

EIM Stakeholder Meeting

June 12, 2019
1pm – 4pm
Rates Hearing Room



For our WebEx and phone participants:

- We have muted all calls on entry, if you have a question, you will need to unmute by using *6. Then please identify yourself by name and let us know who you represent.
- Please do not put this call on hold OR take other calls while you are dialed into this one.
- If we identify a noisy line, you may be disconnected from the meeting.

Agenda

1:00-1:05

- Welcome, Safety Moment, Introductions

1:05 – 1:20

- Review of BPAs EIM Principles, EIM Process, Timeline

1:20- 2:30

- Cost Benefit Analysis Update

2:30 – 3:40

- Letter to the Region: EIM Issues Review

3:40 – 4pm

- Next Steps, Q&A

Statement of BPA's Principles:

1. Participation is consistent with statutory, regulatory, and contractual obligations.
2. Maintain reliable delivery of power and transmission to our customers.
3. Resource participation in the EIM is and always will be voluntary.
4. BPA's decision to participate in the EIM will be based on a sound business rationale.

If BPA signs the EIM Implementation Agreement it would obligate BPA to begin spending on EIM implementation projects with the CAISO and signals BPA's intent to join the EIM as long as BPA's EIM principles continue to be met. However, it does not bind BPA to join the EIM.

Market Context

- A well designed electricity market is built on a foundation of resource adequacy and has features that:
 - Provide for intra-hour energy balancing
 - Compensate explicitly for capacity resources that provide system reliability and flexibility
- BPA views the EIM as *one piece* of a well-designed market
 - Additional market functions are required to fully compensate BPA for the capacity value of the flexible and carbon-free federal power system
- BPA will continue to work with CAISO and stakeholders to enhance regional resource adequacy by ensuring that flexible resources are appropriately compensated for the services that they provide

Timeline Leading up to the ROD

Agendas for previous and future monthly EIM Stakeholder meetings:

July 24	•Grid Modernization Overview, Strategic Plan Connection, Intro to 8 Issues BPA is Reviewing, Initial Cost Benefit Analysis
September 13	•EIM 101
October 11	•Process Plan, Transmission, Generation, Governance
November 14	•Process Plan, Market Power
December 18	•Settlements, Non-Federal Generation Participation
January 16	•Resource Sufficiency, Emerging Markets
February 20	•Base Case Structured Scenario, Market Mitigation
March 13	•EIM Issues and Venues, Oversupply Management Protocol, Settlements, Structured Scenario
April 10	•Carbon in the EIM, Cost Benefit Analysis Status Update, Structured Scenario
May 15	•Cost Benefit Analysis
June 12	•Cost Benefit Analysis Update, EIM Issues Summary Review
Week of June 17	•Start of 30 day public comment period for Letter to the Region
July 8	•Clarifying Question & Answer session on the Letter to the Region
August	•BPA drafts Record of Decision (ROD)
September	•Final ROD for signing the EIM Implementation Agreement

EIM Decision Process

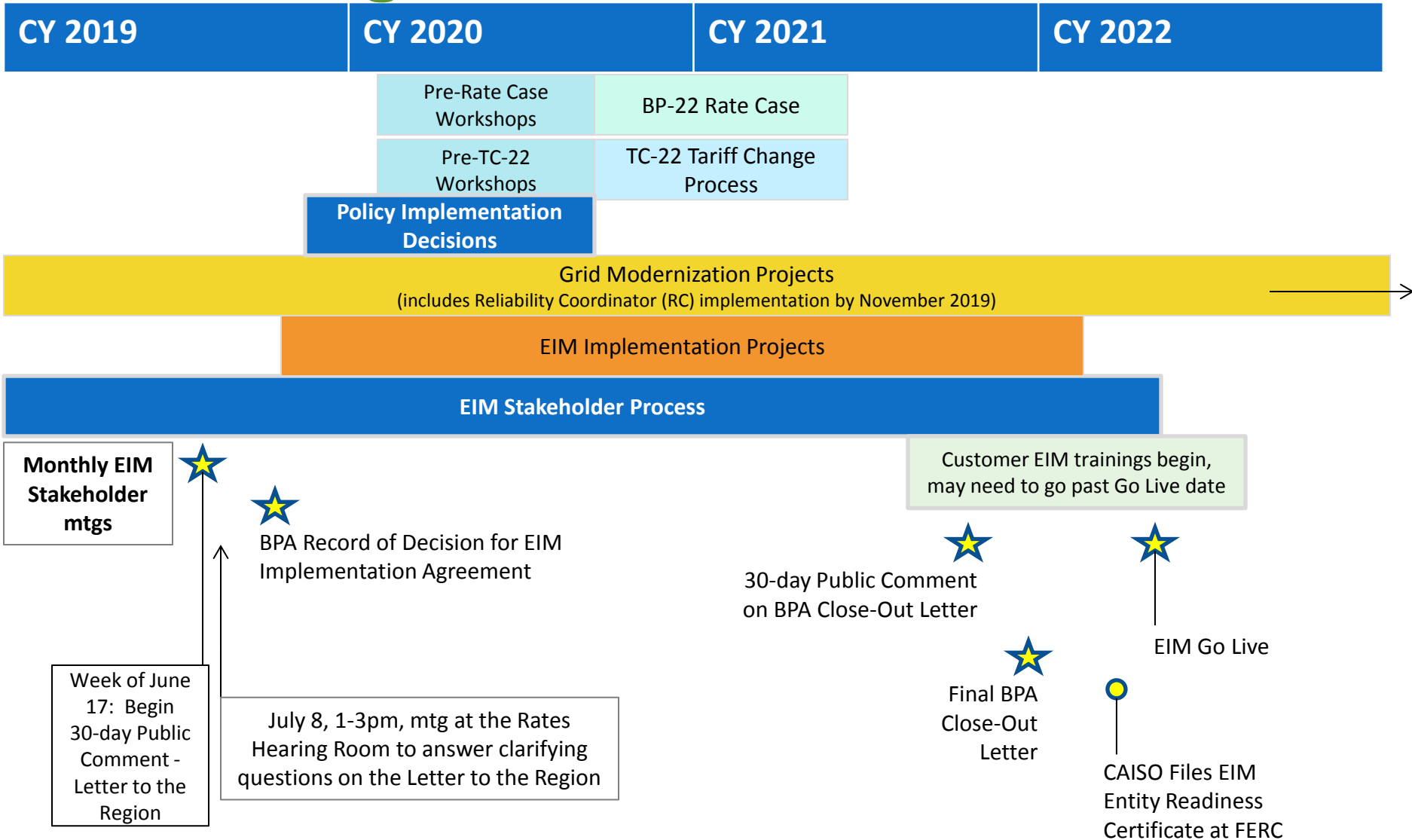
1. Letter to Region and Record of Decision June 2019 – September 2019
 - Solicit stakeholder feedback on: Draft Implementation Agreement, Cost Benefit Analysis, Legal considerations, Roadmap of process/issues, Proposed Decisions on Certain Policy Issues, Principles for Joining
 - 30-day comment period
 - Final decision to sign Implementation Agreement, and on other items covered in Letter to Region

2. Policy Implementation Decisions October 2019 – August 2020
 - Discuss all remaining policy issues with stakeholders.
 - Provide written proposal, solicit written stakeholder comment, and make final written decision(s) on policy issues
 - Final decisions on these policy issues

3. BP-22 and TC-22 Cases October 2020 – July 2021
 - Settlement discussions August – October 2020
 - Follow 7(i) process and conclude with ROD / final decision

4. Draft and Final Close-Out Letters October 2021 – December 2021
 - Draft Close-Out Letter addressing: principles for joining the EIM, any additional policy issues that have arisen, propose final decision whether to join the EIM, and incorporate final decisions made in steps 1 and 2 above.
 - 30-day comment period
 - Final Close-Out Letter: Address comments raised, Final Decision whether to join EIM, if decision is to join - move forward to sign relevant EIM Agreements

BPA's High Level EIM Timeline

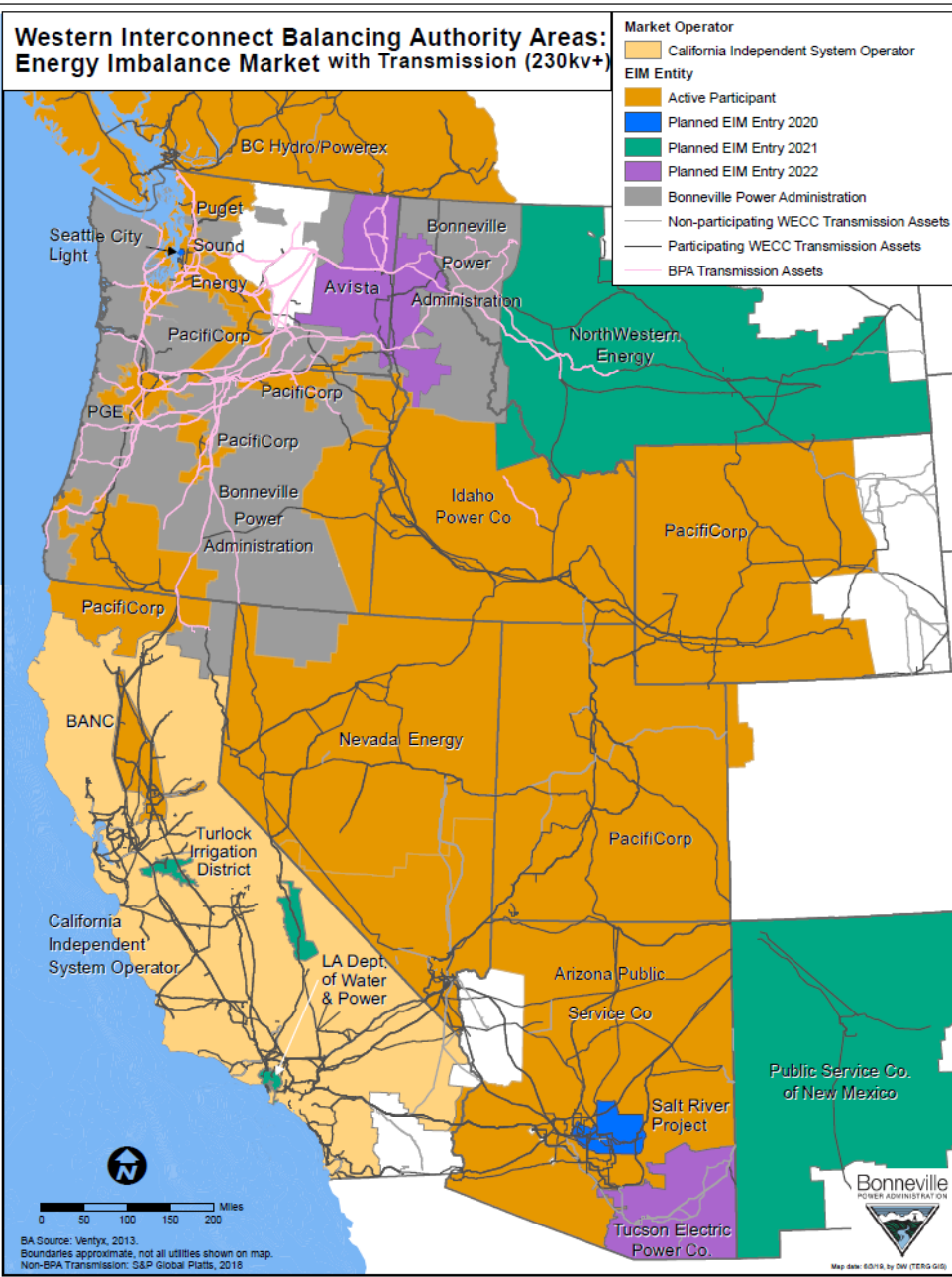


EIM Issues and Venues

Legend:
 F = Final Decision
 I = Implementation

This shows BPA's current thinking but the matrix will evolve over time

Issue	Letter to Region / ROD (July 2019 – September 2019)	Policy Implementation Decisions (October 2019 – August 2020)	TC-22 Tariff Terms & Conditions Case (October 2020 – July 2021)	BP-22 Rate Case (October 2020 – July 2021)	Close-Out Letter (October 2021 – December 2021)
BPA's EIM Principles Development / Evaluation	F – Development	I	I	I	F – Evaluation of the issues against the principles
Statutory Authority for Joining the EIM	F				Confirm consistency with the principles. Final action regarding decision to join.
EIM Impacts on BPA Contractual Commitments	F				
NEPA and Environmental Obligations	F				
EIM Governance	F				
Cost Benefit Analysis	F				
Carbon Obligations	F				
Market Power (LMPM, DEB)	F				
Oversupply Management Protocol	F				
OCBR and other Reliability Tools	F				
Federal Generation Participation Plan	F				
Load Zone (LAP)	F		I	I	
Resource Sufficiency – BAA Level	F				
Transmission – Interchange	F		I	I	
Transmission – Network		F	I	I	
Allocation of EIM Charge Codes		F		I	
Resource Sufficiency – Sub-BAA Level		F	I	I	
Transmission Losses		F	I	I	
Nonfederal Resource Participation Requirements		F	I	I	
Settlements/Billing (Mechanics)		F	I		
Data Submission Requirements		F	I		
Metering Requirements		F	I		



EIM Entity Map

- Active and planned EIM participants
- BPA shown in grey

EIM Cost Benefit Analysis



Agenda

- Stakeholder Comment Discussion
- EIM Start-up and Ongoing Cost Update
- Net Benefits Summary
- E3 Gross Benefits Sensitivities
- Wrap-Up

Themes of Stakeholder Comments

- Assumptions
 - Reflect alternate NW price nodes
 - Further limit BPA flexibility
 - Alternative success rate
 - Limit BPA's access to EIM market

- Other comments
 - Tracking and forecasting EIM benefits
 - Continue updating EIM Business Case

Stakeholder Questions

- Questions
 - How did the model handle negative prices?
 - The model assumed actual EIM clearing prices and simulated BPA DEC flexibilities whenever prices were sufficiently low and sufficient BPA DEC flexibility existed, subject to energy neutrality.
 - Have benefits for other EIM entities led to rate reductions?
 - Benefits (and costs) are difficult to segregate from other operations so it is difficult to translate participation to rate reductions.
 - CAISO estimates gross benefits quarterly.
 - Impact of various water conditions?
 - Extreme water conditions could marginally decrease benefits by limiting flexibility
 - EIM benefits are subject to less uncertainty than Net Secondary Revenue (illustrated by consistent monthly benefits, despite various hydraulic conditions).
 - Does modeling comply with 1% restrictions that are applicable during fish ops?
 - Yes, all spinning capability and feasible min/max assumptions incorporate 1% restrictions during periods where it is a constraint.

Startup Cost Update

- BPA reviewed (and updated) Utilicast startup cost estimates to incorporate increased EIM-related knowledge within BPA
- The range around startup costs reflects uncertainty in required metering investments
 - If interchange upgrades are ultimately determined to be discretionary, their cost will be excluded

Startup Costs (\$M)

EIM Category	Cost* (\$M)	Labor	Non-Labor
Infrastructure (Metering & AGC Modernization)	\$7.9-\$13.3	\$2.7-\$8.1	\$5.3
Operation (EIM Integrator, Schedule Submission, & Bid Curves)	\$17.2	\$9.8	\$7.4
After-the-Fact (Settlements)	\$4.6	\$3.6	\$1.0
Total	\$29.7-\$35.1	\$16.1-\$21.5	\$13.7

Ongoing Cost Update

- BPA leveraged previous estimates of ongoing costs with an evolving understanding of EIM participation to estimate annual costs
- Ongoing cost estimated increased by \$700k due to more granular estimation of EIM Administrative Charges paid to CAISO

Ongoing Costs (\$M/yr)

EIM Category	Cost* (\$M)
Infrastructure	\$0.0
Operation (Resource Plans, EIM Desk, IT O&M, CAISO Fees)	\$5.7
After-the-Fact (Settlements Staff)	\$1.2
Total	\$6.9

Net Benefit Summary

- Based on stakeholder feedback, BPA requested that E3 complete additional simulations
 - Alternate NW price nodes (PSEI, PACW, PGE)
 - Further sensitivities based on the midpoint of results (PGE)
 - Reduced intra-hour volatility by 50%
 - GHG compliance
 - FRST-only participation
 - No BPA participation beyond what is required to meet resource sufficiency
 - Higher Success Rate (90%)

- **Net Benefits Range: \$29-34M**

Net EIM Benefits (\$M/yr)

	Estimated Net Revenue
Initial Scenario (BPAT Price)	\$42.0
PSEI Price	\$29.2
PACW Price	\$33.5
NW Midpoint/Base Scenario (PGE Price)	\$32.3

Net EIM Benefits Sensitivities (\$M/yr)

	Change in Net Revenue
Reduced Volatility	-\$3.9
GHG Compliance	-\$4.6
FRST-Only Participation	-\$14.8
Higher Success Rate	\$7.9

Benefits Analysis

Initial Modeling

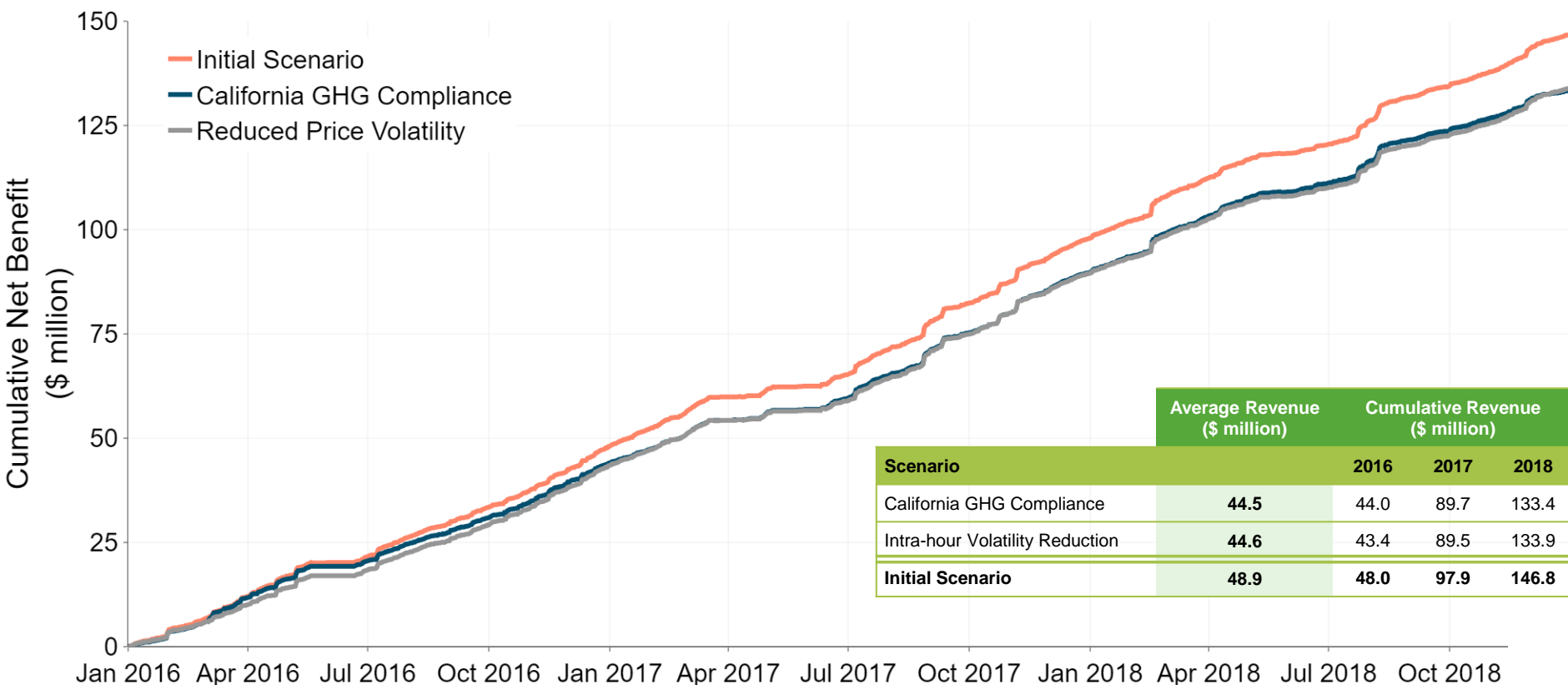


Initial Scenarios Presented

Category	Scenario	Price	BPA Hydro Flexibility
Initial	May 15 th Update	Actual 2016-2018 for DGAP_BPAT-APND	Actual 2016-2018 INC/DEC spinning capability with reserves held
		No marginal GHG applied	Daily hydro energy balance
EIM Price	Reduced Intra-Hour Volatility	DGAP_BPAT-APND prices adjusted to be 50% less volatile within each operating hour	Actual 2016-2018 INC/DEC spinning capability with reserves held Daily hydro energy balance
	California GHG Fee Compliance	Sales are penalized at cost of marginal GHG from historical 2016-2018 EIM prices	Actual 2016-2018 INC/DEC spinning capability with reserves held Daily hydro energy balance



Initial Scenarios Presented at May Stakeholder Meeting

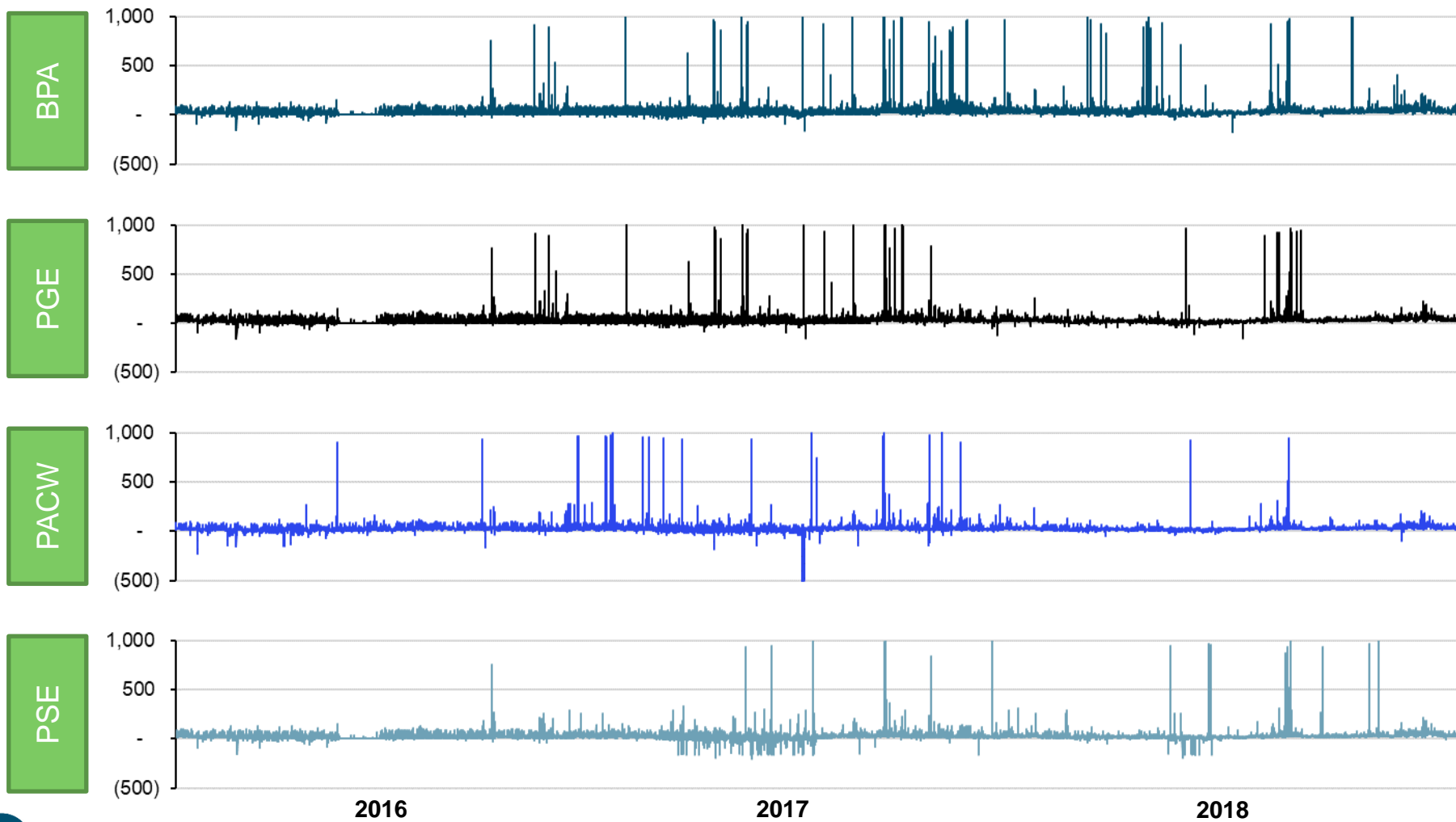


Benefits Analysis

Northwest Prices

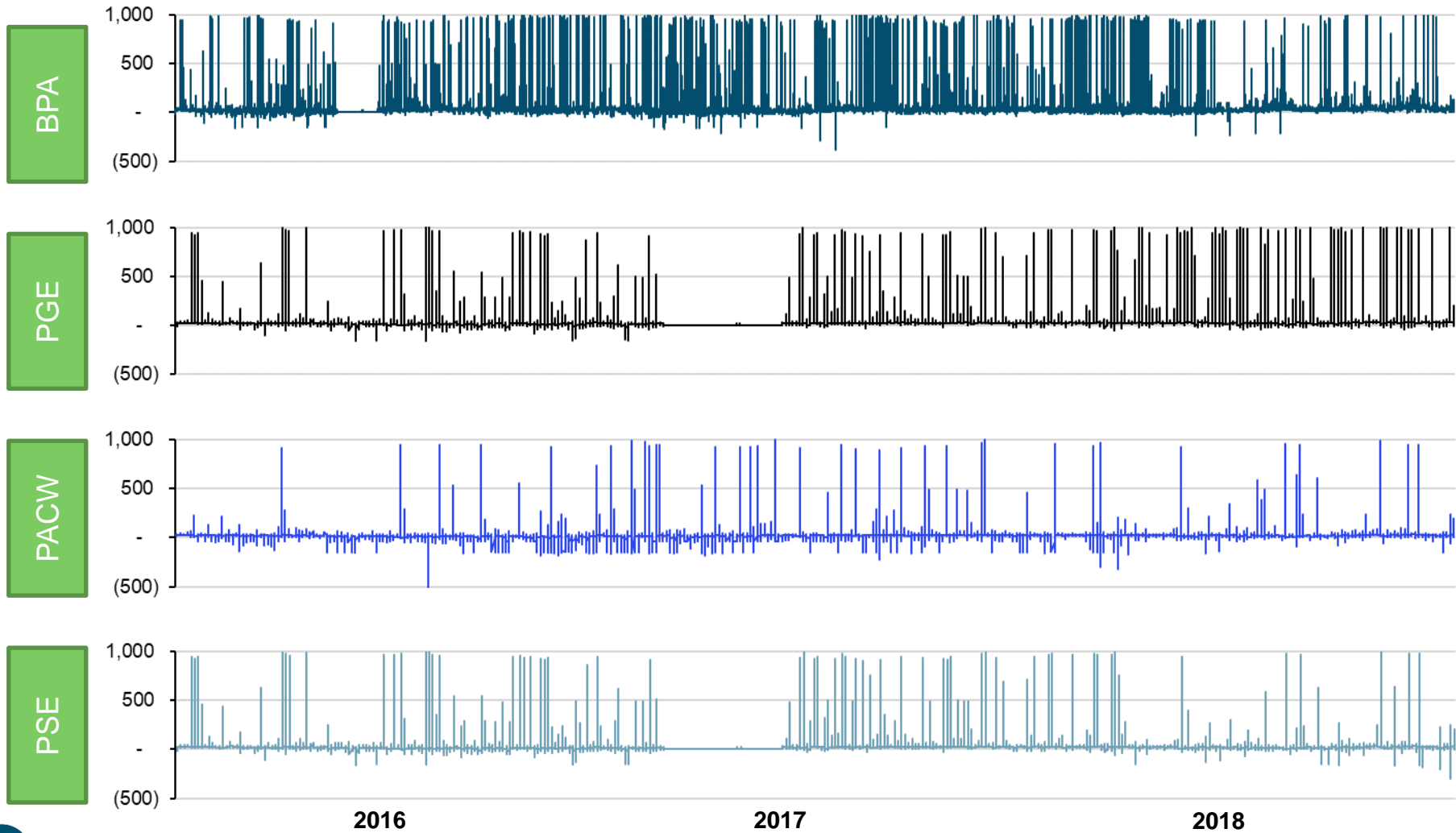


NW Historical 15-Minute EIM Prices*



*Adjusted to remove marginal GHG component

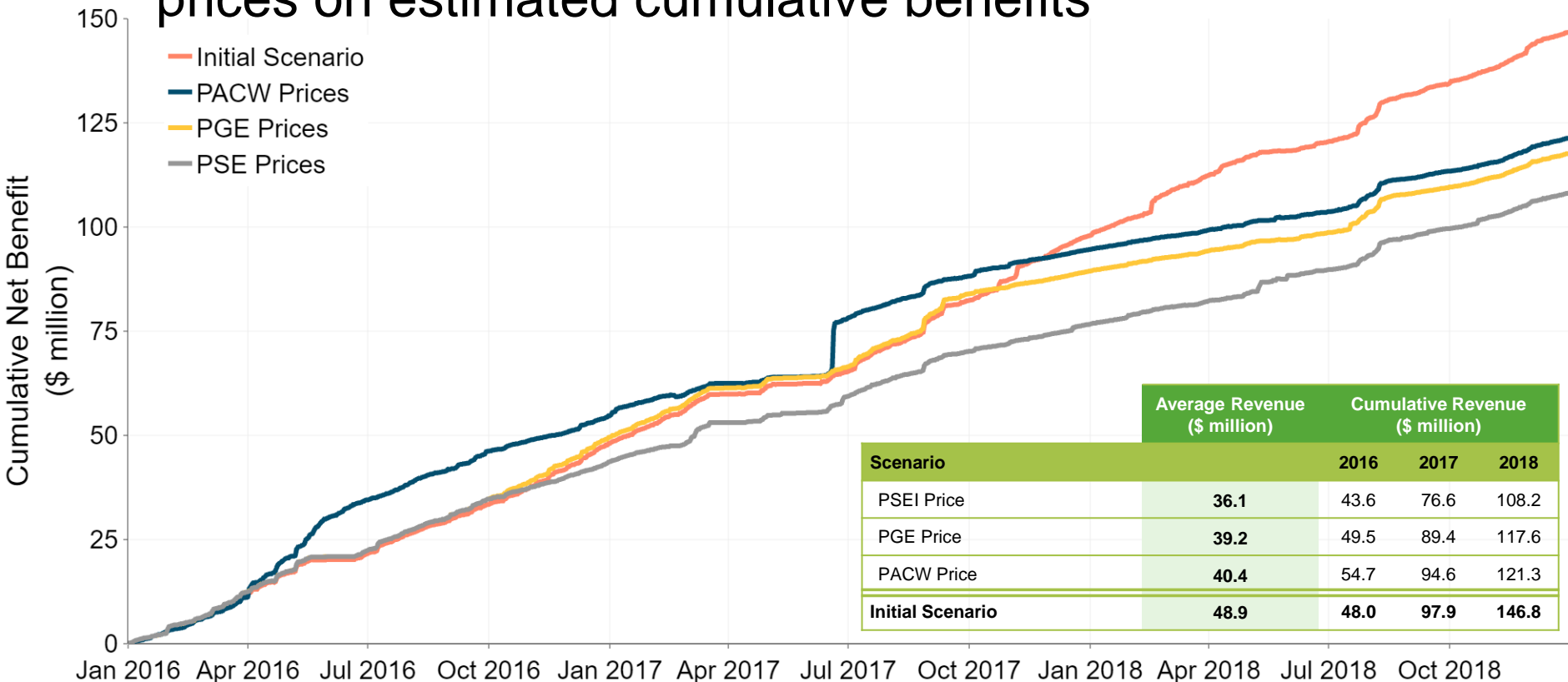
NW Historical 5-Minute EIM Prices*



*Adjusted to remove marginal GHG component

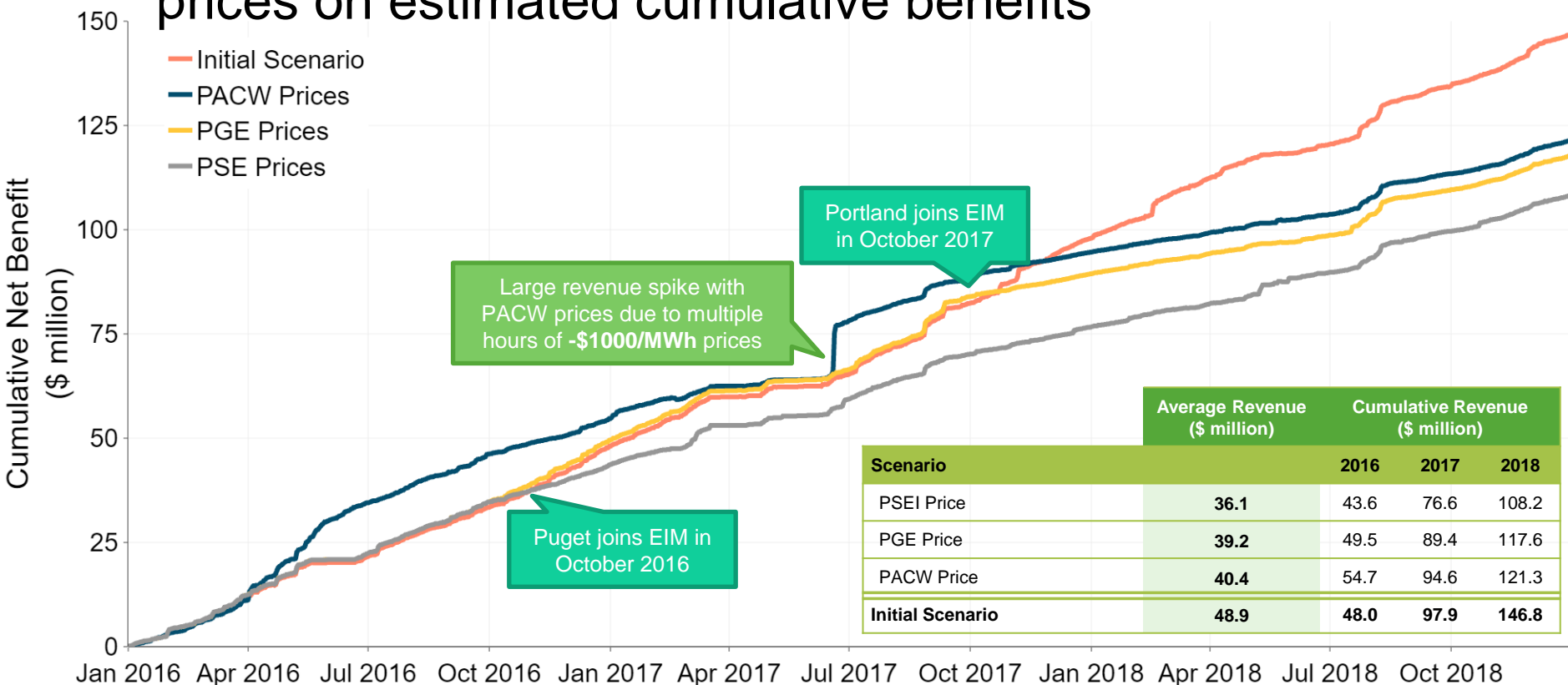
NW Price Scenarios

- Investigated impact of neighboring NW DGAP EIM prices on estimated cumulative benefits



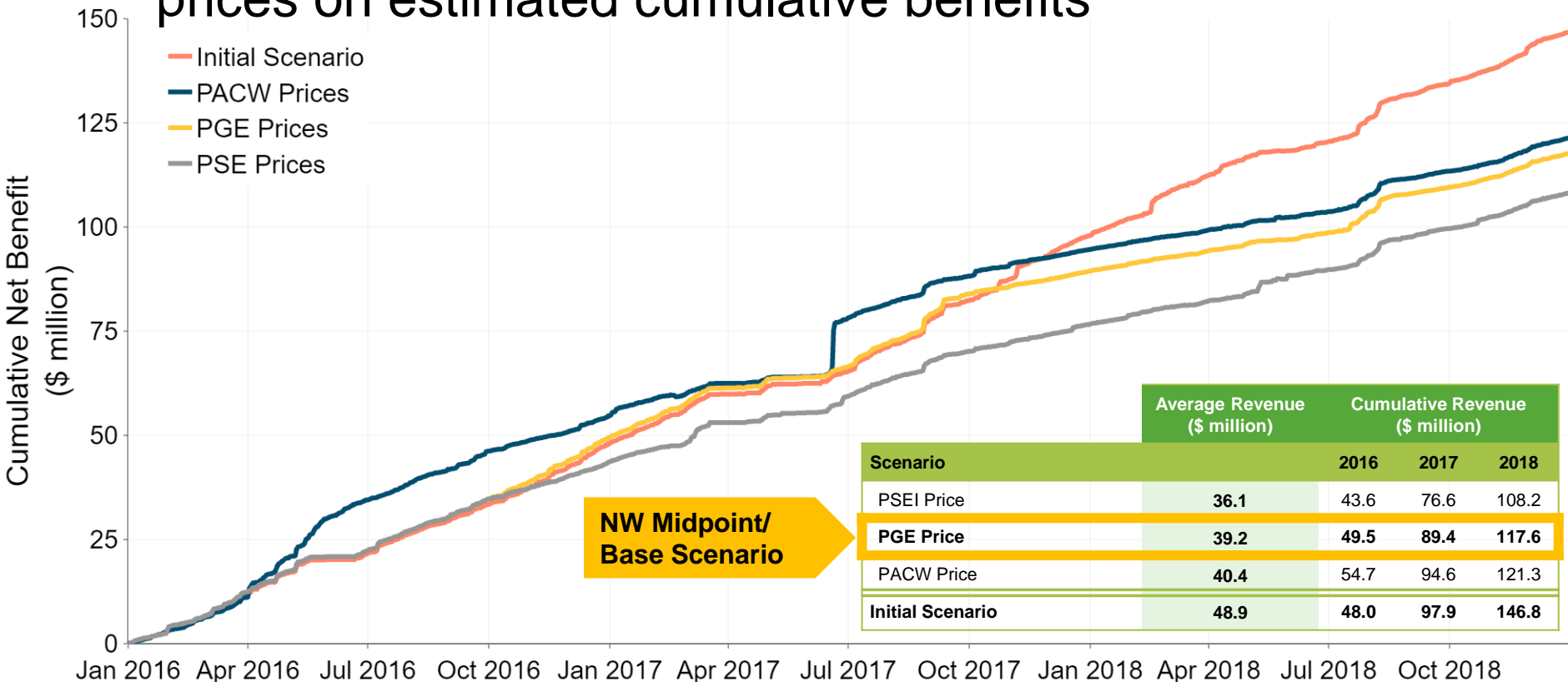
NW Price Scenarios

- Investigated impact of neighboring NW DGAP EIM prices on estimated cumulative benefits



NW Price Scenarios

- Investigated impact of neighboring NW DGAP EIM prices on estimated cumulative benefits



Benefits Analysis

Sensitivity Study



Potential Sensitivities

Sensitivity	NW Midpoint Assumption	More Optimistic	More Conservative
Success Rate	<ul style="list-style-type: none"> 75% 	<ul style="list-style-type: none"> Higher success rate: Better foresight on hydro operations and success in being awarded bids at modeled price 	<ul style="list-style-type: none"> Lower success rate: Hydro is more constrained than expected or bids are not successfully awarded to BPA
Hydro Flexibility	<ul style="list-style-type: none"> Actual “Big 10” Hydro INC/DEC spinning capability Daily hydro energy balance BPA meets FRST in all hours 	<ul style="list-style-type: none"> Use hydro capability beyond spinning capability on “Big 10” Hydro Optimize FCRPS to increase available capability for EIM transactions Allow hydro to be balanced across multiple days 	<ul style="list-style-type: none"> Limiting available spinning capability for EIM participation e.g. no participation beyond what is required for FRST only
EIM Price	<ul style="list-style-type: none"> 2016-2018 PGE prices 	<ul style="list-style-type: none"> Historical DGAP_BPAT-APND prices are more volatile 	<ul style="list-style-type: none"> PSE prices are on average lower and less volatile NW average prices would decrease overall price volatility
EIM Intra-Hour Price Volatility	<ul style="list-style-type: none"> Actual volatility of 2016-2018 PGE prices 	<ul style="list-style-type: none"> Price volatility within the hour will stay the same 	<ul style="list-style-type: none"> Price volatility within the hour is reduced due to higher EIM participation
California GHG Fee	<ul style="list-style-type: none"> No marginal cost of GHG considered in EIM prices 	<ul style="list-style-type: none"> n/a 	<ul style="list-style-type: none"> EIM prices are reduced when increasing generation during intervals of nonzero marginal cost of GHG



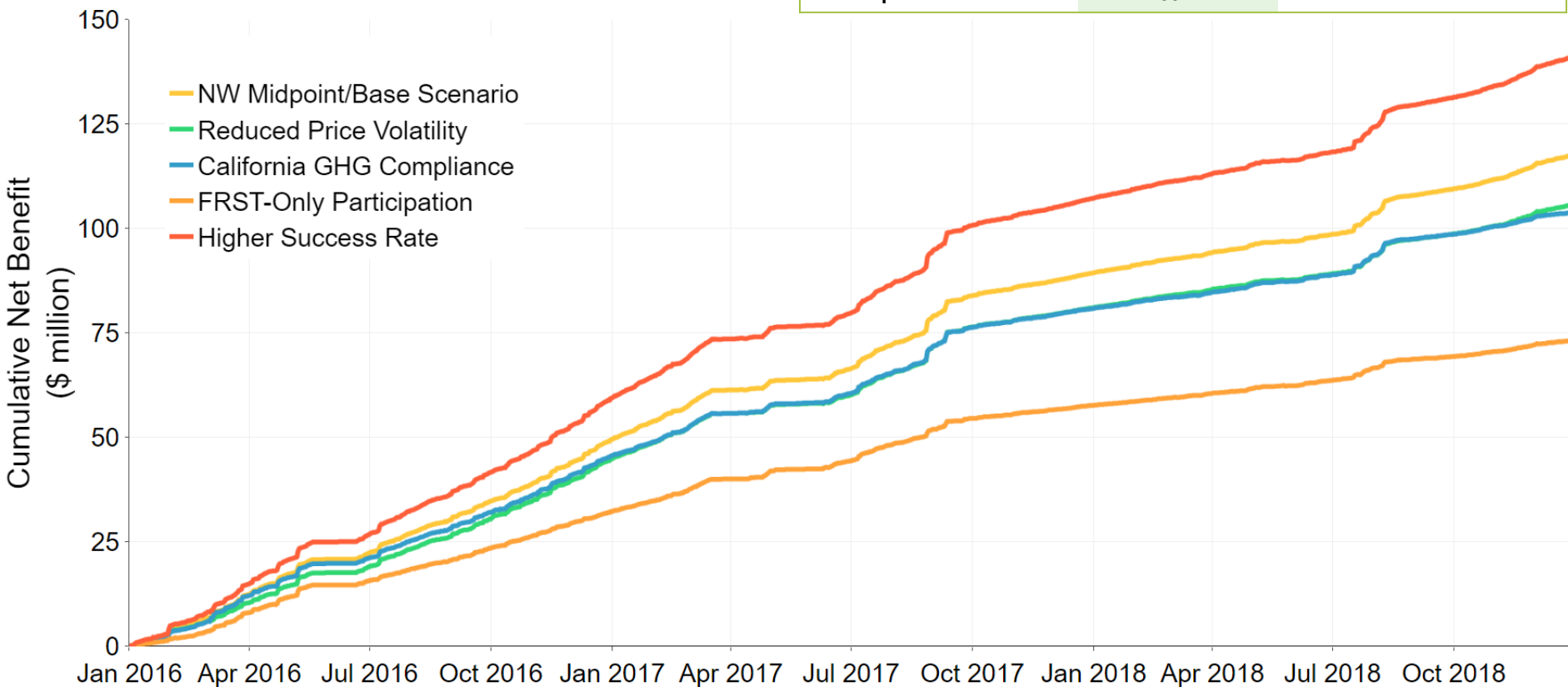
Sensitivities Presented Today

Sensitivity	Price	BPA Hydro Flexibility	Success Rate
NW Midpoint/ Base	Actual 2016-2018 for DGAP_PGE- APND No marginal GHG applied	Actual 2016-2018 INC/DEC spinning capability with reserves held Daily hydro energy balance	75%
Reduced Price Volatility	DGAP_PGE-APND prices adjusted to be 50% less volatile within each operating hour	Actual 2016-2018 INC/DEC spinning capability with reserves held Daily hydro energy balance	75%
California GHG Compliance	EIM prices are reduced when increasing generation during intervals of nonzero marginal cost of GHG	Actual 2016-2018 INC/DEC spinning capability with reserves held Daily hydro energy balance	75%
FRST-Only Participation	Actual 2016-2018 for DGAP_PGE- APND No marginal GHG applied	Limiting hydro flexibility to what is required to meet FRST only Daily hydro energy balance	75%
Higher Success Rate	Actual 2016-2018 for DGAP_PGE- APND No marginal GHG applied	Actual 2016-2018 INC/DEC spinning capability with reserves held Daily hydro energy balance	90%



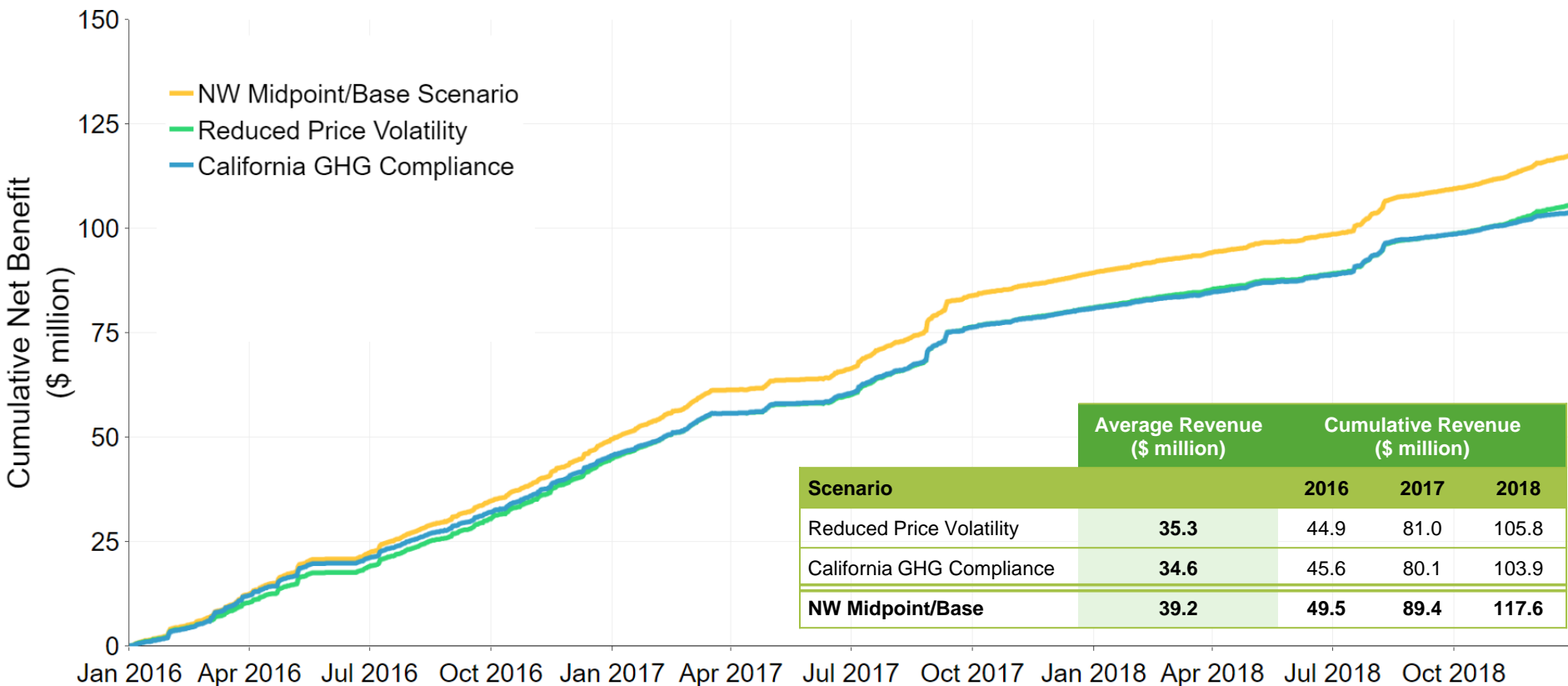
Sensitivities

Scenario	Average Revenue (\$ million)	Cumulative Revenue (\$ million)		
		2016	2017	2018
Reduced Price Volatility	35.3	44.9	81.0	105.8
California GHG Compliance	34.6	45.6	80.1	103.9
FRST-Only Participation	24.4	32.3	57.7	73.3
Higher Success Rate	47.1	59.4	107.2	141.2
NW Midpoint/Base	39.2	49.5	89.4	117.6



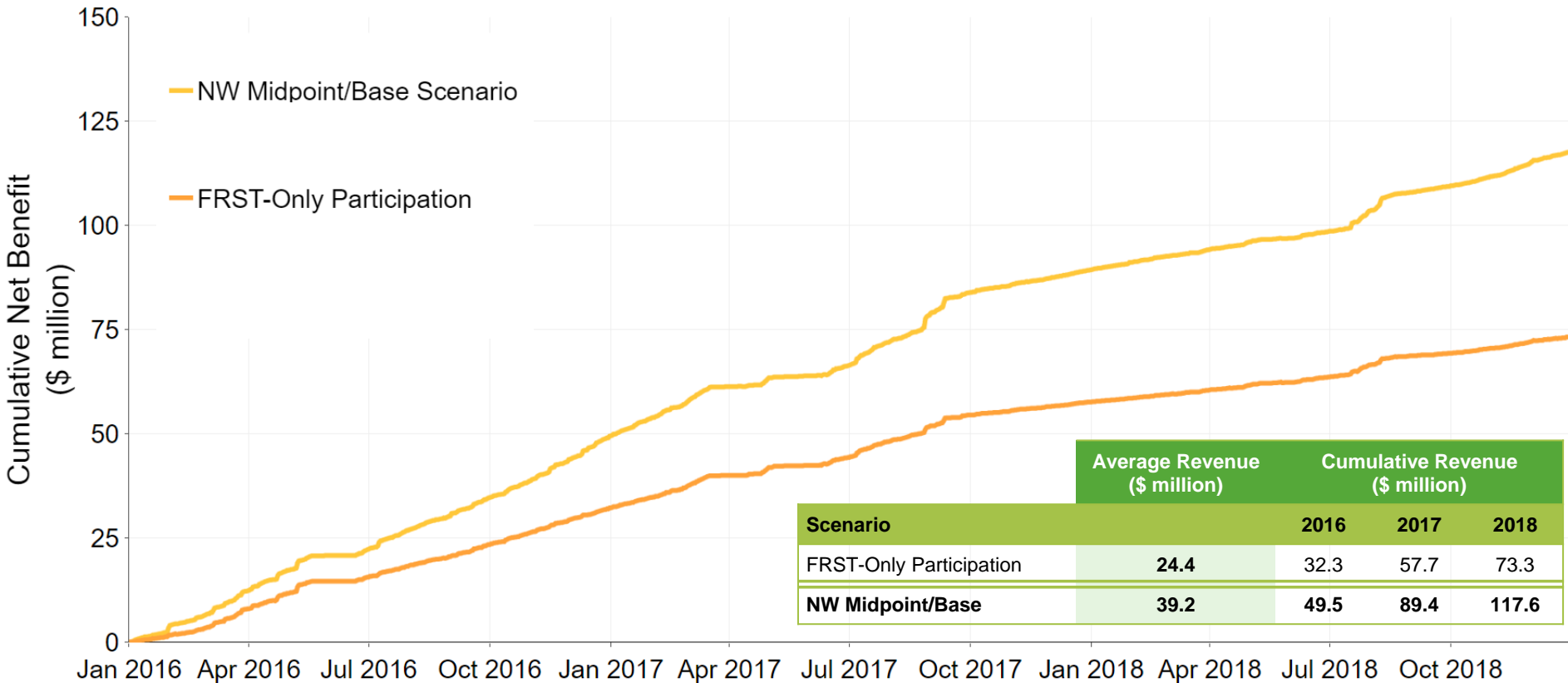
EIM Price Sensitivities

- Price sensitivities still have a small impact on cumulative benefits relative to NW Midpoint/Base Scenario



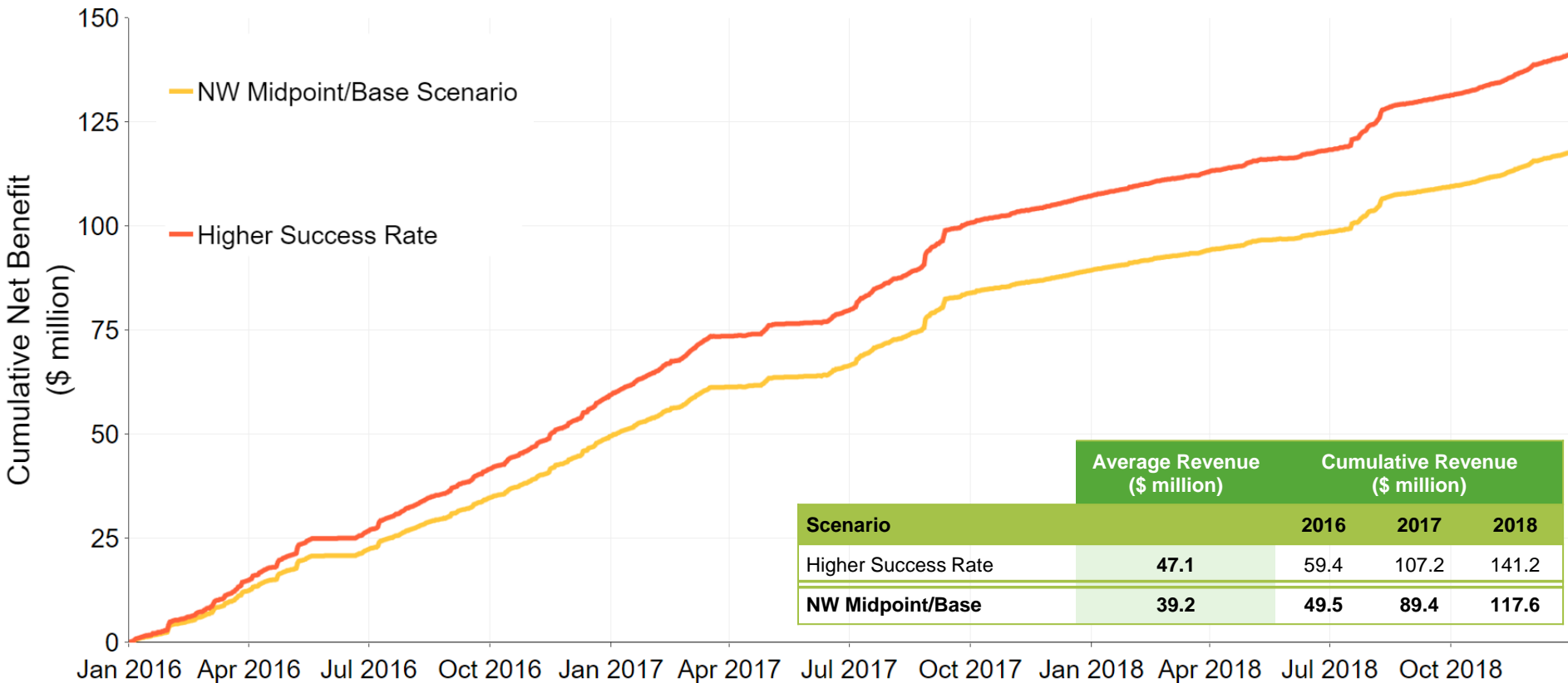
BPA Hydro Flexibility Sensitivity

- Reduced flexibility (no participation beyond what is required for FRST) to transact in EIM



Higher Success Rate Sensitivity

- Assumed 90% success rate translates to 20% higher estimated benefits than NW Midpoint/Base Scenario



Summary of Gross Dispatch Sensitivities

- Considered a wider range of input assumptions, including alternative pricing and available flexibility

Scenario	Cumulative Revenue (\$ million)			Average Revenue (\$ million)
	2016	2017	2018	
Initial Scenario (BPAT Price)	48.0	97.9	146.8	48.9
PSEI Price	43.6	76.6	108.2	36.1
PACW Price	54.7	94.6	121.3	40.4
NW Midpoint/Base Scenario (PGE Price)	49.5	89.4	117.6	39.2
Reduced Volatility	44.9	81.0	105.8	35.3
GHG Compliance	45.6	80.1	103.9	34.6
FRST-Only Participation	32.3	57.7	73.3	24.4
Higher Success Rate	59.4	107.2	141.2	47.1



Wrap-Up

- E3 modeling suggests that dispatch benefits from EIM participation will quickly pay for itself and result in significant ongoing benefits:
 - No sensitivities that were evaluated changed this conclusion
- E3 modeling suggests that EIM participation is a cost-effective non-wires solution and an effective intra-hour congestion management tool
- EIM participation will also:
 - Result in an efficient dispatch of generation to meet load across the entire EIM footprint
 - Provide increased visibility and discipline in the dispatch and marketing of FCRPS
 - Create additional visibility of conditions across the grid which will enhance reliability
 - Allow BPA to effectively participate in the development of future markets to enhance regional resource adequacy by ensuring that flexible resources are appropriately compensated for the services that they provide

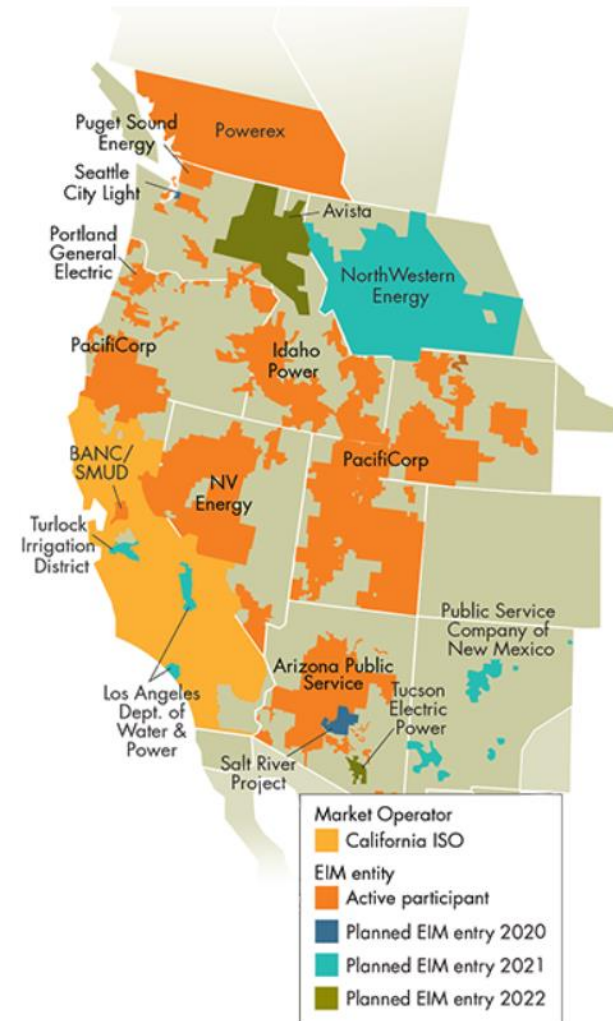
Letter to the Region: EIM Issues Summary Review



Drivers for Market Changes

- Variable energy resources are increasing in the West
- Ability to realize the value of sub-hourly dispatch with flexible and low carbon hydro resources
- Transmission use and system operations are changing
- Western EIM footprint is growing
- Market evolution

Western EIM active and pending participants



Western EIM Evaluation

- Bonneville initiated a formal Stakeholder process in July 2018
- Bonneville began discussion with CA-ISO in September 2018
- Four EIM Principles
 - Consistent with statutory, regulatory, and contractual obligations.
 - Maintain reliability
 - Voluntary participation
 - Sound business rationale

Evaluation Issues

- Relationship of EIM to Other Emerging Markets
- BA Resource Sufficiency
- EIM Settlements
- Market Power
- Treatment of Transmission
- Generation Participation Model (FCRPS)
- Governance
- Carbon Obligation in EIM

Relationship of EIM to Other Emerging Markets

- While we are engaged in the development of market opportunities, Bonneville is focused on whether to sign the Implementation Agreement with CAISO and move forward toward joining the EIM.
- There are two examples of CAISO policy initiatives with potential implications for EIM:
 - **Day-Ahead Market Enhancements (DAME)**
 - High-level objective: Manage uncertainty that occurs between the day-ahead and real-time markets
 - Status: CAISO is focusing the scope on a day-ahead Flexible Ramping Product (FRP) and reforming IFM & RUC; June 20th workshop to re-launch
 - **Expansion of the Day-Ahead Market to EIM (EDAM)**
 - High-level objective: Enable EIM access to a broader pool of resources by extending the enhanced day-ahead market to some or all EIM Entity BAAs
 - Status: CAISO has not yet launched this policy initiative
- Bonneville will actively participate in the advancement of these stakeholder processes and Bonneville expects that the CAISO will complete the DAME policy initiative and implement the FRP before Bonneville goes live in the EIM.

BA Resource Sufficiency

- Bonneville's preliminary analysis indicates that it would pass the RS evaluation a significant amount of the time using historical spinning availability
 - BPA has not yet determined how it will make flexibility available for the EIM
- This provides Bonneville with a high level of confidence that it can achieve the benefits described in the business case
- The likelihood of passing the RS evaluation would increase if any additional bid flexibility is made available, whether from Federal or non-Federal Participating Resources

EIM Settlements

- Bonneville will address settlements issues in the Post-ROD Policy process, subsequent Rate and Tariff Cases, and Business Practice development processes
- Bonneville staff gathered information on settlements via trainings, benchmarking with EIM Entities, reviewing CAISO materials, and internal staff who work with CAISO settlements.
- If Bonneville joins the EIM as an EIM Entity, Bonneville will need to decide whether and how to allocate the CAISO's charge and credits to Bonneville's transmission customers
- If Bonneville decides to allocate some or all of the EIM charge codes to its customers, Bonneville will need to decide how to bill its customers for these charges
- The billing and settlement mechanics policy process will be closely linked with the policy process on allocation of EIM charge codes

Market Power

- Default Energy Bids
 - If determined to have market power, a market participant may have its EIM bid prices mitigated to a Default Energy Bid (DEB) by CAISO
 - Current construct does not adequately reflect the opportunity costs of use limited hydro resources
 - CAISO worked collaboratively with stakeholders to propose a new Hydro DEB option
 - Approval of this option and subsequent implementation is important for BPA's participation in the EIM

Treatment of Transmission

- Bonneville is proposing to adopt the Interchange Rights Holder Methodology for making transmission available to the EIM
- Bonneville expects to be a significant “net wheeler” in the EIM
 - This may lead to cost shifts and free riders
- Bonneville believes the Interchange Rights Holder Methodology better balances the need to provide transmission to the EIM with collecting enough revenue to adequately and fairly recover the costs of the FCRTS

Generation Participation Model (FCRPS)

- Bonneville will initially participate in the EIM with federal hydroelectric dams aggregated into three resource zones:
 - Upper Columbia dams (Grand Coulee, Chief Joseph)
 - Lower Columbia dams (McNary, John Day, The Dalles, Bonneville)
 - Lower Snake dams (Lower Granite, Little Goose, Lower Monumental, Ice Harbor).
- These resource groups will participate in the EIM as separate aggregated participating resources (APR)
 - The amount of generation produced by these resources not bid into the EIM will be treated as an aggregated non-participating resources (ANPR) for purposes of the EIM
 - All other federal resources in the Bonneville balancing authority area will initially be non-participating resources in the EIM

Governance

- BPA has determined that the current EIM governance structure does not contain any “showstoppers” to joining the EIM.
- However, BPA would like to see some improvements to the current governance structure, including:
 - Expand the EIM Governing Body’s primary authority,
 - Improve the durability of the current EIM governance structure
 - Allow for ability to adapt to expanded market functions, and
 - A broader role for public power in the EIM governance structure.
- BPA is supporting these improvements in a current stakeholder process that the CAISO has initiated and continues to coordinate regularly with multiple parties.

Carbon Obligation in the EIM

- Energy generated in or imported into California is subject to California's greenhouse gas (GHG) regulations.
- If BPA were to participate in the EIM, any carbon attributed to imports into California would incur a compliance obligation
- BPA currently cannot purchase carbon allowances
 - Carbon allowances are considered a state tax by the U.S. DOE, BPA, and other federal agencies.
 - Federal agencies have sovereign immunity from state taxes and cannot pay them unless Congress specifically authorizes it
- Absent Congressional authorization to purchase allowances, BPA would not be able to directly deliver EIM energy into California

Next Steps

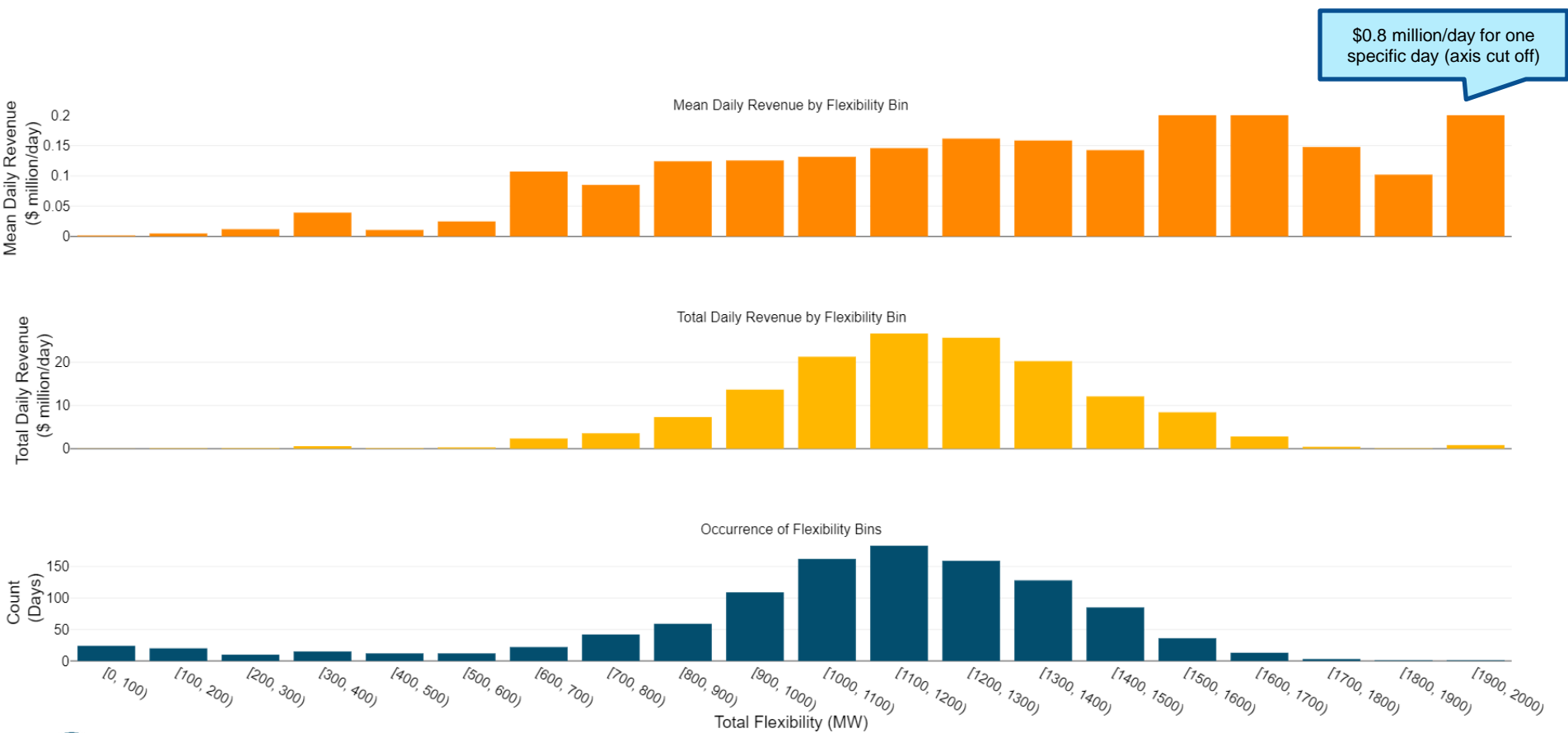
- The 30-day public comment period for the EIM Letter to the Region is planned to start the week of June 17.
- A meeting to answer clarifying questions about the Letter to the Region is scheduled for **Monday July 8th** at the Rates Hearing Room, 1-3pm.
 - WebEx and Phone participation will be available
 - A Tech Forum notice will be sent out as a reminder
- For more information on BPA's EIM Stakeholder process and meetings please visit:
<https://www.bpa.gov/Projects/Initiatives/EIM/Pages/Energy-Imbalance-Market.aspx>
- For more information on BPA's Grid Modernization Initiative please visit:
<https://www.bpa.gov/goto/GridModernization>

Appendix A. Benefits Analysis

Additional Material



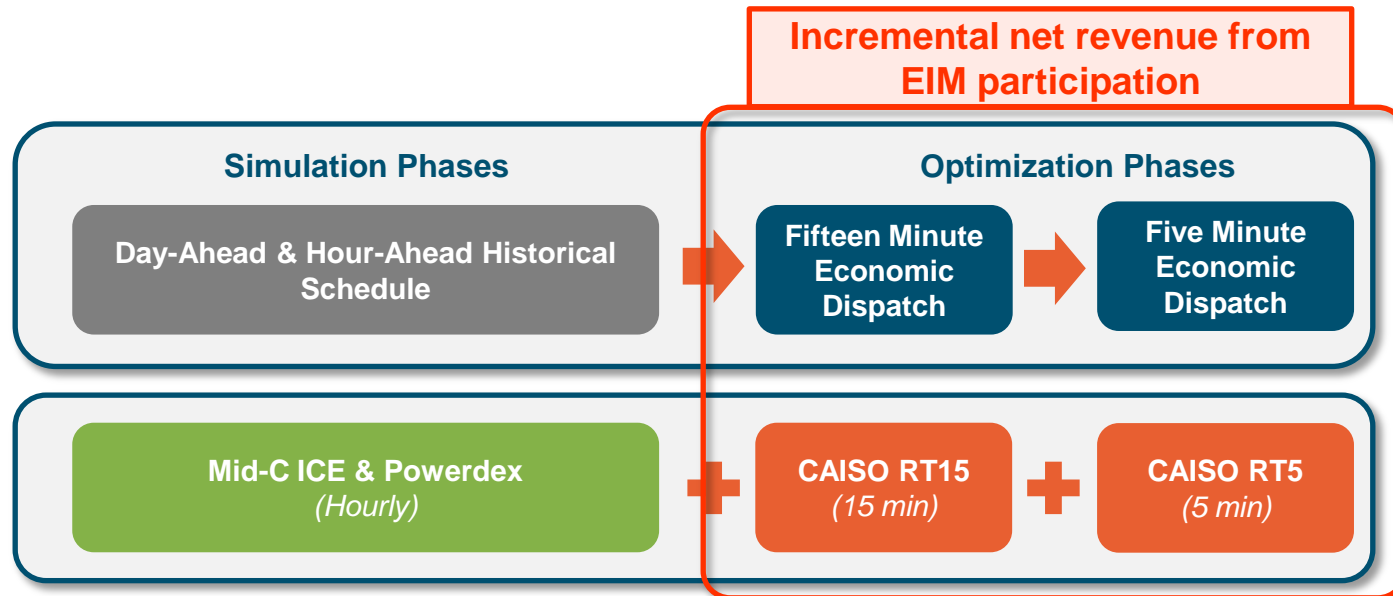
Base Scenario: Revenue & Flexibility



Modeling Approach

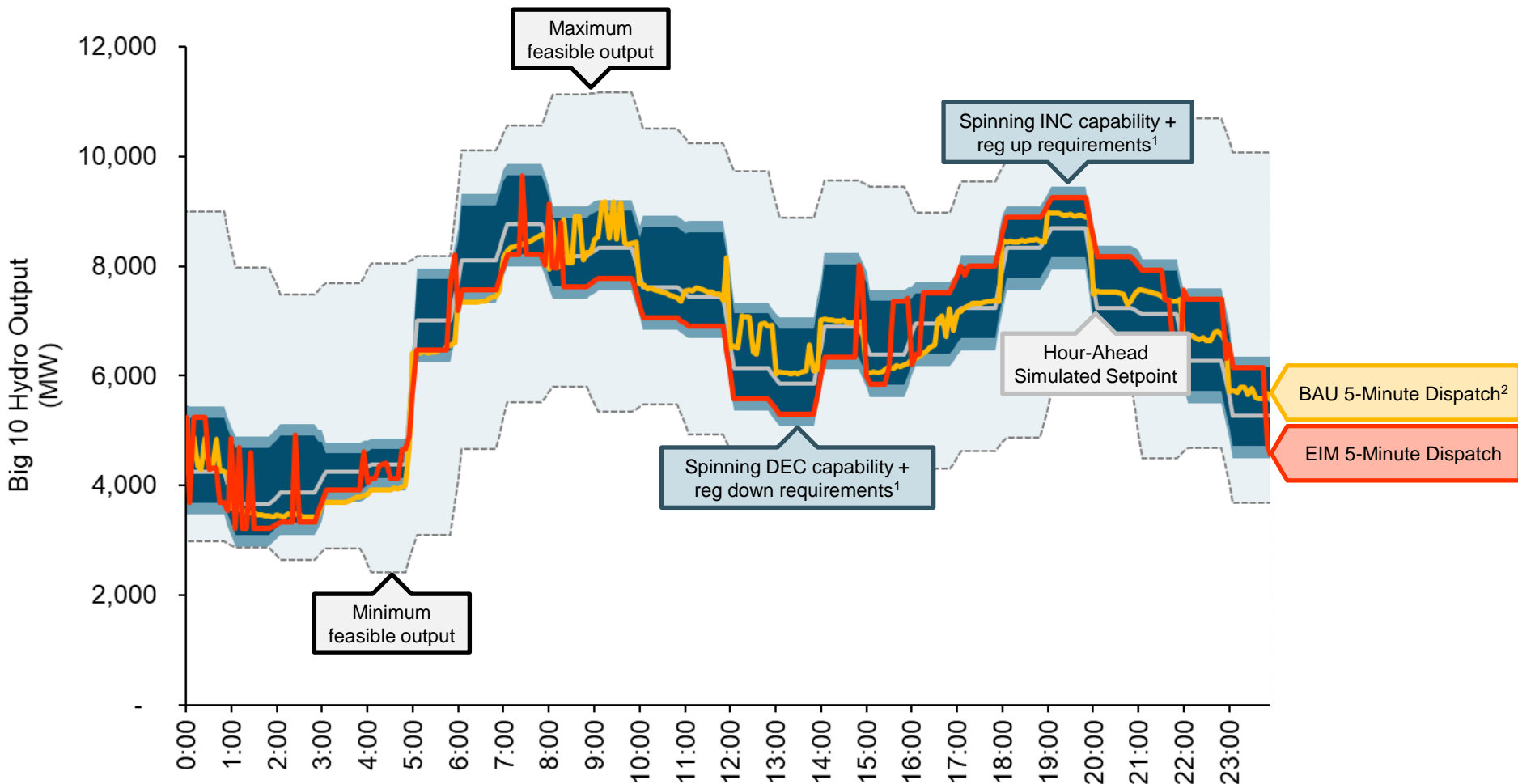
Four-Stage PLEXOS Production Cost Model

- Model quantifies the market value attributed to BPA's resources in four sequential stages:
 - Revenues captured in DA & HA dispatch reflect estimated market value of **all bilateral contracts and other out-of-market transactions**
 - Incremental revenues captured in 15- and 5-minute dispatch reflect **additional value of EIM participation** using BPA's selected hydro resources



Input Assumptions

Big 10 Hydro Flexibility Example

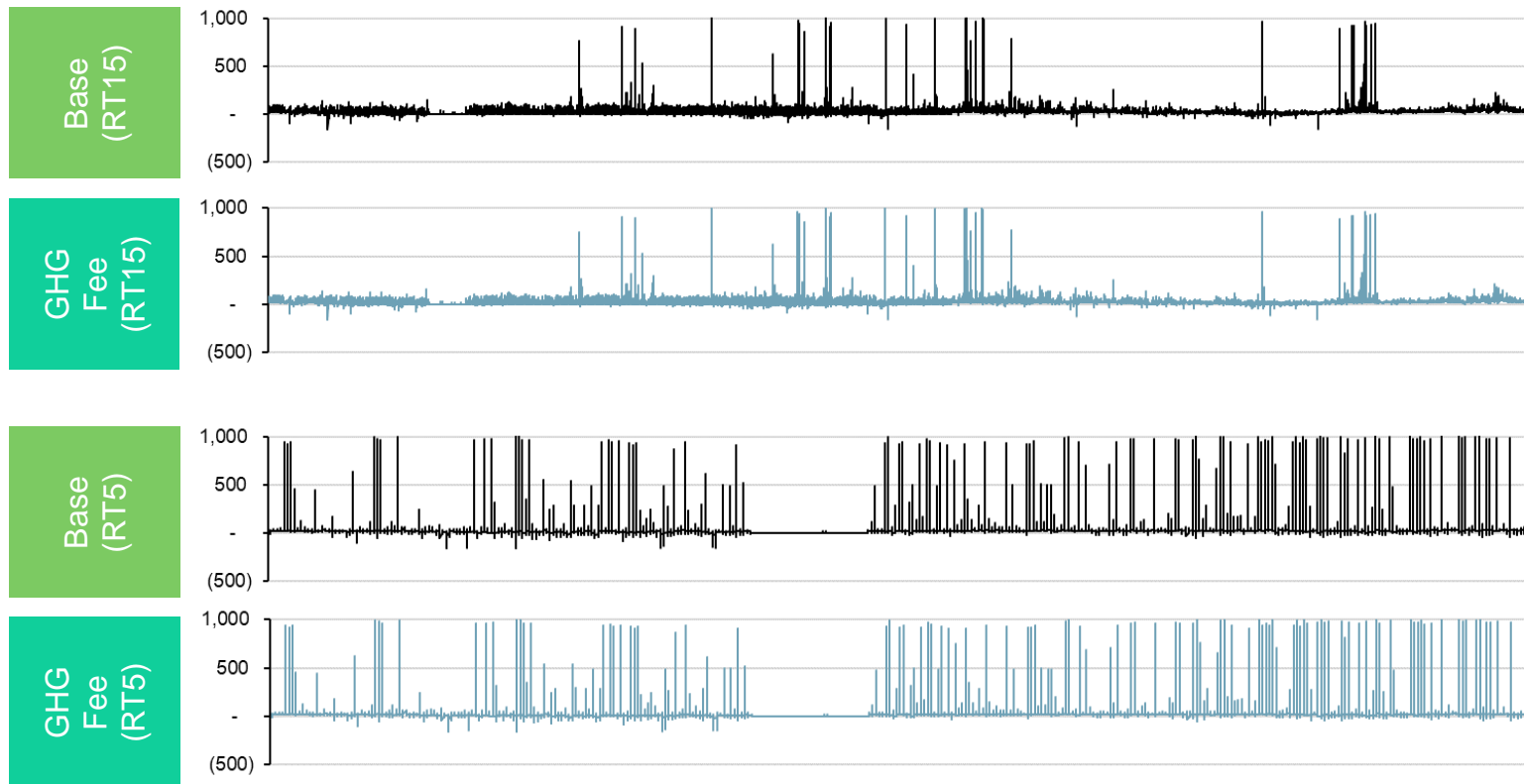


¹ Regulating reserve requirements are larger in EIM case than BAU case, resulting in tighter flexibility bounds

² BAU dispatch shows subhourly spikes due to balancing net load (load – wind) variability

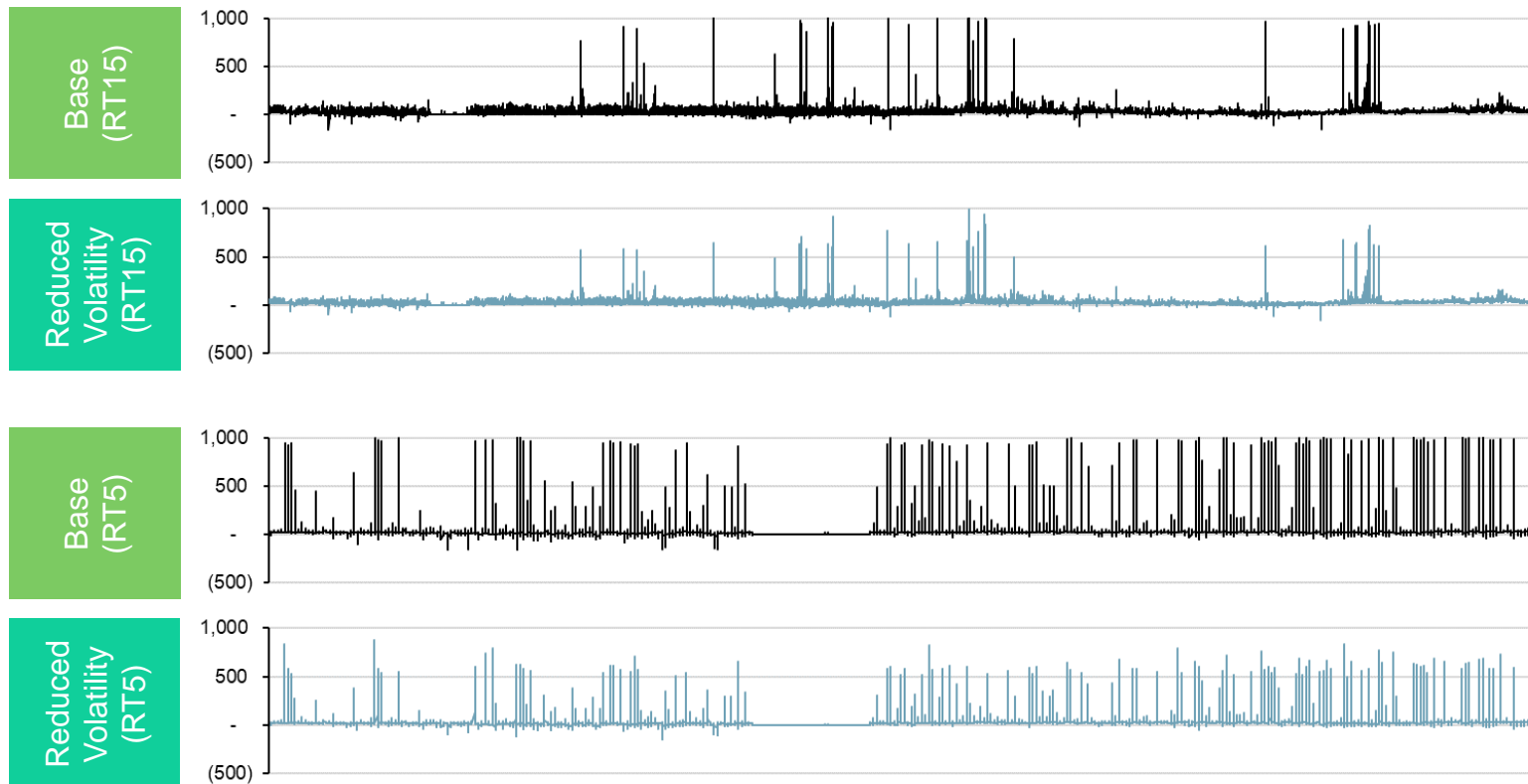
EIM Price Scenarios: GHG Compliance

- We model CAISO GHG Compliance as only affecting BPA prices when selling into EIM
 - Marginal GHG component is small relative to energy, congestion



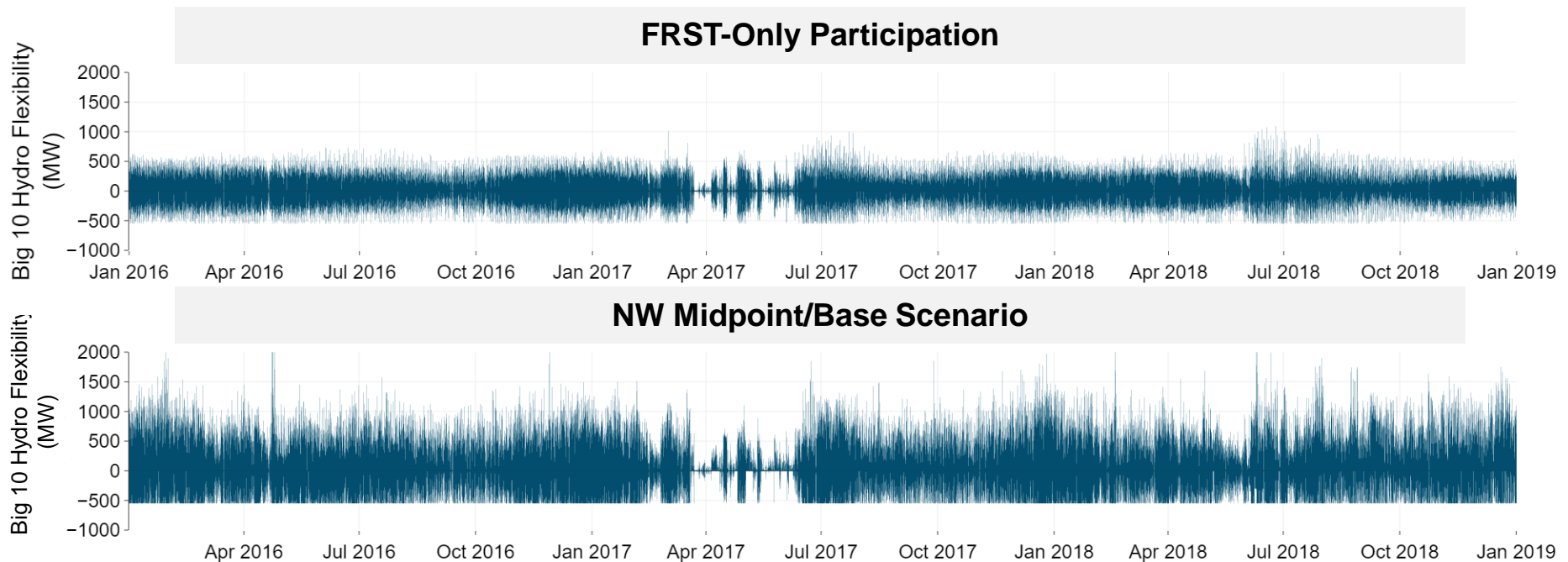
EIM Price Scenarios: Reduced Volatility

- Reduced intra-hour volatility reduces frequency of extreme prices while retaining overall diurnal price pattern



BPA Hydro Flexibility Scenarios

- FRST-only participation assumes that BPA only offers flexibility required to pass FRST
- NW Midpoint/Base assumption is that BPA would offer available spinning capability

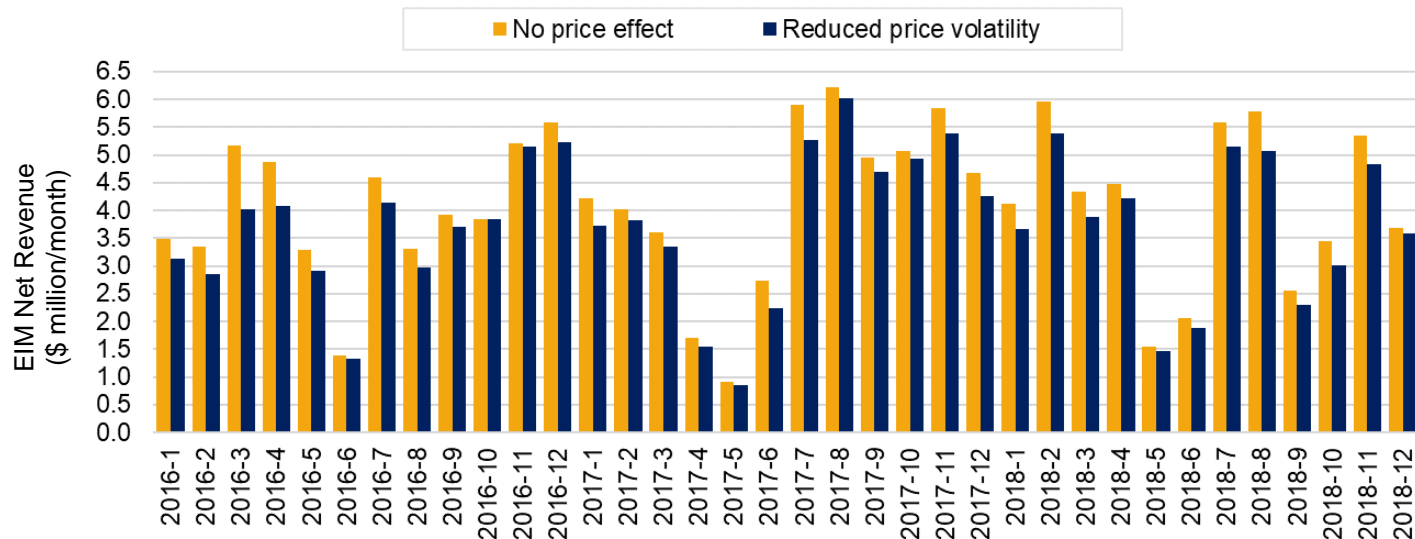


Scenario Results (From May 15th meeting, monthly revenue)

Net Revenues by Month

- Feb-March have lowest levels of wind, nuclear and thermal gen.
- Summer months have high thermal and wind generation showing positive Net EIM Sales
- Wide EIM spreads (\$20-25/MWh) from 2016-2018 result in positive net EIM sales benefits in all months of the year
- Net EIM sales benefit vary from \$0.9-6.2* million per month, lowest in May-June and highest in low hydro generation output months

Net EIM Revenues by Month* (\$M)



* Reported EIM benefit value includes a 75% "success rate" of BPA bids into EIM

