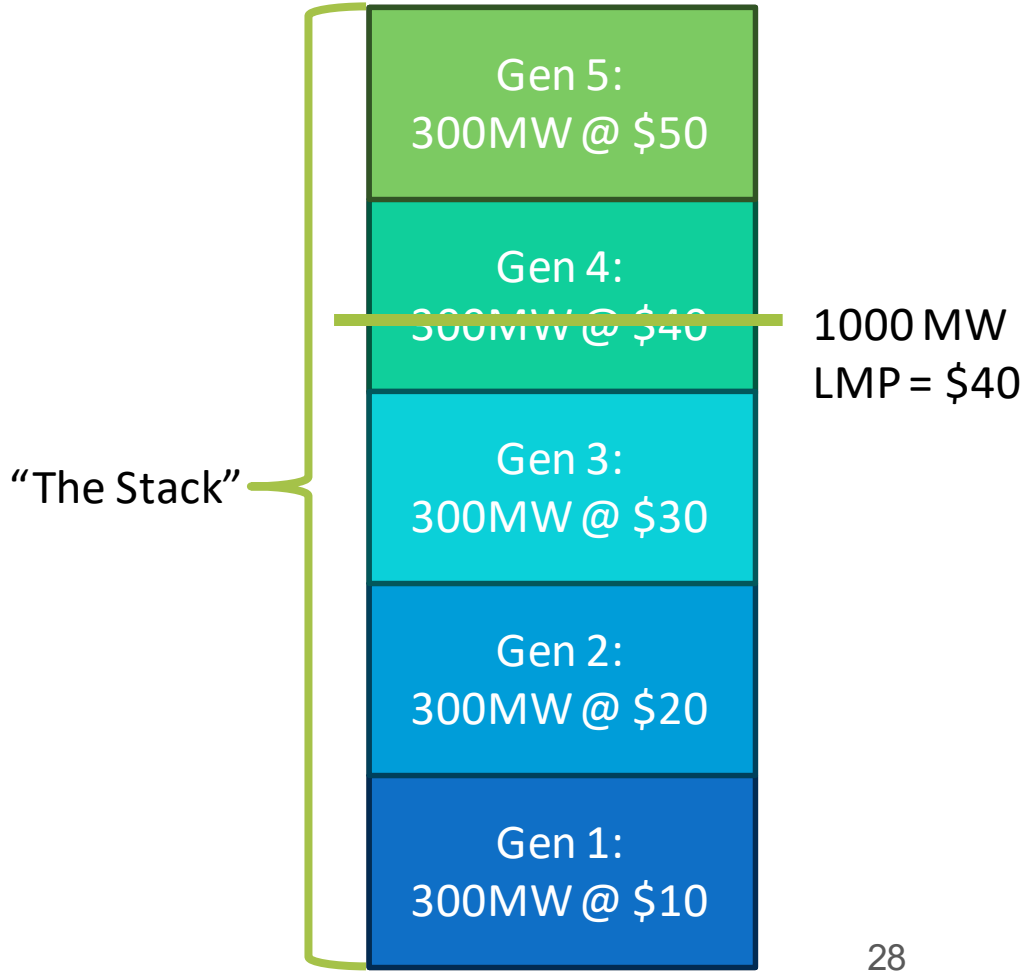
- Let's find the least cost to serve 1000MW of load:



Market Optimization Illustration cntd.

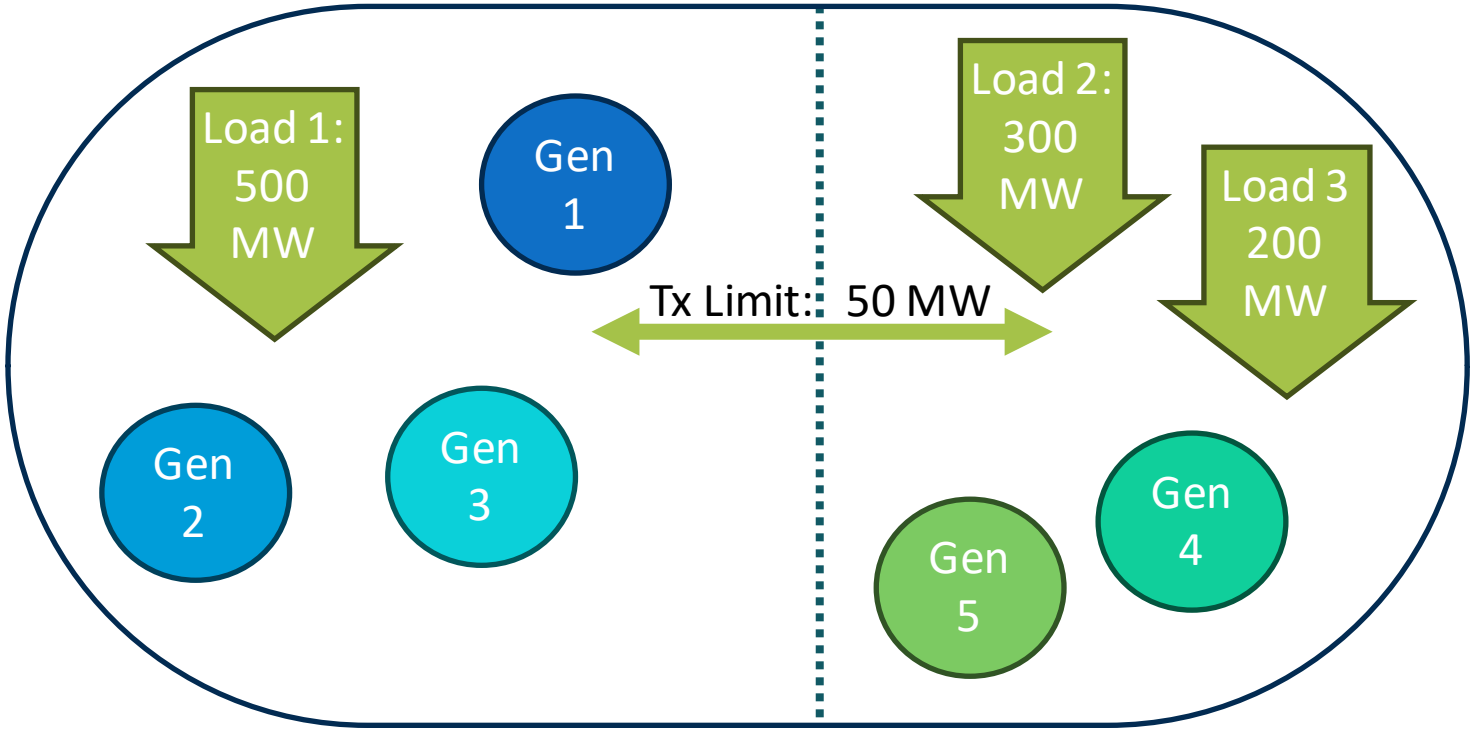
- Let's find the least cost to serve 1000MW of load:





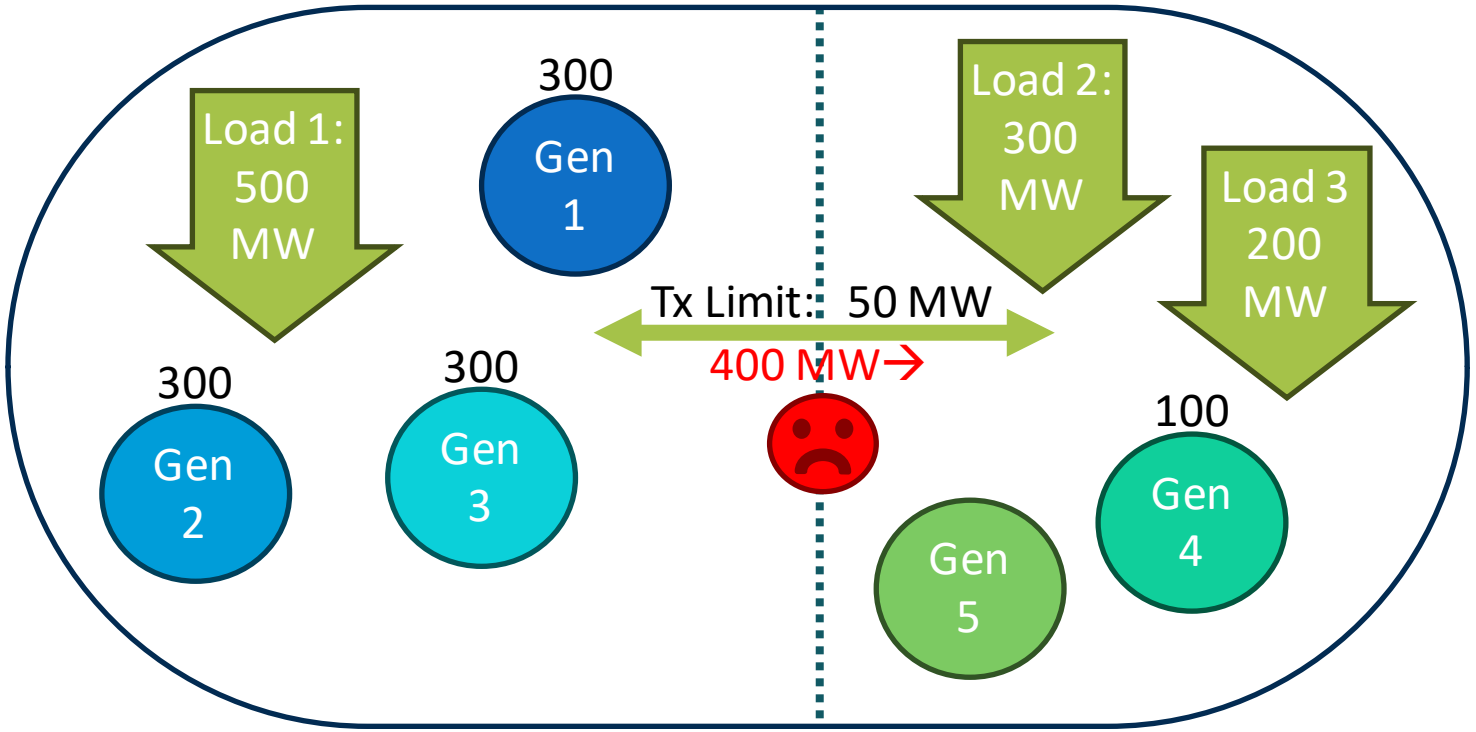
Market Optimization Illustration cntd.

- Let's find the least cost to serve 1000MW of load, with a transmission constraint:



Market Optimization Illustration cntd.

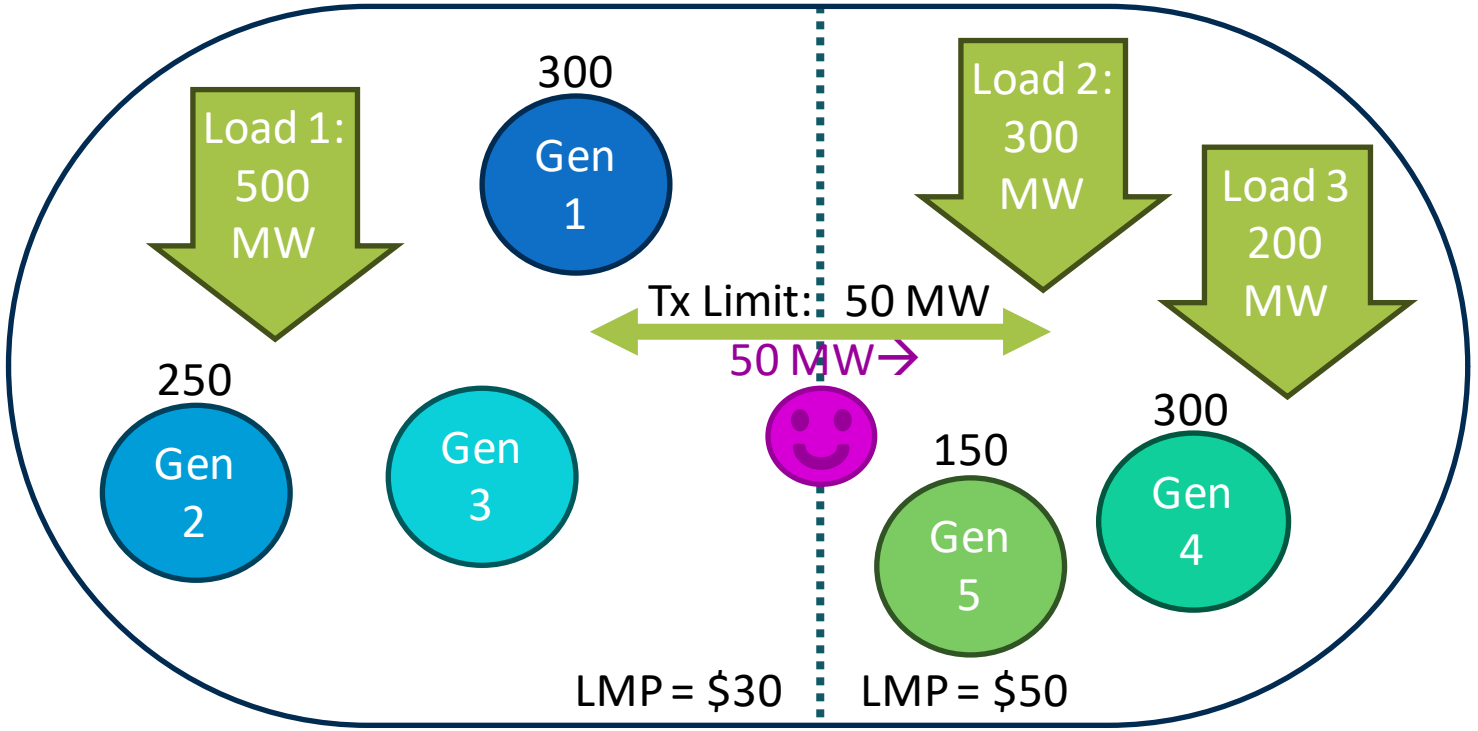
- Let's find the least cost to serve 1000MW of load, with a transmission constraint:

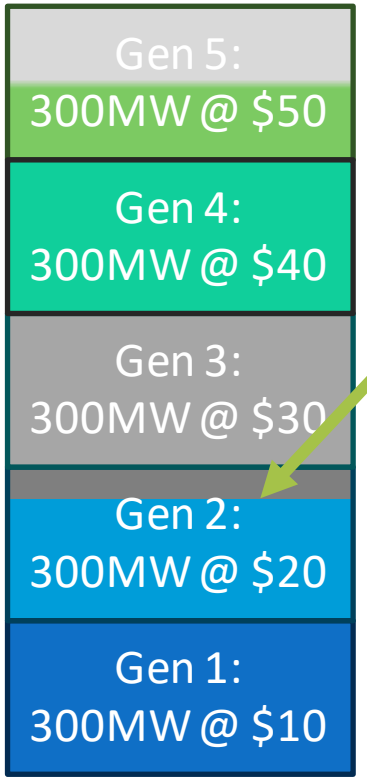


Using the same dispatch results in a transmission constraint violation!

Market Optimization Illustration cntd.

- Let's find the least cost to serve 1000MW of load, with a transmission constraint:





Constraint binds! Now, find the next least cost gen that doesn't violate the constraint to serve the rest of the load on the right side

Scenario Overview

Scenario Overview

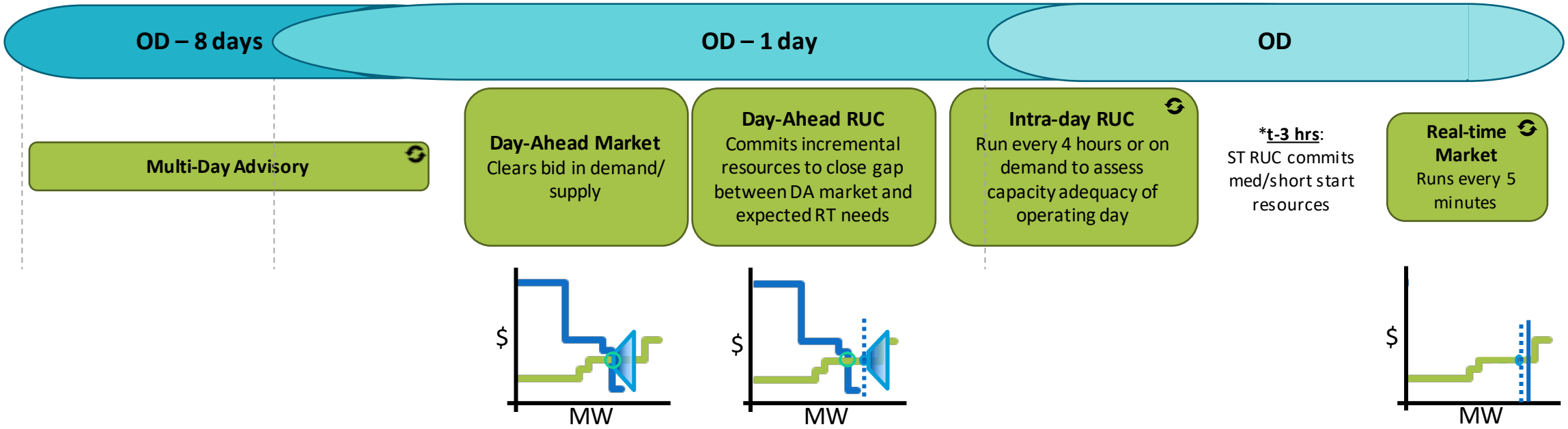
- Today's scenarios present a high-level illustrative overview of how the Markets+ process runs.
- In many ways, the scenarios would be very similar under the EDAM market design.
- The use of the M+ market design for the scenarios was done for convenience and in no way indicates a decision by Bonneville regarding whether Bonneville will join a market and if so which market
- These scenarios show "normal" operations, illustrating inputs/outputs based on market roles, basic optimization, and basic settlement.
- BPA plans to provide further scenarios with additional layers of complexity throughout our summer workshops.

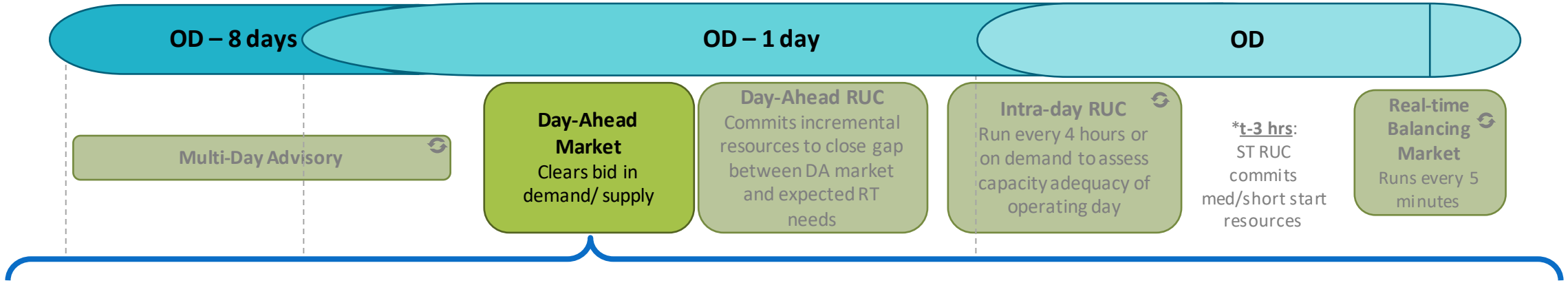
Baseline DAM Setup

Assumptions

- Not specific to any market participant type
- Intended to illustrate the process, inputs, and outputs of a Day-Ahead Market and Real-Time Balancing Market

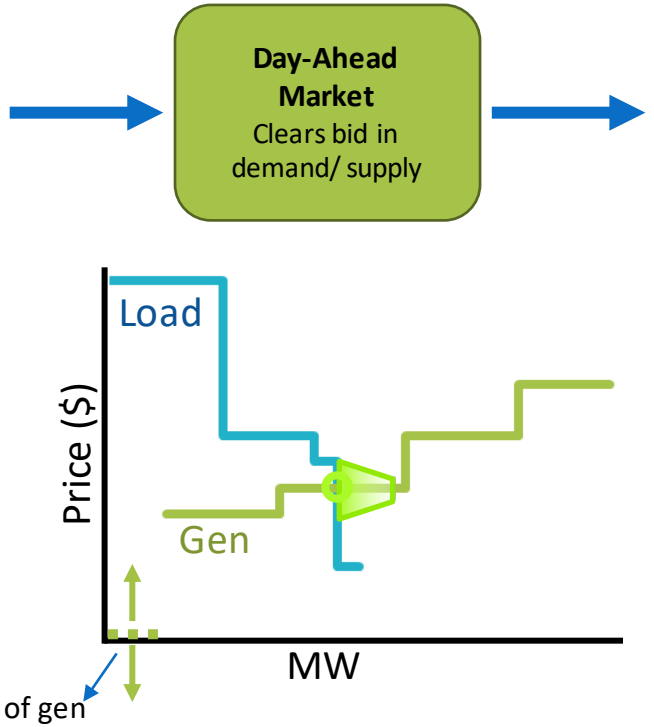
Process Timeline (SPP M+)





DAM Inputs

- DA Generation Offers/"Self-schedules"*
  - Identify commitment status
  - Identify 24 hourly resource offer (MW/price pairs)
  - Identify daily energy max (storage)
  - And more!
- Load Bids
  - Identify 24 hourly demand bids (MW/price pairs)
  - Hourly "Must-offer" demonstration
- Virtual (Convergence) Offers/Bids (Supply or Demand) **
- MO-Calculated Flex Reserve Requirement
  - Relative to load/VER forecast
- Transmission Capability

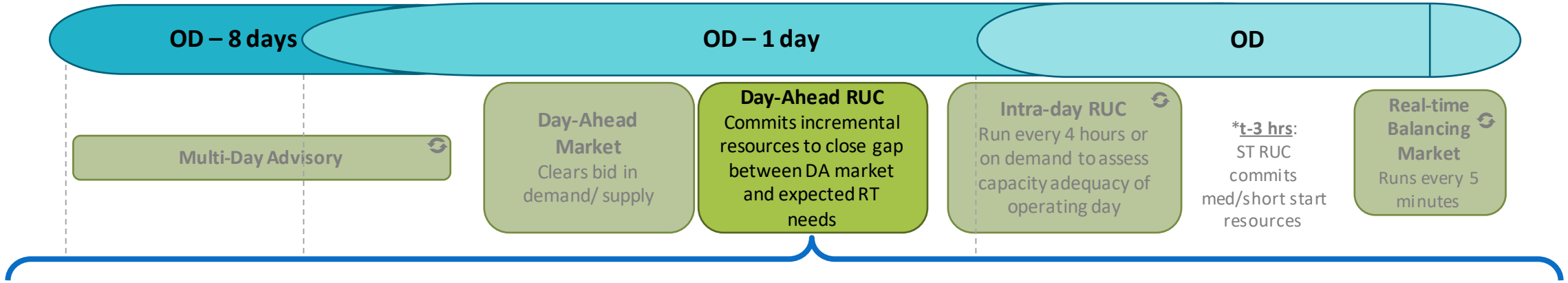


DAM Outputs

- 24 Hourly Energy Awards – sum to cleared load bids
  - Physical Generation
  - Virtual Supply**
- Associated Hourly Energy Prices (LMP)
- 24 Hourly Flex Reserve Awards – sum to Flex Reserve Requirement
  - Physical Generation
- Associated Hourly Flexibility Reserve Prices
- Expected Tx Flows

*Use of the term "self-schedule" represents submission of a static hourly resource output without market adjustability. Such a submission is treated as a price-taker

** Virtuals will not be active at M+ go-live



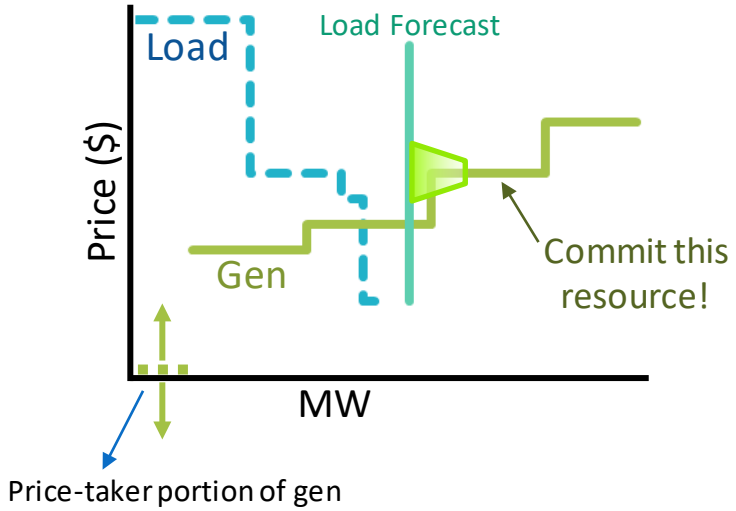
DA RUC Inputs

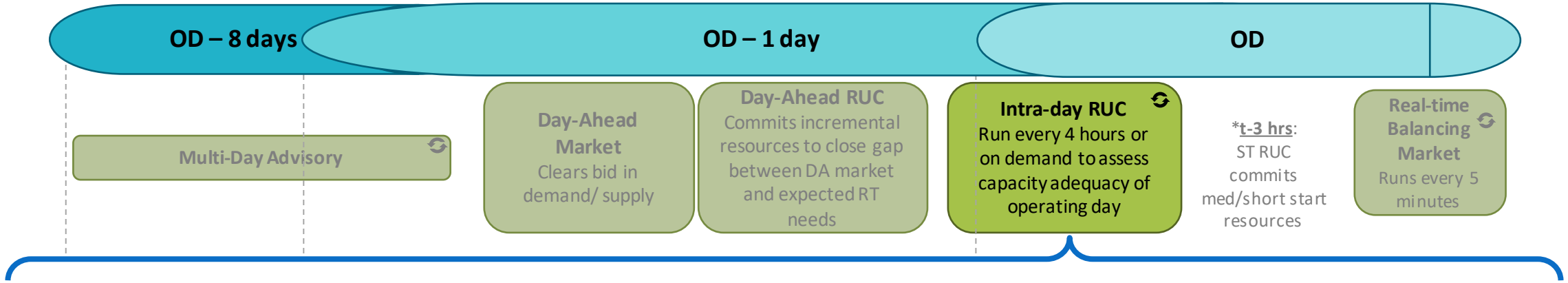
- DAM Outputs
- Load Forecast
- VER Forecast
- Updated Gen Offers/"Self-schedules"
  - Start-up/no-load costs
- Transmission Capability

Day-Ahead RUC
Commits incremental resources to close gap between DA market and expected RT needs (Begins 45 mins after DAM results posted)

DA RUC Outputs

- Additional unit starts/stops
  - Make-whole payment guarantee

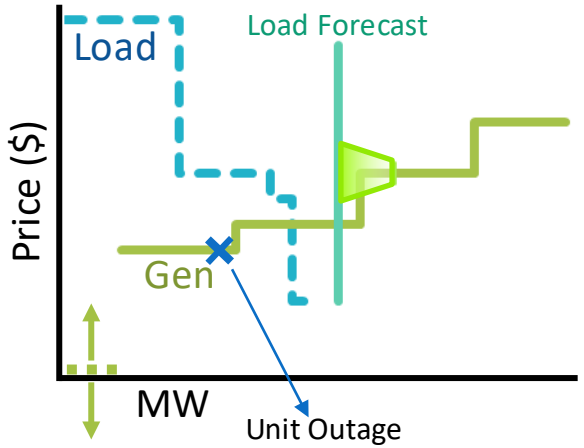


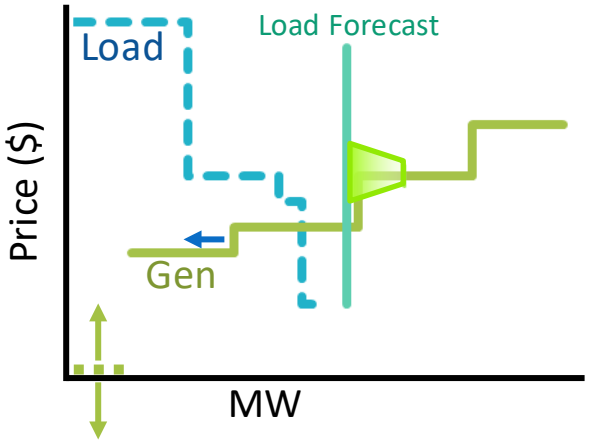


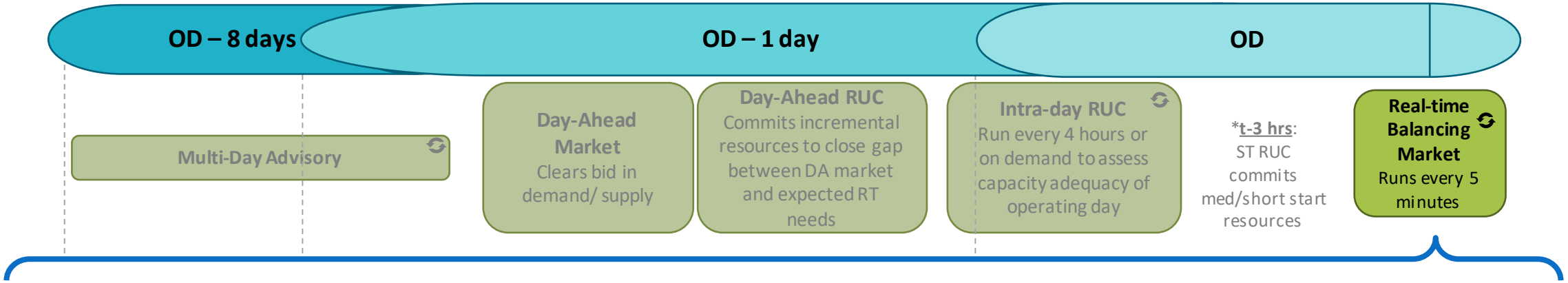
Intra-day RUC Inputs
- DAM/RUC Outputs
- Changes (e.g. outages, contingencies, unanticipated uncertainty)
- RT Gen Bids/Self-schedules
- Transmission Capability

Intra-day RUC
Run every 4 hours or on demand to assess capacity adequacy of operating day

Intra-day RUC Outputs
- Additional unit starts/stops
  - Make-whole payment guarantee



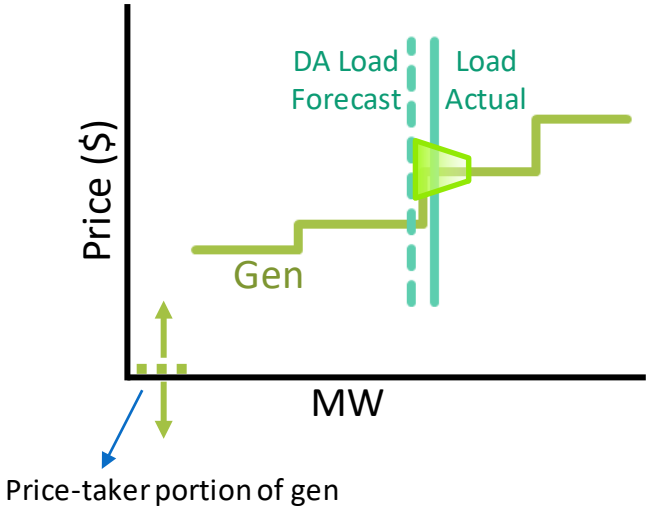




RTBM Inputs

- DAM/RUC Outputs
- Real-time Load Consumption
- Real-time VER output
- Real-time Gen Offers/"Self-schedules"
  - RT MOO demonstration
- Transmission Capability

Real-time Balancing Market
Runs every 5 minutes



RTBM Outputs

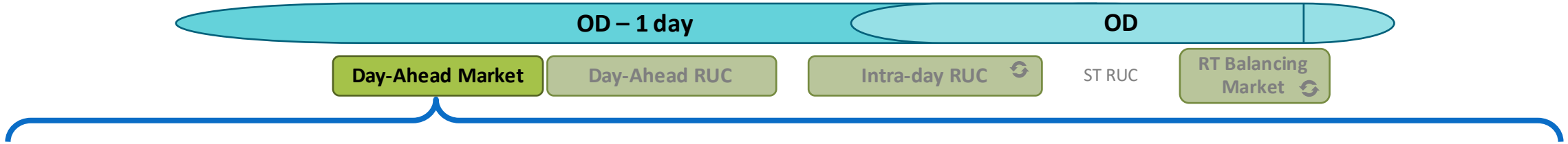
- 5-minute Energy Award
  - Physical Generation
- 5-minute Real-time LMP
  - Gen and load settlements are incremental to DA awards

Baseline DAM Scenario

Baseline DAM Scenario

Assumptions

- Expanding on the Baseline scenario with numeric examples (still not specific to any market participant type)
- Providing a numeric example for day-ahead and real-time settlements
- Virtuals are not offered yet on Day 1 of Go-Live



DAM Inputs

- Generation Offers/"Self-schedules"
- Load Bids
- MO-Calculated Flex Reserve Requirement
- Transmission Capability

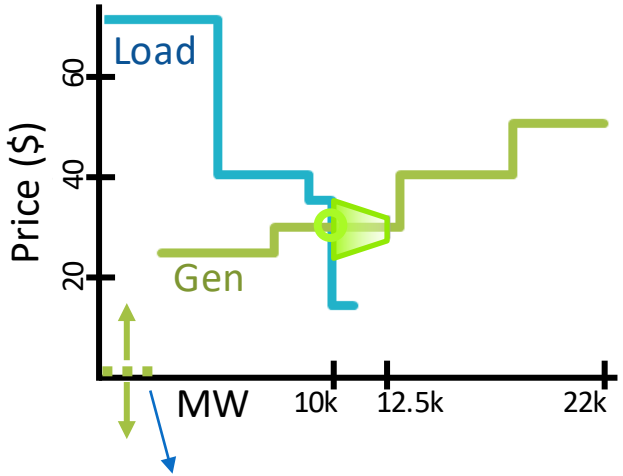
Day-Ahead Market

DAM Outputs

- 24 Hourly Energy Awards – sum to cleared load bids
- Associated Hourly Energy Prices (LMP)
- 24 Hourly Flex Reserve Awards – sum to Flex Reserve Requirement
- Associated Hourly Flexibility Reserve Prices
- Expected Tx Flows

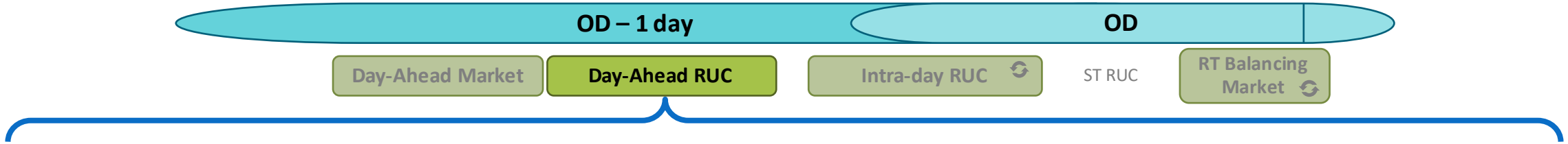
Generator	Offer	Min MW	Max MW	$
Gen 1	"Self-Schedule"	0	1000	N/A
Gen 2	Range	1500	6500	$25
Gen 3	Range	0	5500	$30
Gen 4	Range	0	5000	$40
Gen 5	Range	0	4000	$50

Load	MW	$
Load 1	5000	$70
Load 2	4000	$40
Load 3	1000	$35
	1000	$15
Flex Req.	2500	N/A



Generator	Award Type	Award MW	LMP
Gen 1	Energy	1000	$30
Gen 2	Energy	6500	
Gen 3	Energy	2500	
Gen 3	Flex	2500	

Load clears to 10,000 MW

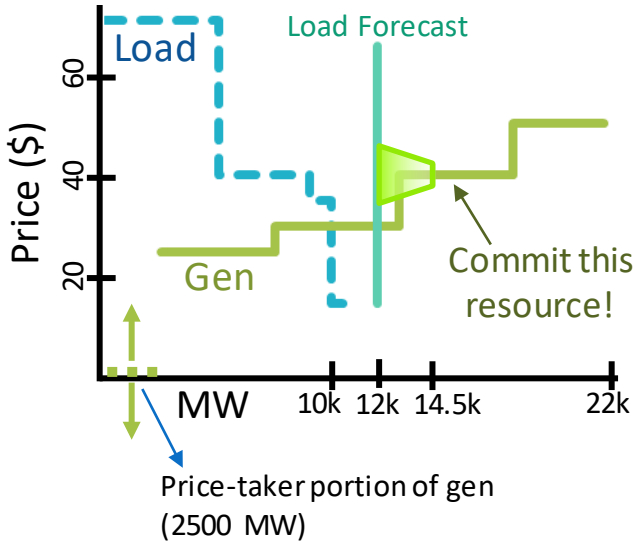


DA RUC Inputs

- DAM Outputs
- Load Forecast
- VER Forecast
- Generation Offers/"Self-schedules"
  - startup/no-load
- Transmission Capability

Generator	Offer	Min MW	Max MW	$	DAM Award
Gen 1	"Self-Schedule"	0	1000	N/A	1000 MW (EN)
Gen 2	Range	1500	6500	$25	6500 MW (EN)
Gen 3	Range	0	5500	$30	2500 MW (EN) 2500 MW (Flex)
Gen 4	Range	0	5000	$40	-
Gen 5	Range	0	4000	$50	-

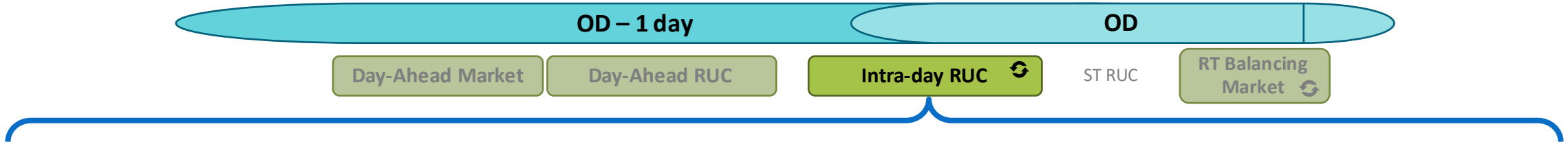
Load	MW
Forecast	12000
Cleared in DAM	10000



DA RUC Outputs

- Additional unit starts/stops
  - Make-whole payment guarantee

- RUC needs additional 2000 MW
- Commit G4

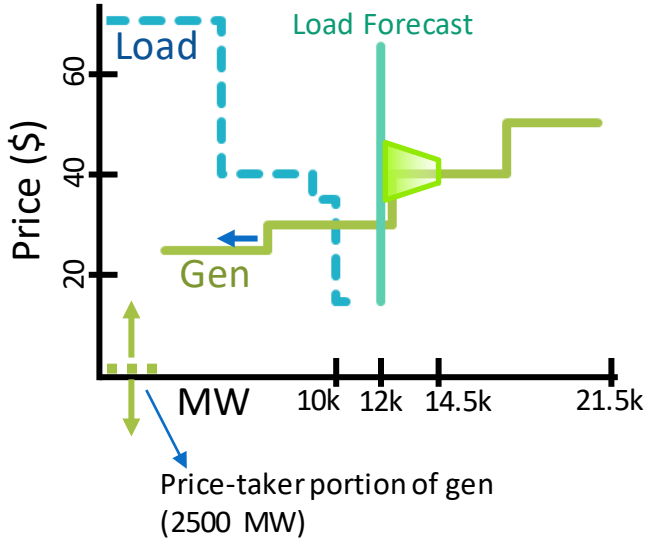


Intra-day RUC Inputs
- DAM/RUC Outputs
- Changes (e.g. outages, contingencies, unanticipated uncertainty)
- Generation Offers/"Self-schedules"
- Transmission Capability

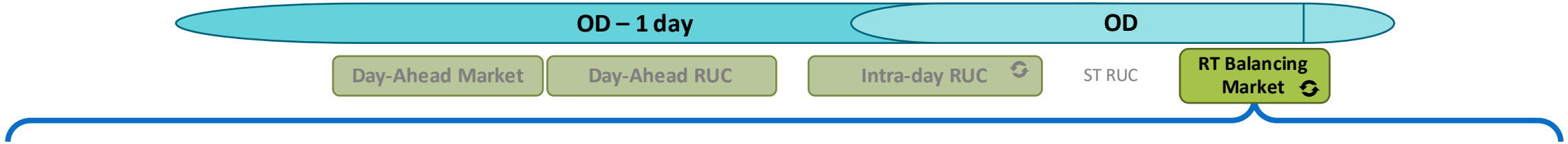
Intra-day RUC Outputs
- Additional unit starts/stops
  - Make-whole payment guarantee

Unit outage!

Generator	Offer	Min MW	Max MW	$	DAM Award
Gen 1	"Self-Schedule"	0	1000	N/A	1000 MW (EN)
Gen 2	Range	1500	**6000**	$25	6500 MW (EN)
Gen 3	Range	0	5500	$30	2500 MW (EN), 2500 MW (Flex)
Gen 4	Range	0	5000	$40	RUC: Committed
Gen 5	Range	0	1000	$50	-



- Rolling RUC needs additional 500 MW
- G4 still has unawarded offer range above potential need – no additional commitment necessary



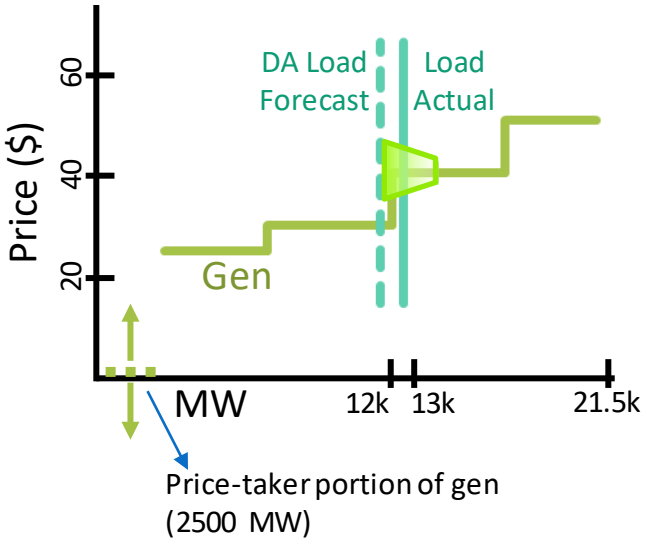
RTBM Inputs

- DAM/RUC Outputs
- Real-time Load Consumption
- Real-time VER output
- Generation Offers/"Self-schedules"
- Transmission Capability

RTBM Outputs

- 5-minute Energy Award
  - Physical Generation
- 5-minute Real-time LMP
  - Settlement is incremental to DA award

Generator	Offer	Min MW	Max MW	$	DAM Award
Gen 1	"Self-Schedule"	0	1000	N/A	1000 MW (EN)
Gen 2	Range	1500	6000	$25	6500 MW (EN)
Gen 3	Range	0	5500	$30	2500 MW (EN) 2500 MW (Flex)
Gen 4	Range	0	5000	$40	RUC: Committed
Gen 5	Range	0	1000	$50	-



Gen Dispatch	MW	LMP
Gen 1	1000	$40
Gen 2	6000	
Gen 3	5500	
Gen 4	500	

Day Ahead Settlement

DAM Inputs

Generator	Offer	Min MW	Max MW	$
Gen 1	"Self-Schedule"	0	1000	N/A
Gen 2	Range	1500	6500	$25
Gen 3	Range	0	5500	$30
Gen 4	Range	0	5000	$40
Gen 5	Range	0	4000	$50

Load	MW	$
Load 1	5000	$70
Load 2	4000	$40
Load 3	1000	$35
	1000	$15
Flex Req.	2500	N/A

DAM Outputs

Generator	Award Type	Award MW	LMP
Gen 1	Energy	1000	$30
Gen 2	Energy	6500	
Gen 3	Energy	2500	
Gen 3	Flex	2500	

Generator	Award	MW	$ per MW	Settlement
Gen 1	Energy	1000	$30	$30,000
Gen 2	Energy	6500	$30	$195,000
Gen 3	Energy	2500	$30	$75,000
Gen 3	Flex	2500	Flex Price	$X
Gen 4		0		-
Gen 5		0		-
Total (w/out Flex)		10000		$300,000

Load	MW	$ per MW	Settlement
Load 1	5000	$30	-$150,000
Load 2	4000	$30	-$120,000
Load 3	1000	$30	-$30,000
Total:	10,000	$30	-$300,000*

*Plus allocation of flex product cost

Note: All MWs (including “self-schedules”) are settled in the market

RUC "Settlement"

DA RUC Inputs

Generator	Offer	Min MW	Max MW	$	DAM Award
Gen 1	"Self-Schedule"	0	1000	N/A	1000 MW (EN)
Gen 2	Range	1500	6500	$25	6500 MW (EN)
Gen 3	Range	0	5500	$30	2500 MW (EN) 2500 MW (Flex)
Gen 4	Range	0	5000	$40	-
Gen 5	Range	0	4000	$50	-

Load	MW
Forecast	12000
Cleared in DAM	10000

DA RUC Outputs

- RUC needs additional 2000 MW
- Commit G4

Generator	Award	MW	$ per MW	Total Load Cost
Gen 1	Energy	1000	$30	$30,000
Gen 2	Energy	6500	$30	$195,000
Gen 3	Energy	2500	$30	$75,000
Gen 3	Flex	2500	Flex Price	$X
Gen 4	Commitment	0		Make Whole*
Gen 5		0		-
Total (w/out Flex)		10000		$300,000

Load	MW	$ per MW	Total Load Cost
Load 1	5000	$30	-$150,000
Load 2	4000	$30	-$120,000
Load 3	1000	$30	-$30,000
Total:	10,000	$30	-$300,000

* Make-Whole dependent on RT Settlement amount

RUC "Settlement" cntd.

ID RUC Input

- G1 has a unit outage, capping its max range at 6000 MW instead of 6500 MW

Generator	Offer	Min MW	Max MW	$	DAM Award
Gen 1	"Self-Schedule"	0	1000	N/A	1000 MW (EN)
Gen 2	Range	1500	6000	$25	6500 MW (EN)
Gen 3	Range	0	5500	$30	2500 MW (EN) 2500 MW (Flex)
Gen 4	Range	0	5000	$40	-
Gen 5	Range	0	4000	$50	-

ID RUC Output

- Rolling RUC needs additional 500 MW
- G4 still has unawarded offer range – no additional commitment necessary

No change (no additional commitments)

Generator	Award	MW	$ per MW	Total Load Cost
Gen 1	Energy	1000	$30	$30,000
Gen 2	Energy	6500	$30	$195,000
Gen 3	Energy	2500	$30	$75,000
Gen 3	Flex	2500	Flex Price	$X
Gen 4	Commitment	0		Make Whole
Gen 5		0		-
Total (w/out Flex)		10000		$300,000

Load	MW	$ per MW	Total Load Cost
Load 1	5000	$30	-$150,000
Load 2	4000	$30	-$120,000
Load 3	1000	$30	-$30,000
Total:	10,000	$30	-$300,000

Real Time Settlement

RTBM Inputs

Generator	Offer	Min MW	Max MW	$	DAM Award
Gen 1	"Self-Schedule"	0	1000	N/A	1000 MW (EN)
Gen 2	Range	1500	6000	$25	6500 MW (EN)
Gen 3	Range	0	5500	$30	2500 MW (EN) 2500 MW (Flex)
Gen 4	Range	0	5000	$40	RUC: Committed
Gen 5	Range	0	1000	$50	-

Load	MW	DA Cleared
Load 1	6100	5000
Load 2	3900	4000
Load 3	3000	1000
Total	13000	10000

RTBM Outputs

Gen Dispatch	MW	LMP
Gen 1	1000	$40
Gen 2	6000	
Gen 3	5500	
Gen 4	500	

- RT Settlement is Incremental to DA Settlement
  - Done on a 5-minute granularity, so for this example assume gen/load/LMP was flat for the hour

Generator	Day Ahead Award (MW)	Real Time Output* (MW)	Incremental Dispatch (MW)	$ per MW	Settlement
Gen 1	1000	1000	0	$40	$0
Gen 2	6500	6000	-500	$40	-$20,000
Gen 3	2500	5500	3000	$40	$120,000
Gen 4	0	500	500	$40	$20,000**
Gen 5	0	0	0		-
Total	10000	13000	3000	$40	$120,000

Load	Day Ahead Clear (MW)	Real Time Actual (MW)	Incremental Load (MW)	$ per MW	Settlement
Load 1	5000	6100	1100	$40	$44,000
Load 2	4000	3900	-100	$40	-$4,000
Load 3	1000	3000	2000	$40	$80,000
Total:	10,000	13,000	3,000	$40	$120,000**

*Assume all 4 generators generated to their RT awards.

** Gen 4 is eligible for a make-whole payment if start-up/no-load costs were more than $20,000. If so, Load would receive an uplift charge to cover the make-whole payment

Net Market Settlement

Gen	Award	MW	$/MW	Settlement
Gen 1	En	1000	$30	$30,000
Gen 2	En	6500	$30	$195,000
Gen 3	En	2500	$30	$75,000
Gen 3	Flex	2500	Flex Price	$X
Gen 4		0		-
Gen 5		0		-
Total (no Flex)		10000		$300,000

Load	MW	$/MW	Settlement
Load 1	5000	$30	-$150,000
Load 2	4000	$30	-$120,000
Load 3	1000	$30	-$30,000
Total:	10,000	$30	-$300,000*

Gen	DA Award (MW)	RT Output (MW)	Incr. Dis. (MW)	$/MW	Settlement
Gen 1	1000	1000	0	$40	$0
Gen 2	6500	6000	-500	$40	-$20,000
Gen 3	2500	5500	3000	$40	$120,000
Gen 4	0	500	500	$40	$20,000**
Gen 5	0	0	0		-
Total	10000	13000	3000	$40	$120,000

Load	DA Clear (MW)	RT Actual (MW)	Incr. Load (MW)	$/MW	Settlement
Load 1	5000	6100	1100	$40	$44,000
Load 2	4000	3900	-100	$40	-$4,000
Load 3	1000	3000	2000	$40	$80,000
Total:	10,000	13,000	3,000	$40	$120,000**

Gen	DA Settlement	RT Settlement	Net	$/MW
Gen 1	$30,000	$0	$30,000	$30
Gen 2	$195,000	-$20,000	$175,000	$29.2
Gen 3	$75,000*	$120,000	$195,000*	$35.5
Gen 4	$0	$20,000	$20,000	$40
Gen 5	$0	$0	$0	
Total	$300,000	$120,000	$420,000	$32.3

Load	DA Settlement	RT Settlement	Net	$/MW
Load 1	-$150,000	-$44,000	-$194,000	$31.8
Load 2	-$120,000	$4,000	-$116,000	$29.7
Load 3	-$30,000	-$80,000	-$110,000	$36.7
Total:	-$300,000*	-$120,000	-$420,000* **	$32.3

*Gen 3 will receive additional $X based on flex price, and load will receive an allocation of the flex product cost

** Gen 4 is eligible for a make-whole payment if start-up/no-load costs were more than $20,000. If so, load would receive an uplift charge to cover the make-whole payment

Net Market Settlement cntd.

Gen	DA Settlement	RT Settlement	Net	$/MW
Gen 1	$30,000	$0	$30,000	$30
Gen 2	$195,000	-$20,000	$175,000	$29.2
Gen 3	$75,000*	$120,000	$195,000*	$35.5
Gen 4	$0	$20,000	$20,000	$40
Gen 5	$0	$0	$0	
Total	$300,000	$120,000	$420,000	$32.3

Load	DA Settlement	RT Settlement	Net	$/MW
Load 1	-$150,000	-$44,000	-$194,000	$31.8
Load 2	-$120,000	$4,000	-$116,000	$29.7
Load 3	-$30,000	-$80,000	-$110,000	$36.7
Total:	-$300,000*	-$120,000	-$420,000* **	$32.3

*Gen 3 will receive additional $X based on flex price, and load will receive an allocation of the flex product cost

** Gen 4 is eligible for a make-whole payment if start-up/no-load costs were more than $20,000. If so, load would receive an uplift charge to cover the make-whole payment

Points of note:

- A significant driver in scenario outcomes is whether prices in RT are higher or lower than DA.
  - For example, in this scenario, load saved money by procuring more of their energy in DA because DA prices were lower than RT.
    - Note that these are somewhat dependent upon the interaction of gen and load bids and offers, particularly in this simplified example. E.g. if L3 had bid higher in DA, G4 may have been used in DAM run and price would have been $40 anyway
  - The trade-off between certainty in DA vs. pushing some load to RT will be driven mainly by an entity's risk profile, but also by price forecasting and expectations of load forecasts. Virtual transactions (when enabled) will drive convergence between DA and RT prices and can be an incentivize load to bid into DA.
- Another significant variable is your opportunity cost and how that informs offer curves
  - In this scenario, G1 chooses to self-schedule. But if G1 had an opportunity cost above $30/MWh, they would be better optimized to only "self-schedule" their minimum generational needs (e.g. must-run MWs for hydro) and indicate their opportunity cost to the market for any remaining generation via their offer curve. For example, maybe 500 MW of G1 was required to run, and the remaining 500 MW could have been offered as price sensitive, reflecting the opportunity cost of the resource.
- This settlement example is simplified. It (mostly) does not reflect start-up/no-load/fast-start pricing, uplifts, MTU, RTBM uncertainty product, GHG pricing programs, congestion rents, etc.

Layer on Market Participation Structure and Sufficiency

What is a Market Participant ("MP")?

- Markets+ Tariff Definition: An entity that **executes the Market Participant Agreement** in Attachment E, or on whose behalf an unexecuted Market Participant Agreement has been filed at FERC.
- More generally: an entity that is directly participating in the market, usually by virtue of **having load and/or generation** in the market footprint **or by otherwise participating and receiving settlements** from the Market Operator in the market (e.g. virtual bidding). Each MP will have various requirements for participation based on their unique set up.
- For example, we would expect:
  - BPA Power would be the MP representing federal resources and Load Following load
  - Planned Product customers would be the MP representing their load and their owned non-fed generation
  - IPP generators in the BPA BAA would be their own MP

How is sufficiency assessed in M+?

- One of the **requirements associated with MPs** who are Load Responsible Entities (LREs) and MPs who have export obligations is **to demonstrate sufficient resources** to support those loads/obligations.
- Resource Adequacy: LREs must be participants in the Western Resource Adequacy Program (WRAP)
- Resource Sufficiency: Must-Offer Obligation ("MOO") - A minimum requirement for each MP with load and/or export obligations to bring enough supply to "cover" those obligations

How is sufficiency assessed in M+?

- DAM/DA RUC MOO Equation:

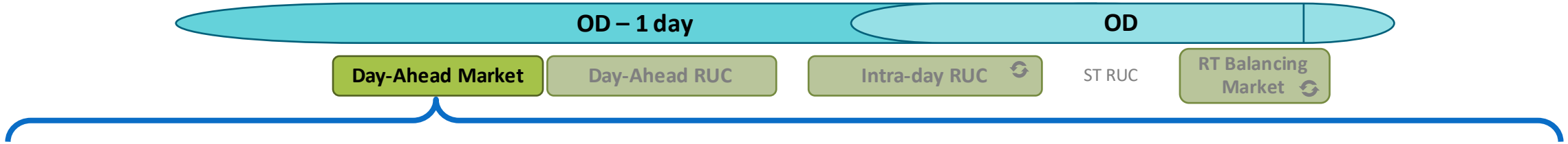
  DA Load Forecast + Allocated Upward Uncertainty +/- Sales/Purchases +/- WRAP Ops Requirement

- RTBM MOO Equation:

  DA Awards (Energy and Flex) +/- post-DAM Bilateral Sales/Purchases +/- WRAP Ops Requirement

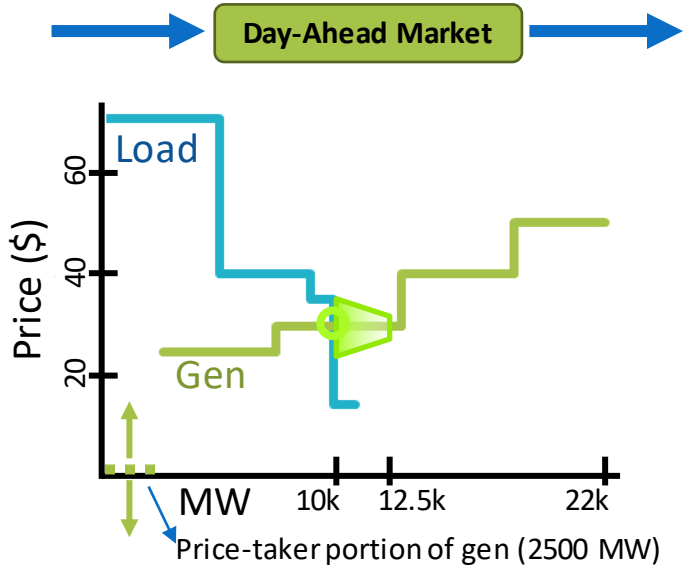
- Failure consequence: In Markets+, a financial penalty is applied for failure to meet the MOO. No limitations to participation are applied.

So now what does our example look like…?



DAM Inputs

- Generation Offers/"Self-schedules"
- Load Bids
- MO-Calculated Flex Reserve Requirement
- Transmission Capability



DAM Outputs

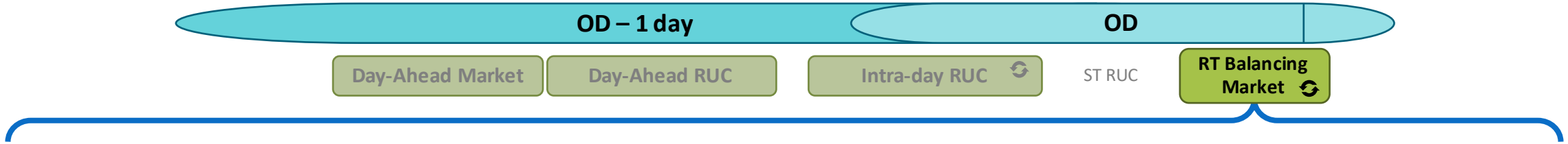
- 24 Hourly Energy Awards – sum to cleared load bids
- Associated Hourly Energy Prices (LMP)
- 24 Hourly Flex Reserve Awards – sum to Flex Reserve Requirement
- Associated Hourly Flexibility Reserve Prices
- Expected Tx Flows

MP	Load Forecast	Flex Product Allocation	DA MOO	Gen Offer Range	Gen Offer Price	Load Bids	Load Bid Price
MP A	5300	1200	5300 + 1200 + 3800 = 10300	G2: 1500-6500 G5: 0-4000	$25 $50	L1: 5000	$70
MP B	4000	800	4000 + 800 + -3800 = 1000	G1: 1000 (self-sch) Contract with MP A*: 3800	N/A N/A	L2: 4000	$40
MP C	2700	500	2700 + 500 = 3200	G4: 0-5000	$40	L3: 1000 1000	$35 $15
MP D	N/A	N/A	0	G3: 0-5500	$30	N/A	N/A
Total	12000	2500	14500	2500 - 22000			

*Assume that MP A and MP B have indicated to the market that a contract exists in order to shift the MOO obligation, and this contract is settled bilaterally outside of the market

Gen	Award Type	Award MW	LMP
Gen 1	Energy	1000	$30
Gen 2	Energy	6500	
Gen 3	Energy	2500	
Gen 3	Flex	2500	

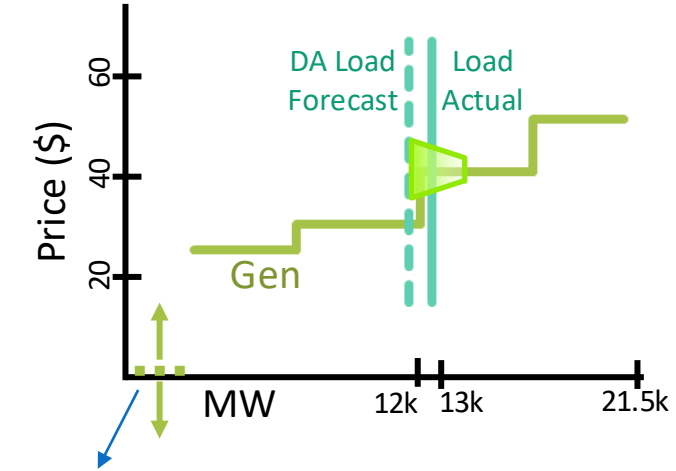
Load clears to 10,000 MW



RTBM Inputs
- DAM/RUC Outputs
- Real-time Load Consumption
- Real-time VER output
- Generation Offers/"Self-schedules"
- Transmission Capability

RTBM Outputs
- 5-minute Energy Award
  - Physical Generation
- 5-minute Real-time LMP
  - Settlement is incremental to DA award

MP	RT MOO	Gen Offer Range	Gen Offer Price	Load Actual
MP A	6500	G2: 1500-6500 G5: 0-4000	$25 $50	L1: 6100
MP B	1000	G1: 1000 (self-sch)	N/A	L2: 3900
MP C	Min Gen Per RUC Commitment	G4: 0-5000	$40	L3: 3000
MP D	2500 (En) 2500 (Flex)	G3: 0-5500	$30	N/A
Total	10000 + G4 commit (En)* 2500 (Flex)	2500 - 22000		13000



Gen Dispatch	MW	LMP
Gen 1	1000	$40
Gen 2	6000	
Gen 3	5500	
Gen 4	500	

*Note that the DA RUC saw the full 0-5500 offer range from G4 as available. If G4 adjusted its offer range in a subsequent RUC or for the RTBM, the market optimization would have looked for other available capacity to commit/dispatch.

Net Market Settlement by MP

	MP	Price	Gen Award	Gen Settlement	Load Cleared	Load Settlement	Day Ahead Net Settlement
DA	MP A	$30	G2: 6500 G5: 0	$195,000	L1: 5000	($150,000)	$45,000
	MP B	$30	G1: 1000	$30,000	L2: 4000	($120,000)	($90,000)
	MP C	$30	G4: 0	-	L3: 1000	($30,000)	($30,000)
	MP D	En: $30	G3 En: 2500	$75,000	-	-	$75,000 + $X
		Flex: Flex Price	G3 Flex: 2500	$X			
	Total*			$300,000		($300,000)	$0

*Gen 3 will receive additional $X based on flex price, and load will receive an allocation of the flex product cost

** Gen 4 is eligible for a make-whole payment if start-up/no-load costs were more than $20,000. If so, load would receive an uplift charge to cover the make-whole payment

	MP	Price	Gen Incremental Dispatch	Gen Settlement	Incremental Load	Load Settlement	RT Net Settlement
RT	MP A	$40	G2: (6000-6500) = -500 G5: 0	($20,000)	L1: (6100-5000) = 1100	($44,000)	($64,000)
	MP B	$40	G1: (1000-1000) = 0	$0	L2: (3900-4000) = -100	$4,000	$4,000
	MP C	$40	G4: (500-0) = 500	$20,000**	L3: (3000-1000) = 2000	($80,000)	($60,000)
	MP D	$40	G3: (5500-2500) = 3000	$120,000	-	-	$120,000
	Total**	-	-	$120,000	-	($120,000)	$0

	MP	DA Gen Settlement	RT Gen Settlement	Net Gen Settlement	DA Load Settlement	RT Load Settlement	Net Load Settlement	Net Net Settlement
Net	MP A	G2: $195,000, G5: 0	G2: -$20,000 G5: 0	$175,000	L1: -$150,000	L1: -$44,000	($194,000)	($19,000)
	MP B	G1: $30,000	-	$30,000	L2: -$120,000	L2: $4,000	($116,000)	($86,000)
	MP C	-	G4: $20,000	$20,000	L3: -$30,000	L3: -$80,000	($110,000)	($90,000)
	MP D	G3: $75,000 + $X	G3: $120,000	$195,000	-	-	-	$195,000
	Total	$300,000	$120,000	$420,000	($300,000)	($120,000)	($420,000)	$0

Net Market Settlement by MP

	MP	DA Gen Settlement	RT Gen Settlement	Net Gen Settlement	DA Load Settlement	RT Load Settlement	Net Load Settlement	Net Net Settlement
Net	MP A	G2: $195,000, G5: 0	G2: -$20,000 G5: 0	$175,000	L1: -$150,000	L1: -$44,000	($194,000)	($19,000)
	MP B	G1: $30,000	-	$30,000	L2: -$120,000	L2: $4,000	($116,000)	($86,000)
	MP C	-	G4: $20,000	$20,000	L3: -$30,000	L3: -$80,000	($110,000)	($90,000)
	MP D	G3: $75,000 + $X	G3: $120,000	$195,000	-	-	-	$195,000
	Total	$300,000	$120,000	$420,000	($300,000)	($120,000)	($420,000)	$0

*Gen 3 will receive additional $X based on flex price, and load will receive an allocation of the flex product cost

** Gen 4 is eligible for a make-whole payment if start-up/no-load costs were more than $20,000. If so, load would receive an uplift charge to cover the make-whole payment

Additional points of note:

- Again, opportunity cost is important. In this scenario, MP A was able to avoid spending $50/MW to run G5 to serve its load obligation (L1 and the contracted portion of L2). With the LMP at $40, MP A saves $10/MW for every MW they are able to purchase from the market instead of serving with G5. Thus, while on net they are paying money to the market, that choice saved them money in absolute terms, given the cost to run G5 was higher than the price paid to serve load.
- Note that from the Market Operator perspective, all DA and RT settlements sum to $0. This represents the concept of “revenue neutrality”; the Market Operator does not keep or give money across time (besides administrative fees). All money allocated out to MPs must be paid via charges to other MPs.

Roles/Responsibilities

What if I'm a…. Load/LRE?

Pre-Market

- Participate in WRAP Forward Showing and Ops Program
- Register Load
- Register Transmission (participating and/or opt-in) for market use and for Congestion Rent eligibility
- Tag known imports prior to 10 AM

Markets

- DA MOO Demonstration
- DA Bid Submission*
  - 24 hourly bid ranges and associated price curves for load
- No direct real-time role; all actual load consuming in real-time will be served regardless of DA bid price

Settlements

- Receive Settlements from Market Operator

Note: If a load is represented by an MP but is not the MP themselves, much of this may be taken care of by that MP

*In SPP markets, the term "bid" is usually used for load and "offer" is used for generation

What if I'm a…. Generator?

Pre-Market

- Generator Registration
- Transmission Registration for Congestion Rent
- Tag known exports prior to 10 AM

Markets

- DA Offer Submission*
  - 24 hourly offer ranges for each resource or ORA
    - Hourly Minimum Generation
    - Hourly Maximum Generation
    - Associated Price Curve
  - Daily Energy Maximum (hydro/storage)
  - And more!
- Intra-Day Updates
- RT MOO / RT Offer Submission
- Generate!

Settlements

- Receive Settlements from Market Operator

*In SPP markets, the term "bid" is usually used for load and "offer" is used for generation

What if I'm a…. Planned Product Customer?

- In the Markets+ footprint, we would expect Planned Product customers would:
  - be LRE/MP of their load (see Load slide)
  - control their customer-owned non-federal generation (see Gen slide)
  - need reflection of contracted gen (including Slice and Block) for MOO
    - Determination of how Slice will operate in a DAM will ultimately be determined in the Provider of Choice process and subsequent rate/tariff cases
- Outside the Markets+ footprint
  - More to come

What if I'm a…. Load Following Customer?

- We would expect Load Following customers would:
  - likely NOT be LRE/MP of their load (BPAP would represent LF as a whole)
  - control their customer-owned non-federal generation (see Gen slide)
    - BUT there may be restrictions/requirements in their use in the market as determined as part of the Provider of Choice process

What if I'm…. BPA Power?

- We expect BPA Power would be the LRE for all load following customers
- BPA Power would be responsible for all federal resource participation in the market

Questions?

Closeout and Q&A

Wrap Up

- Please submit comments on this workshop by June 8th
- Please send comments to techforum@bpa.gov (with "DAM Participation Evaluation" in the subject heading)
  - All formal feedback received will be posted to the BPA.gov page for BPA's DAM Participation Evaluation