E3 Day Ahead Market Analysis

BPA Day Ahead Market Workshop

October 30, 2026

Portland, Oregon



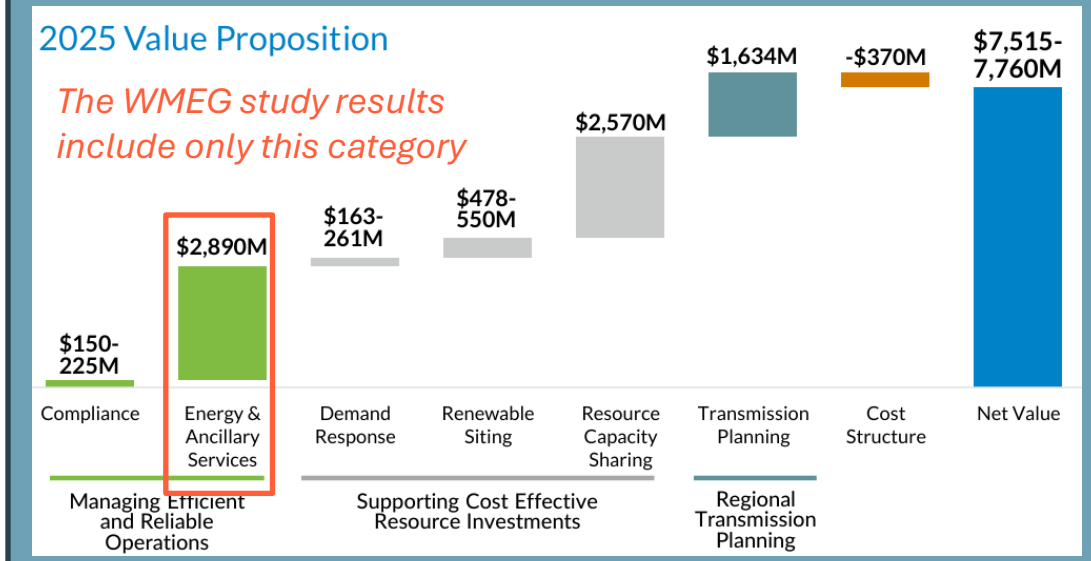
Energy+Environmental Economics

Arne Olson, Senior Partner
Jack Moore, Senior Director

Production costs savings typically make up a smaller portion of market benefit than resource investment and other cost savings

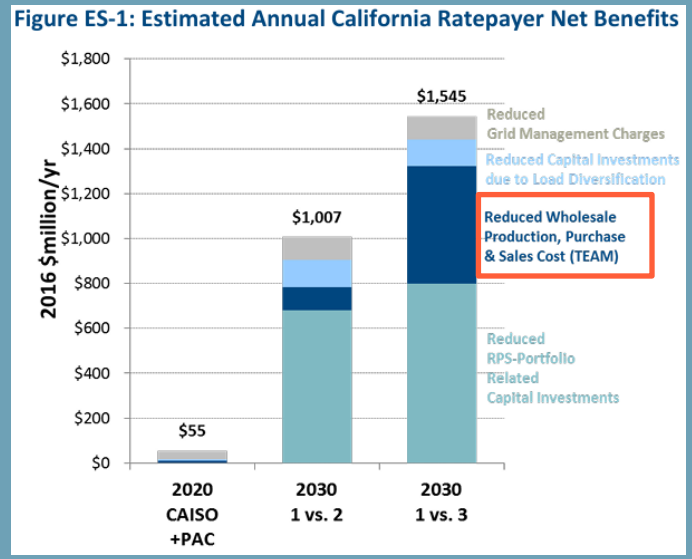
- The WMEG analysis focused exclusively on variable production cost savings
- Savings from more efficient capital investment – resource adequacy, access to better lower cost clean energy sources, efficient regional transmission planning – are likely to be larger in the long run

MISO's 2025 Value Proposition Report



https://cdn.misoenergy.org/2025 Value Proposition Report784752.pdf

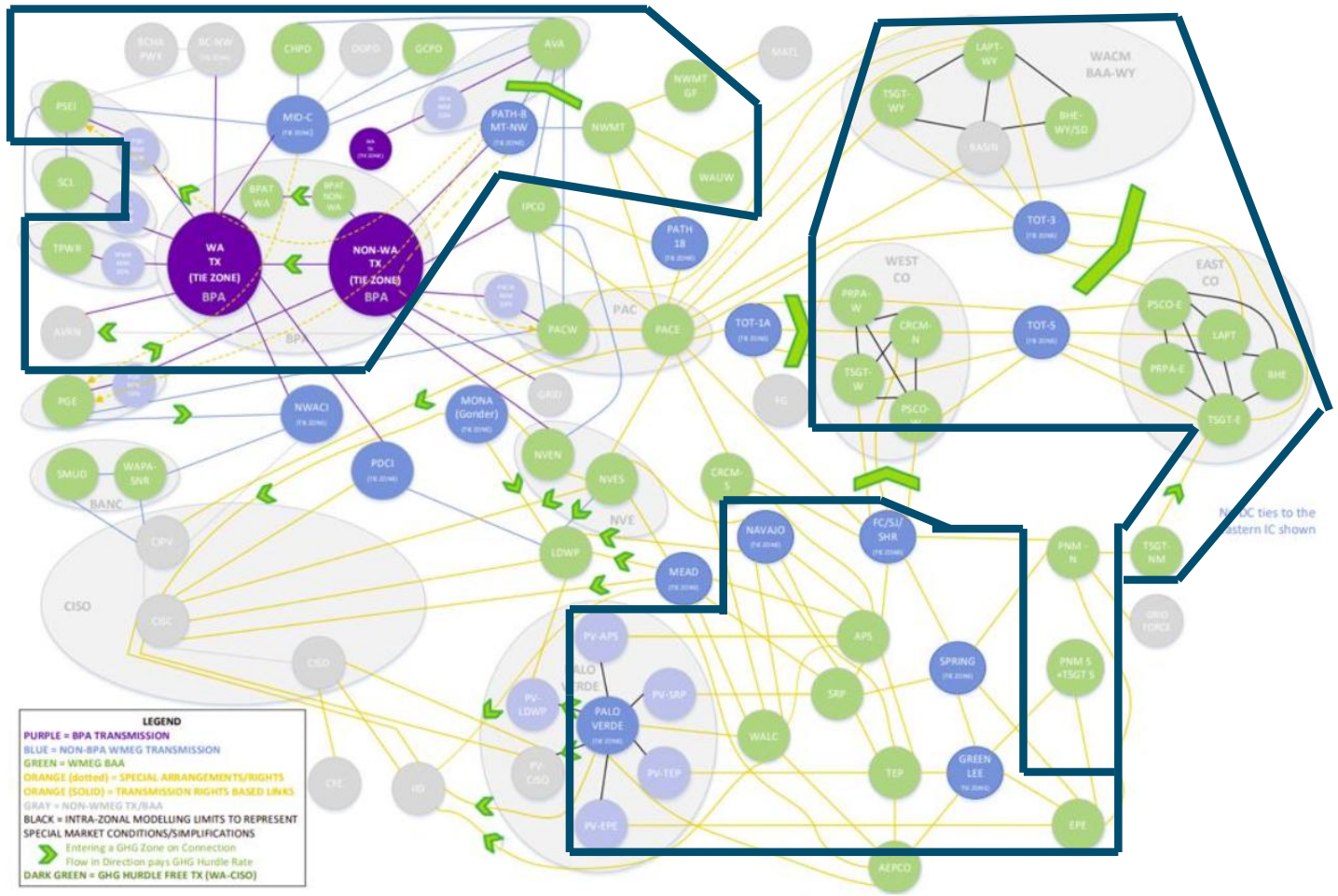
CAISO SB 350 Study



https://www.caiso.com/documents/sb350study-volume1purpose-approachandfindings-mainreport.pdf

The hurdle rates used in the modeling primarily represents inefficiency caused by two market dispatches

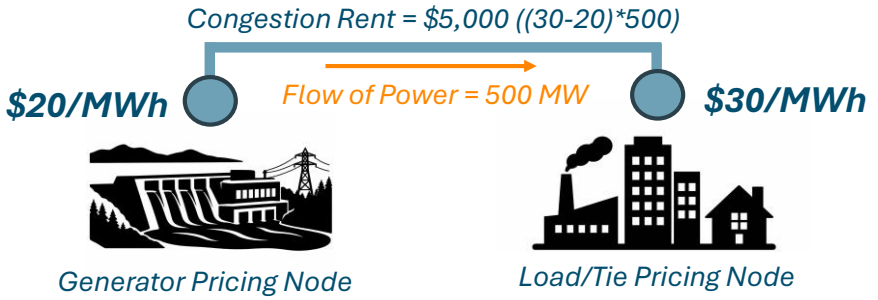
- Each market simultaneously optimizes dispatch over the facilities that it controls
- Neither market has visibility or control over dispatch or transmission utilization in the neighboring market
- This leads to underutilization of both transmission and generation in both markets
- Transactions between two ex post markets are necessarily subject to market price risk



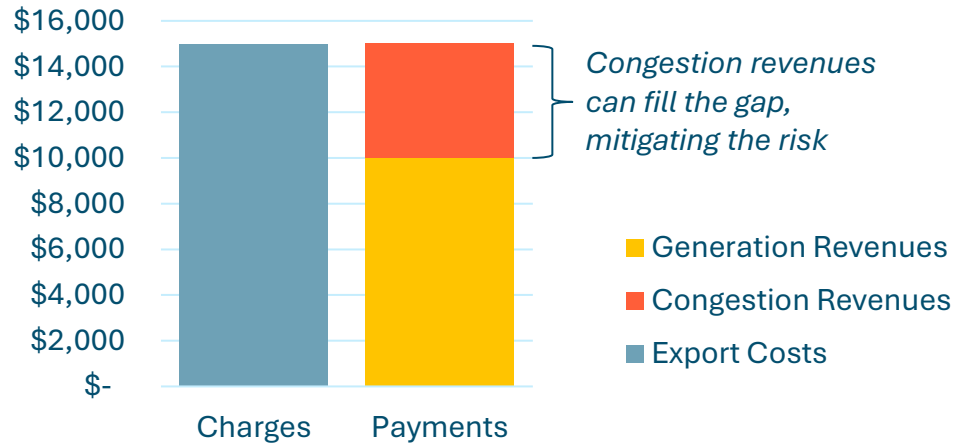
Physical vs. financial transmission rights and why congestion revenue allocation is important

- **In LMP markets, power cannot be "moved" from one location to another – the market selects the optimal quantity of generation at each node and sets locational prices based on marginal value**
- **Physical transmission rights require the market to pretend that power moves according to a paper schedule, and to compensate it accordingly**
  - These **"out of market" transactions** impose costs on other customers
- **Translation of physical rights to financial rights enhances market efficiency by eliminating strategic use of out of market physical schedules**
  - The translation process locks in the value of transmission investments in the form of **congestion revenue rights**

- **Assume an export transaction of 500 MW with LMPs of $20/MWh at the generator and $30/MWh at the relevant tie, where an entity has the rights to the congestion**

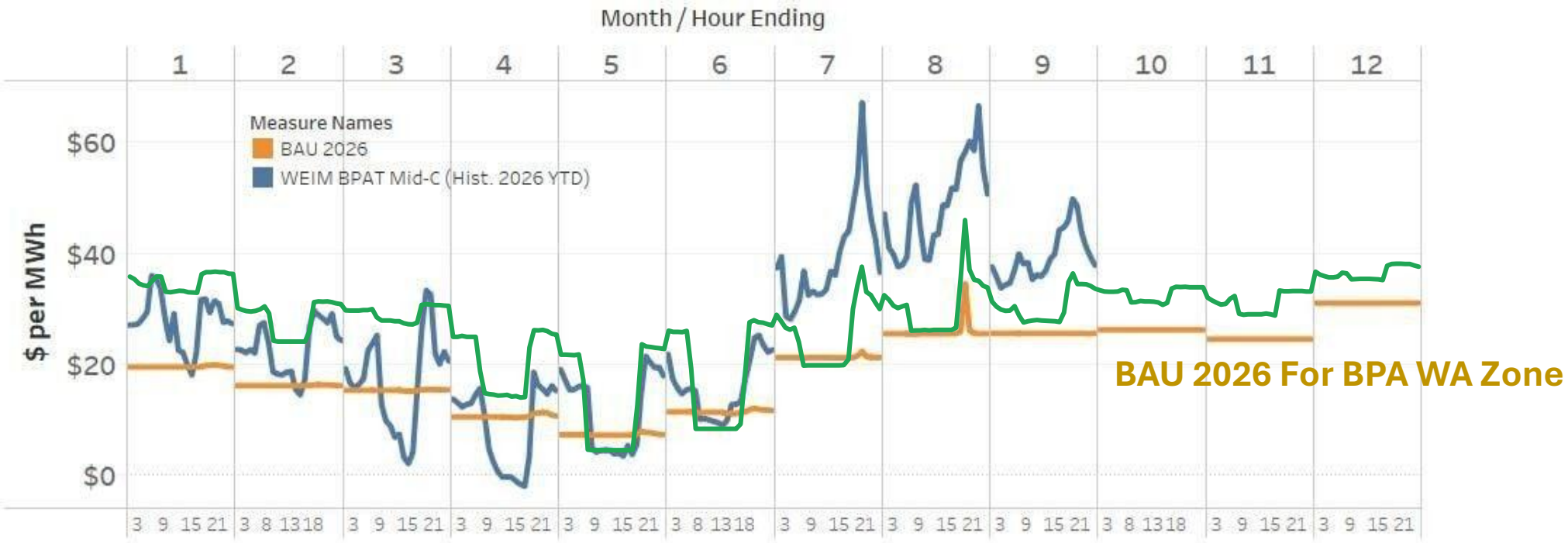


Entities without congestion rights may be eligible to receive a ratio share of congestion rents (e.g., through auction revenues)



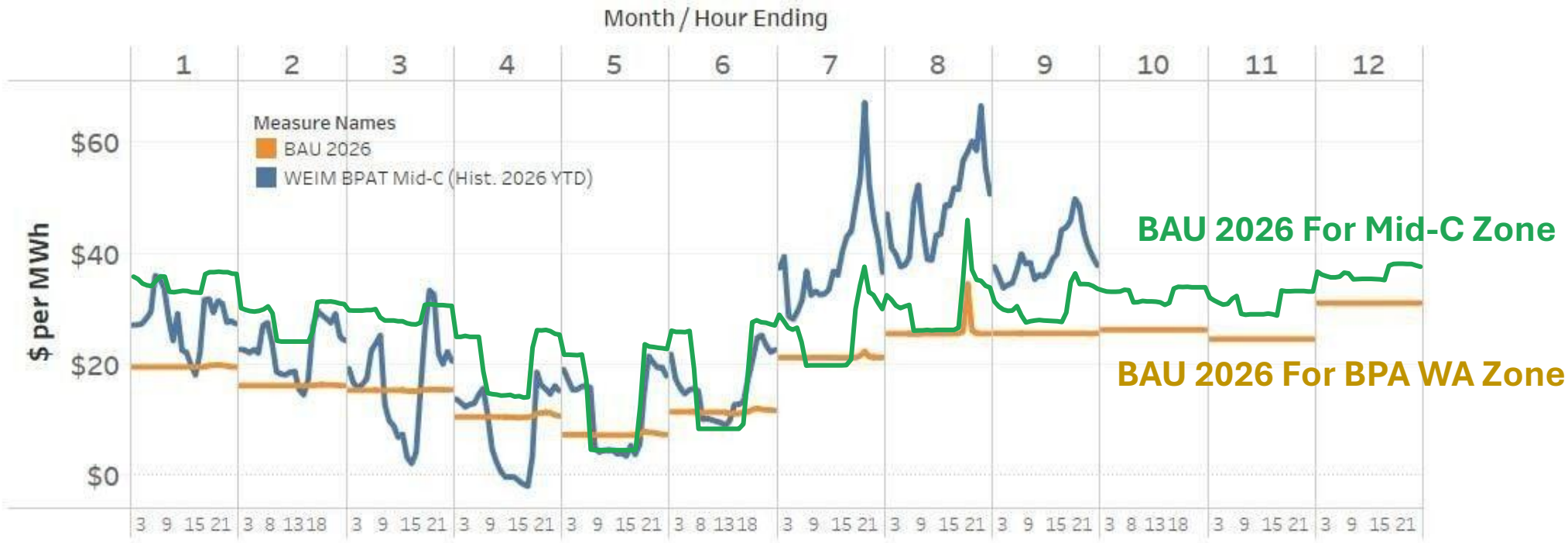
Mid-C price shapes in the PLEXOS analysis are reasonable

- Energy GPS noted lack of diurnal shape in “BPA WA” zone prices
- Treatment of BPA generation was customized to prevent low carbon power “shuffling”



Mid-C price shapes in the PLEXOS analysis are reasonable

- Energy GPS noted lack of diurnal shape in “BPA WA” zone prices
- Treatment of BPA generation was customized to prevent low carbon power “shuffling”
- Mid-C zone prices reflect an expected diurnal price shape
- BPA also receives congestion revenue from sending power out of BPA WA Zone



WMEG Model Details



Energy+Environmental Economics

Methodology focus of E3 WMEG Study & BPA Follow-Up Analysis

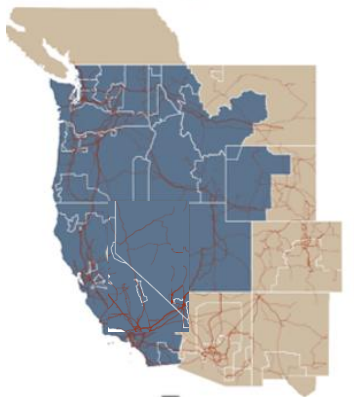
+ Key intent of WMEG study:

- Consistent study approach to make an apples-to-apples comparison **between different EDAM vs. M+ market footprints** (based on features known at the time, e.g., fast start pricing in M+)
- Cover **all entities in the Western Interconnection** in a comparable way for an ongoing future outlook, rather than indexing too closely to specific current contracts and local detail for any one single entity
- Use **industry best practice methodology & software, reviews & agreed to by WMEG members,** and incorporate input assumptions and data from those members

+ BPA WMEG follow-up analysis focus:

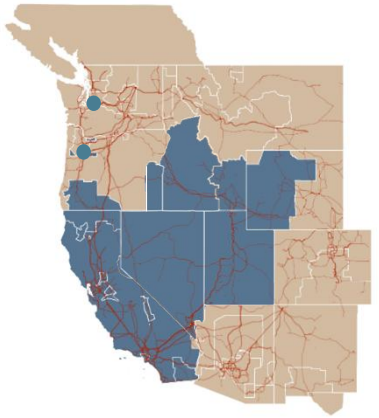
- **Evaluate the incremental impact of different footprints and sensitivity conditions** that BPA requested to complement the information from results already provided by WMEG
- Aimed to be **consistent with the original WMEG cases** to enable comparison between them
- This **limited the amount of customization for BPA-specific details** (such as contracts) to be modified into the model – not intended to capture the transmission positions or be overly indexed to a particularly area or entity.
- The **primary focus was in comparing between different market participation cases either EDAM vs. Markets+** (less emphasis on the "no-market" base case)

Alt split 2NV



EDAM: CA, PacifiCorp, NVE, all Northwest
Markets+; Southwest and Rockies

Alt split 4A*



EDAM: CA, PacifiCorp, **NVE, Idaho Power, PGE, SCL**
Markets+: BPA, BC, PSE, Avista, Tacoma, MidCs, SW, Rockies

Markets+ (M+) EDAM

Benefits from EDAM relative to M+:

+ **2026: $165 million greater**
+ **2030: $193 million greater**
+ **2035: $216 million greater**

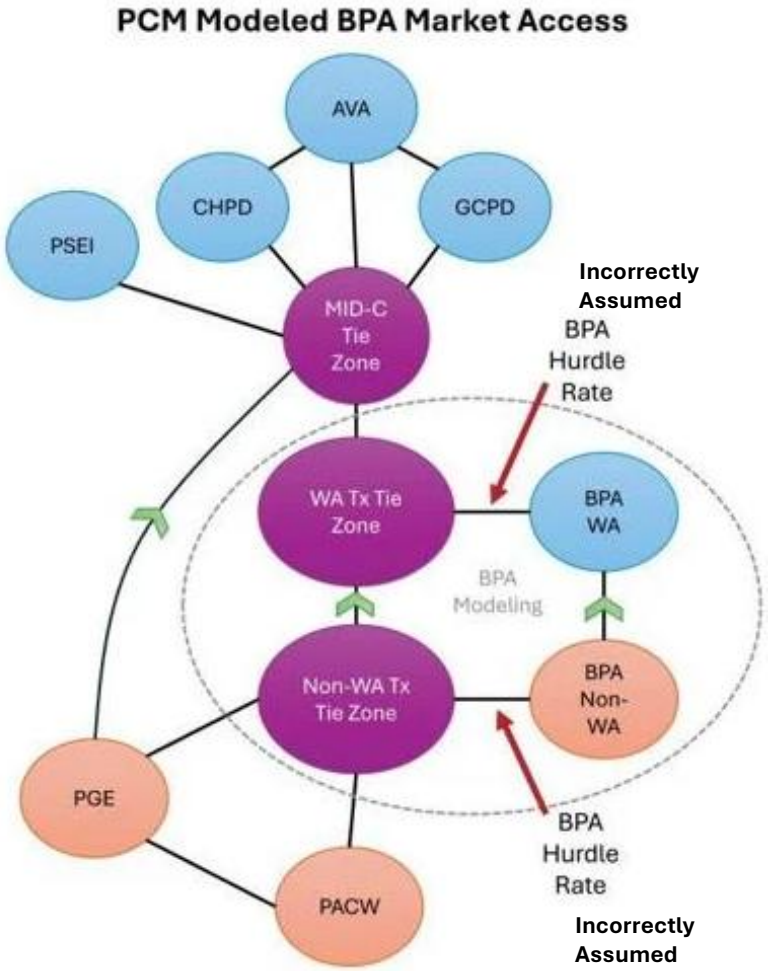
Credit: Greg MacDonald, PSE

Key modeling assumptions that affect results

+ **Daily hydro budgets and relatively high intra-day hydro flexibility in Northwest region**
  - Leads to flat prices in certain zones the model when flexibility of the hydro is high to even out dispatch across the day
+ **BPA-provided assumption on limits to the amount of GHG-free power that BPA can sell into CA and WA zones with a carbon premium**
  - This assumption is intended to have the model reflect that a significant portion of FCRPS BPA must be sold to BPA loads outside of WA. Further, given the modeled size and flexibility of the FCRPS relative to the non-BPA load in WA, the limits aimed to prevent artificially lowering the GHG pricing by assigning more BPA generation to WA than was reasonable.
  - In the model, a 1,000 MW hourly limit was applied for GHG-free sales from BPA to non-BPA loads zones in Washington, plus a 1,500 MW hourly limit on sales to CA
  - The remaining BPA generation in the model can be sold to parties represented without GHG pricing (all non-CA and non-WA zones), or can be moved to WA or CA by incurring a GHG import charge as unspecified sales
  - In hours when these limits are binding at their maximum level, the marginal price at BPA WA zone will be based on exports to other zones which do not include the carbon price premium
  - However, the model assigns BPA additional revenue (included in the congestion benefit category) related to the GHG-driven price spread on the 1,000 MW of transactions from BPA WA to non-BPA WA zones, and for the 1,500 MW of transactions from BPA to CA zones.
+ **Allocation of revenues associated with transmission rights is between distinct from energy/LMP revenues**
  - All power will be priced at LMPs in either market (same as either market's interface would)
  - There is then a separate congestion revenue component that operates based on the spread and rights between neighboring zones

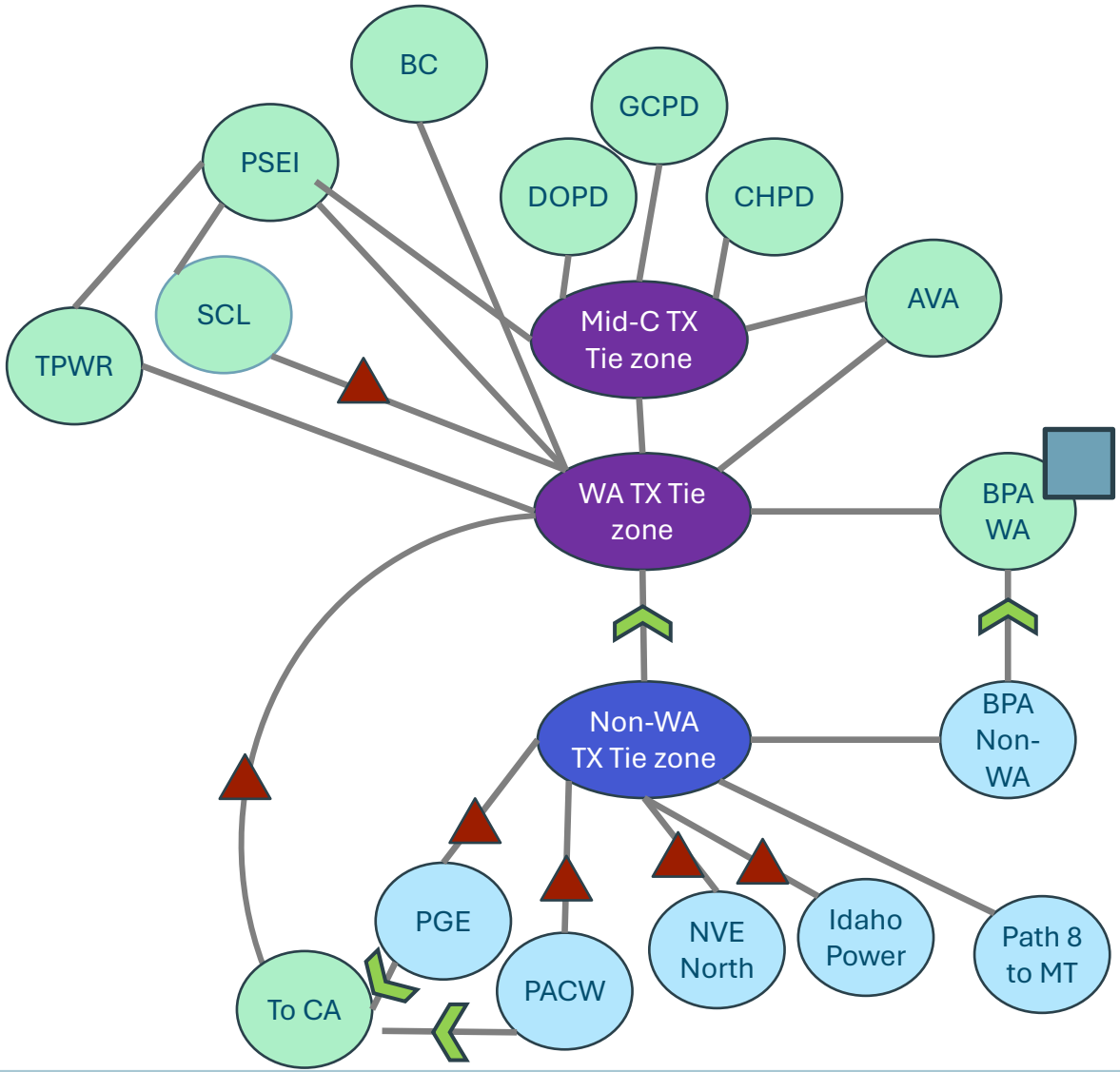
Interpretation error on where hurdle rates are placed

+ **Energy GPS mistakenly assumed that there was a $14.50 hurdle rate applied on all BPA sales to trading partners. "BPA must pay a $14.50/MWh hurdle rate to leave the island."**
  - This is inaccurate and leads to flawed conclusions about the model's functionality and validity.



Energy GPS incorrect characterization of E3 topology

WMEG Modeling Topology in Northwest Region



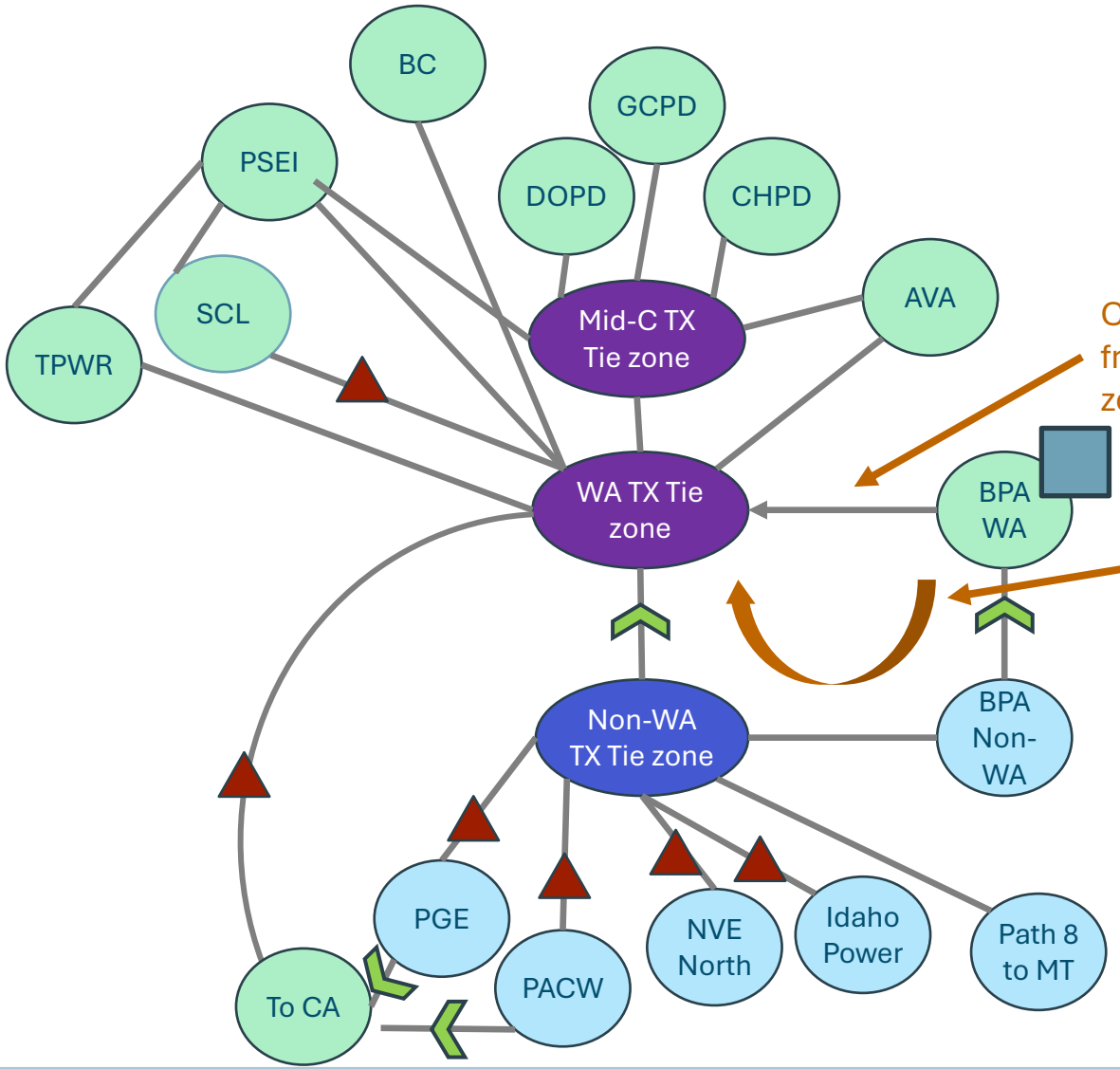
▲ = Market seams hurdle rates (for Alt Split 4A footprint with BPA in M+)

❮ = GHG Import charge to WA/CA

+ The E3 WMEG model only applied market hurdle rates on the seams between EDAM and Markets+:

- For example, in Alt Split 4A, a hurdle charge was applied on the connection between BPA and EDAM zones (such as PGE & PACW) – and no hurdle was applied between BPA and other M+ zones
- Similarly, in Alt 2NV, trades between BPA and other EDAM zones have zero cost, but there is a hurdle to get into M+

WMEG Modeling Topology in Northwest Region & impact of GHG related constraints



= Market seams hurdle rates (for Alt Split 4A footprint)

= GHG Import charge to WA/CA

Constraints on quantity of GHG free power transferred from BPA WA to other WA zones & from BPA WA to CA zones

FCRPS generation

Additional flow enabled from BPA to non-BPA WA zones incurs GHG import charge

- **Limited quantity of power than is enabled to be transfer from BPA WA to non-BPA zones as GHG-free power**
- **Remaining BPA WA generation sells to BPA load outside of WA, to other Non-WA zones, or to WA zones (but treated as generic power and incurs GHG import charge)**
- **Import charge results in lower price at BPA WA zone than other WA zones**

Comparison of relative prices by zones driven by GHG assumptions requested by BPA

+ **Energy GPS expressed concern that the price comparisons across location don't make sense. E.g., "BPA Washington sales are valued $10/MWh lower than all other Washington locations."**
  - These prices do make sense when one correctly understands how GHG is treated in the model and understands how benefits are calculated

	2026						
	Alt Split 4A	Alt Split 4A M2M	Alt Split 4A M2M2	BAU	Alt Split 2NV	Alt Split 4A M2M3	EDAM Bookend
AVA	$24.15	$26.74	$28.67	$29.72	$23.88	$29.85	$31.16
PSEI	$24.15	$26.74	$28.67	$31.86	$23.88	$29.85	$31.16
GCPD	$24.15	$26.74	$28.67	$30.57	$23.88	$29.85	$31.16
CHPD	$24.15	$26.74	$28.67	$30.57	$23.88	$29.85	$31.16
MID-C TZ	$24.15	$26.74	$28.67	$30.57	$23.88	$29.85	$31.16
BPAT-WA Tx TZ	$24.15	$26.74	$28.67	$29.88	$23.88	$29.85	$31.16
BPAT-WA	$15.36	$17.54	$19.14	$19.54	$19.78	$20.10	$21.26
BPAT-Non-WA	$13.35	$15.64	$17.28	$18.89	$18.59	$18.41	$19.52
BPAT-Non-WA Tx TZ	$13.35	$15.64	$17.28	$20.80	$18.57	$18.40	$19.49
PGE	$26.10	$25.89	$24.69	$23.05	$18.57	$23.61	$19.49
PACW	$21.64	$21.36	$21.04	$20.39	$20.00	$20.88	$20.65
IPCO	$21.83	$21.53	$21.21	$23.20	$20.22	$21.03	$20.71
BPA Mkt	M+	M+	M+	BAU	EDAM	M+	EDAM
Hurdle Rate	$14.50	$10.00	$7.50	$14.50	$0.00	$4.50	$0.00

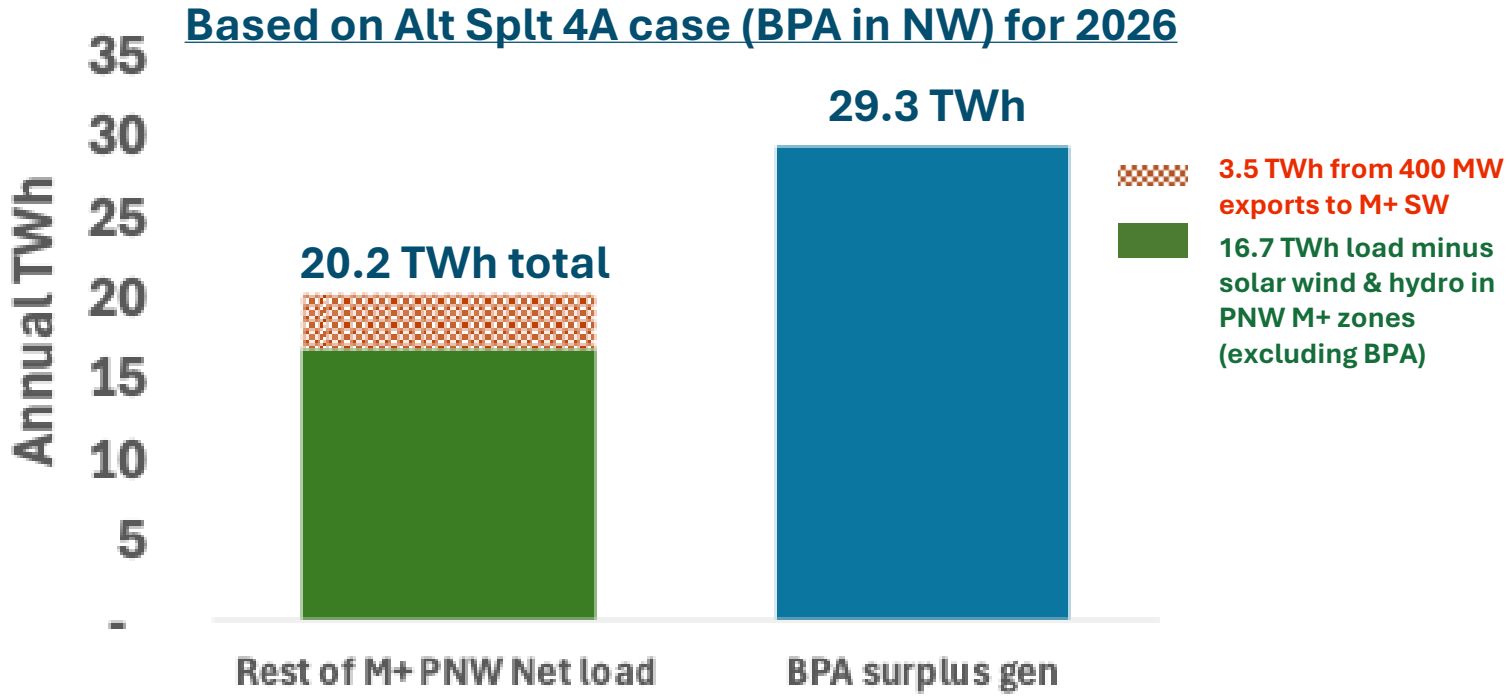
+ **In the model, a limit was applied to the quantity of power that could be sent to WA (1.0 GW) & CA (1.5 GW total) without a GHG cost applied**
  - These limits typically lead to the marginal price in BPA WA Tx Tie zone (and other WA zones) to include carbon.
  - Remaining output of the BPA WA zone goes to non-WA zones or back to WA with a GHG hurdle rate, so the marginal price for generation in BPA WA is typically based on the non-carbon fee.

However, BPA receives revenue from the price spread on this line for the quantity of power sent to WA or CA zones (this revenue shows up in the congestion revenue benefit category)

- Thus, looking at the BPA WA price in isolation only shows a portion of the revenue impact to BPA

Notes on Market Fundamentals

- BPA's quantity of surplus generation to sell is 45% larger than all the rest of Markets+ participants in the Northwest net load excluding hydro & export ties assumed to M+ in SW
- Regardless of intermediaries for transactions, a significant portion of PNW M+ energy must end up in EDAM (or past through EDAM areas)





Potential Paths for Further Analysis

- **This discussion has been helpful in bringing out areas that may be informative to get more information from the modelling work though sensitivity cases, including**
  - Test more targeted **alternative allocation of congestion revenues** under different seam hurdle rate cases
  - Run **BPA in EDAM case (Alt 2 NV) with lower seam hurdle rates** for apples-to-apples comparison to BPA in Markets+ case (Alt 4A)
  - Run sensitivity case to **consider allowing different quantity of BPA GHG-free hydro to go to WA or CA zones**

Appendix:
Additional Info From Sept Meeting

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E3's Market Studies for WMEG and BPA



Energy+Environmental Economics

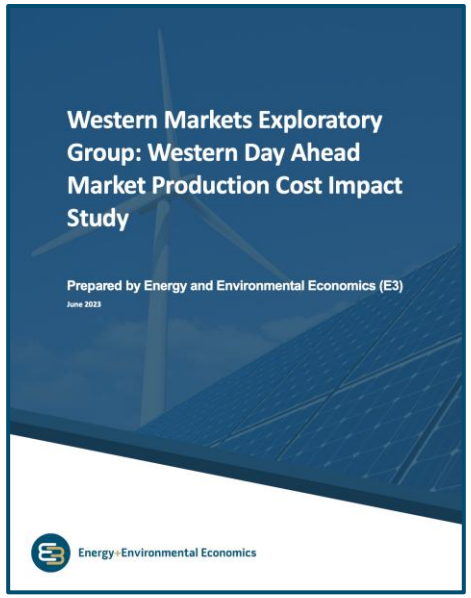
E3 Western Market Exploratory Group (WMEG) Cost-Benefit Study, September 2022 – May 2023

- **25 Western Utilities formed WMEG and retained E3 to analyze the impact of different potential day ahead market footprints and features**
- **E3 led study work from Sept 2022 through May 2023, incorporating significant input and review from the utility participants (including utilized confidential data from each WMEG member)**
- **WMEG participants represented a diverse array of public and investor owned utilities, Western geographies, and resource mixes, including many entities that chose to participate in Markets+**

Utility Participants in WMEG study included:

Arizona Electric Power Cooperative
Arizona Public Service
Avista Corp
Balancing Authority of Northern CA
Black Hills Energy
Bonneville Power Administration
Chelan County PUD No. 1
El Paso Electric Company
PUD #2 of Grant County
Idaho Power Company
Los Angeles Dept. of Water & Power
NorthWestern Energy
NV Energy
PacifiCorp
Platte River Power Authority
Portland General Electric
Public Service New Mexico
Puget Sound Energy
Salt River Project
Seattle City Light
Tacoma Power
Tri-State G&T Association
Tucson Electric Power
Xcel Energy Colorado
Western Area Power Administration.

Benefits considered:	**Benefits *not* considered:**
Variable production costs	Resource adequacy capacity savings
	Clean energy procurement savings
	Efficient regional transmission planning
	Grid reliability
	Consolidated Balancing Area operations



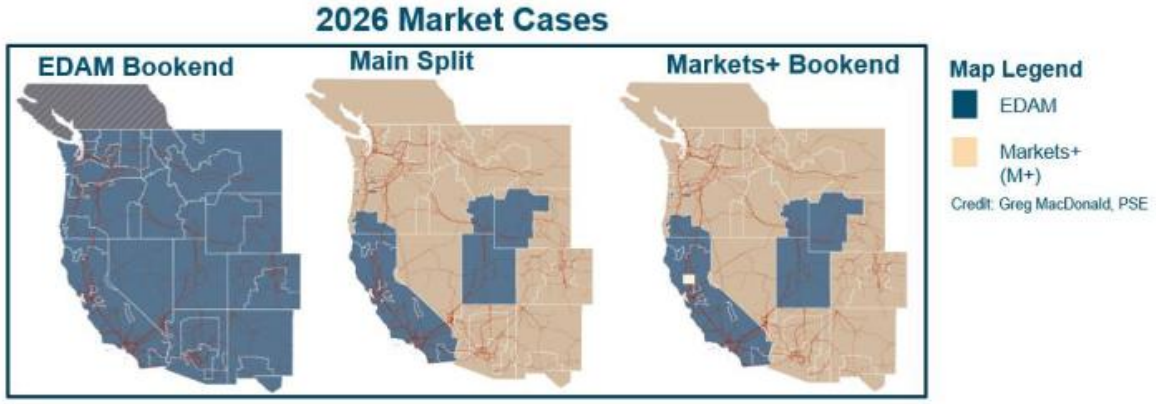
E3 WMEG Study (2022-2023): Methodology and Results

Methodology

- E3 used industry best practice methodology, agreed to by all WMEG members, for evaluating the benefits of alternative market designs and footprints
- Conducted detailed hourly PLEXOS production simulations for both the day-ahead (DA) and real-time (RT) operational stages
- "Adjusted Production Cost" benefits methodology accounts for each market participant's unique resource portfolio by pricing imports and exports at the endogenous zonal market price
- Congestion revenue (on internal transmission within each market) was allocated based on the zonal location where congestion occurred
  - For congestion on the seam between markets, congestion was allocated among the market participants based on their share of total market load
- WA and CA assumed to be together in Western Climate Initiative GHG market

Results

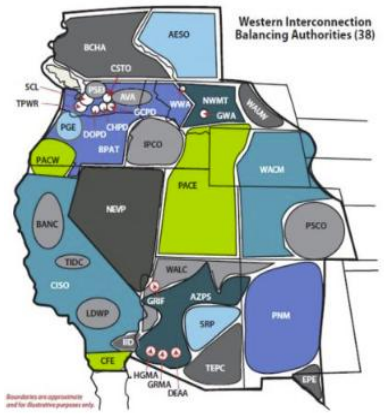
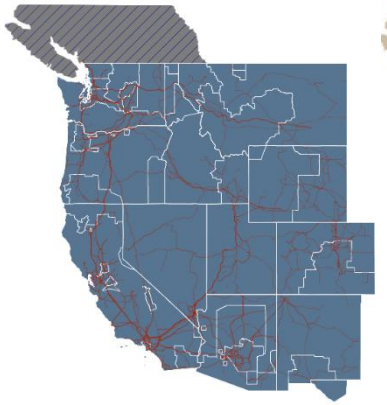
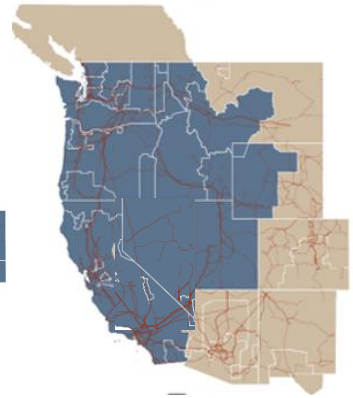
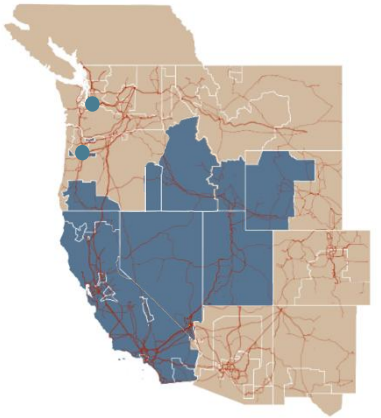
- Regionwide adjusted production costs decline by $60 million in the EDAM Bookend case (vs. 2026 BAU case)
- Regionwide costs increase by $218 million in the Markets+ Bookend case
- BPA's adjusted production costs decline by $113 million (vs. BAU) in the EDAM Bookend case, and by $25 million in the Main Split case
  - For the 2026 case, BPA benefits from joining EDAM are $90 million greater than from Markets+



BPA WMEG Follow-up Study work, 2023 - 2024

- **After the WMEG work was completed, BPA retained E3 for ongoing support to explore additional alternative scenarios**
- **E3 worked very closely with BPA's team to identify the scenarios of interest to develop key assumptions for the cases**
- **Additional cases included sensitivities to hydro levels, hurdle rates, and market footprint**
- **Key case results (Alt Split 2NV vs. 4A):**
  - For the 2026 case, BPA benefits from joining EDAM are **$165 million greater** than from Markets+
  - For the 2030 case, BPA benefits from joining EDAM are **$193 million greater** than from joining Markets+
  - For the 2035 case, BPA benefits from joining EDAM are **$216 million greater** than from joining Markets+)

Selected Footprints Compared for BPA

	Business as Usual	Westwide Market*	Alt split 2NV	Alt split 4A*
				
	DA trading without organized market; RT within the existing EIM and EIS footprints	**Single DA and RT market** that covers the entire WECC excluding Alberta and BC	**EDAM:** CA, PacifiCorp, NVE, all Northwest **Markets+**; Southwest and Rockies	**EDAM**: CA, PacifiCorp, **NVE, Idaho Power, PGE, SCL** **Markets+**: BPA, BC, PSE, Avista, Tacoma, MidCs, SW, Rockies
BPA in:	EIM only	Single Market	EDAM	Markets+

**Also modeled BPA in EIM only as a sensitivity to Westwide Market and Alt Split 4A*

EDAM

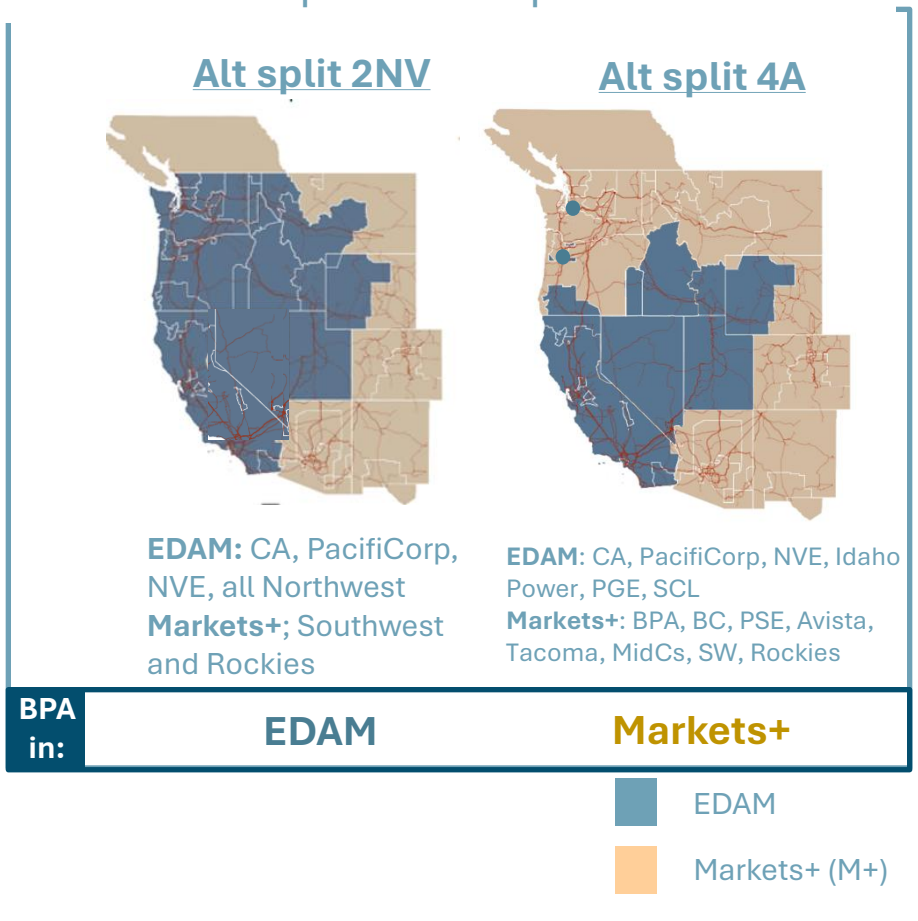
Markets+ (M+)

Credit: Greg MacDonald, PSE

The primary driver of lower Bonneville benefits in Markets + is reduced market revenues due to lower market prices

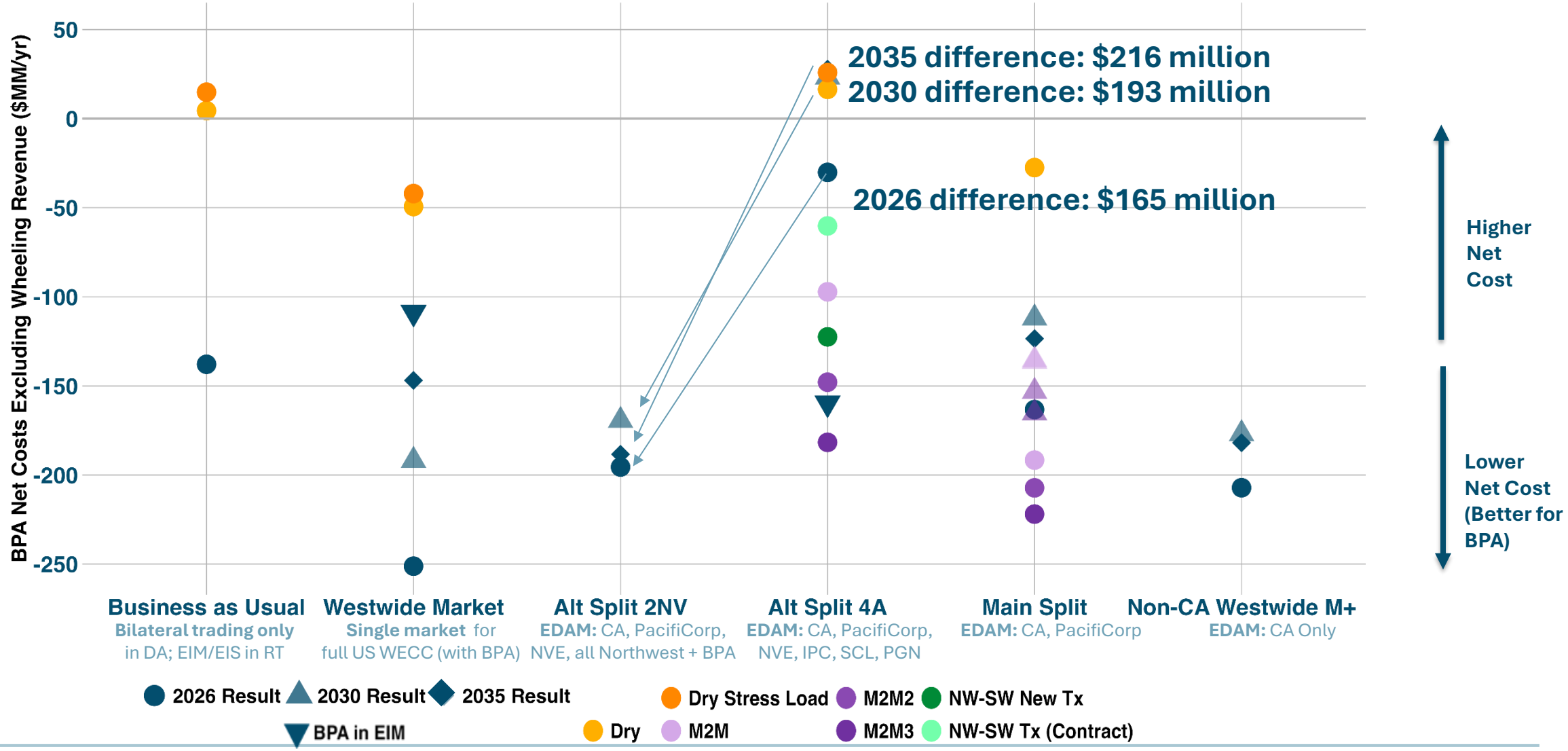
- **BPA is a net seller of energy, with very low marginal production cost**
- **Scenarios with higher prices prevailing for BPA yield more net revenue from sales**
- **In the Alt Split 4A Case, BPA joins Markets+ along with PowerEx, PSE, Avista, Grant County PUD, Chelan County PUD, Tacoma, and Northwestern**
  - Plus 400 MW of Markets+ dedicated transmission to the Southwest portion of Market+
  - Hurdle rates are applied to reflect the cost of transmission charges & market risk to cross the market seam into EDAM
- **The Pacific Northwest portion of M+ has more hydro sellers than buyers, and limited transmission out without a market seam hurdle**
- **BPA joining Markets+ results in lower, flatter prices - and lower market revenues for BPA, than when BPA is in EDAM (which has more net purchasers seeking flexibility)**

Selected Footprints Compared for BPA

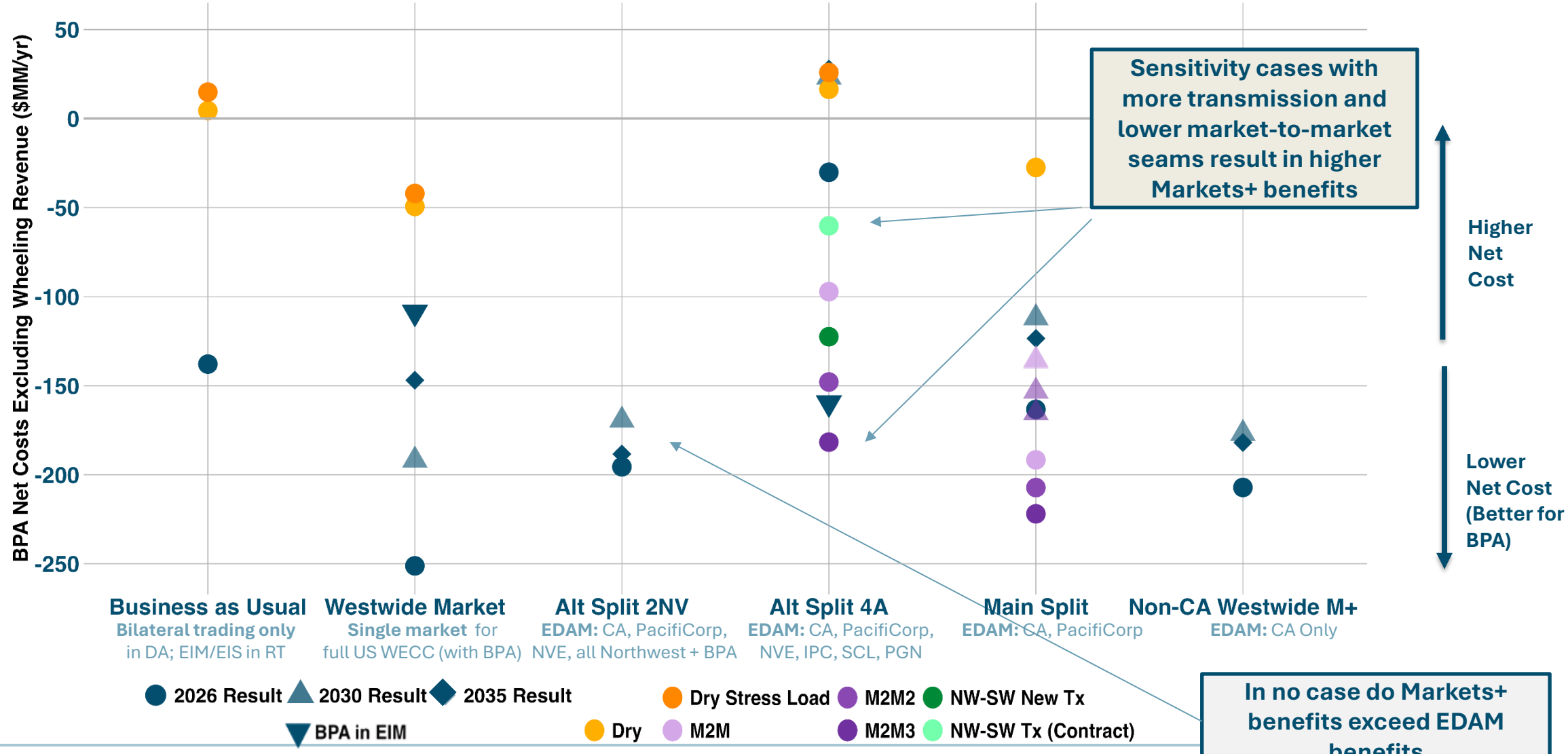


Credit: Greg MacDonald, PSE

Core cases show very high benefits for BPA joining EDAM vs. Markets+



BPA sensitivity study cases did not change the core conclusion that Bonneville would benefit more from joining a larger market



2. Response to specific points raised by Public Power Council

Comparison of E3 and PPC study methodologies

E3 Methodology

- E3 conducted a fundamentals-based market study using a rigorous, best-practice methodology agreed to by WMEG members
- WMEG members contributed to and thoroughly vetted the PLEXOS production simulation model
- Market benefits determined by multiplying price and quantity pairs calculated by PLEXOS
- Price and quantity pairs are internally consistent for model years 2026, 2030 and 2035 based on the regional resource portfolios in each year
- Price and quantity pairs reflect transmission constraints between zones across the Western Interconnection

PPC Methodology

- PPC methodology is based on a selective review of historical price trends, not a rigorous and internally consistent market study
- Methodology is non-standard and non-transparent
- Price and quantity pairs are not internally consistent, do not reflect specific regional resource portfolios, do not incorporate transmission constraints, do not reflect market depth

Hurdle Rates and Friction Between Market Seams



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PPC suggested the WMEG study used unrealistically high "hurdle rates" on market seams between EDAM & M+. We disagree.

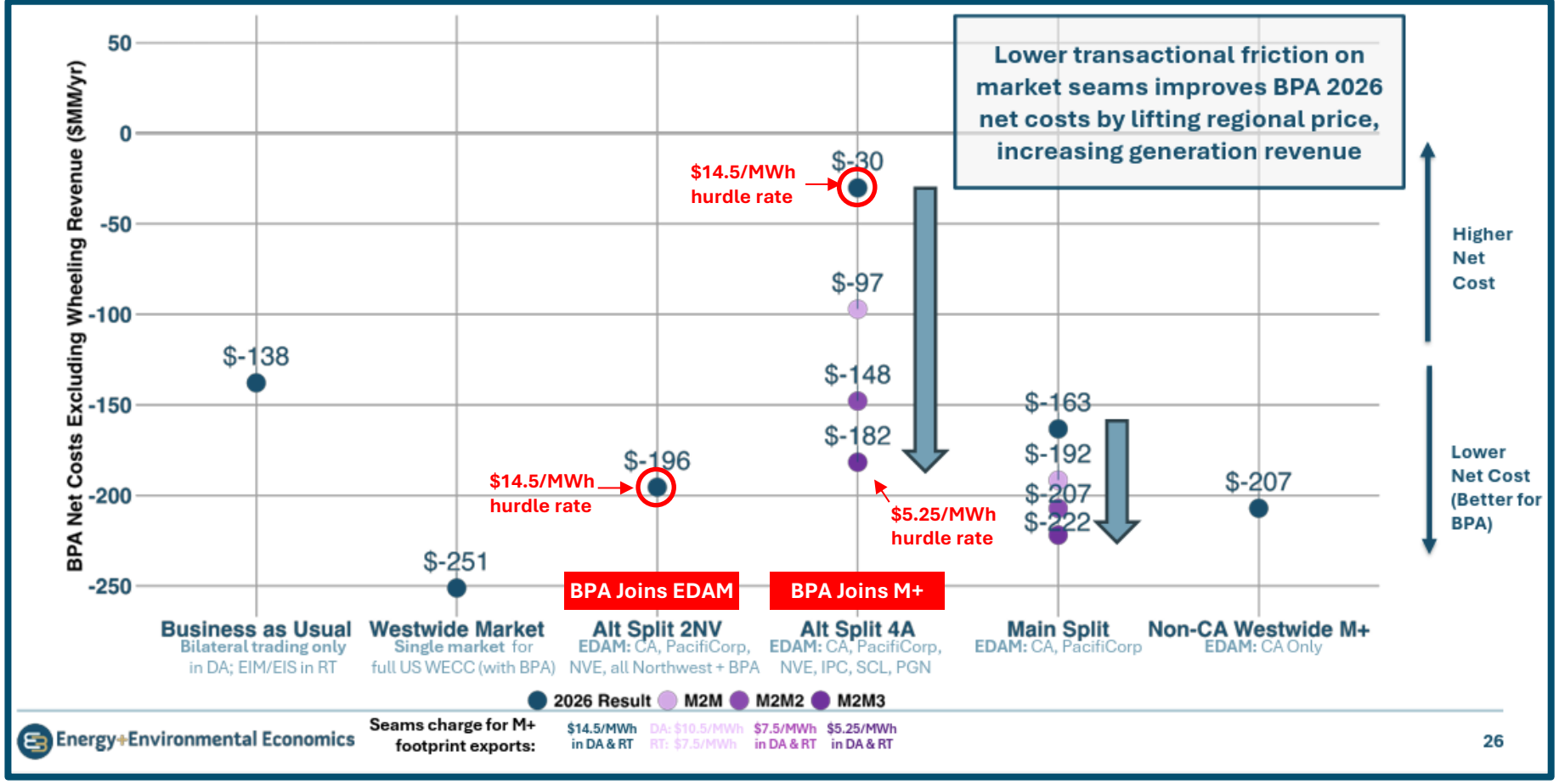
PPC asserts that E3's modeling used unrealistically high hurdle rates between adjacent markets

"The drastic differences in anticipated cost savings from changing the assumed hurdle rates stem from how the incremental hurdle rates applied to exports and imports reduce or increase modeled trade between regions. In these scenarios, every MWh of trade between market footprints is subjected to the same "hurdle rate." This outcome is an unrealistic assumption given the structure of both day-ahead markets and the continuation of a robust bilateral forward market overlay, and it is completely inconsistent with observed trading behavior today. "

- **In production simulation models, hurdle rates are $/MWh charges placed on the border between two markets to reflect actual charges and transactional friction that impede economic transactions**
  - Hurdle rates will typically make the prevailing local price in the upstream or exporting market be lower, and the "downstream price" in the importing market higher
- **The $15/MWh hurdle rate was determined by the WMEG stakeholder group. It represents a combination of transmission wheeling charges (~$5)/MWh and market friction or risk adders associated with cross-seam transactions ($10/MWh)**
- **Price data from neighboring Eastern markets (PJM-MISO, PJM-NYISO, NYISO-ISONE) show sizable persistent day ahead price spreads, which indicates that it may be overly optimistic to assume that two abutting organized markets fully moderate the impact of seams over time with experience.**
- **PPC's case comparison is inappropriate as it compares a Markets+ case with low inter-market hurdle rates to an EDAM case with high inter-market hurdle rates**

PPC asserts that BPA benefits are only $14 million greater in EDAM vs. M+, if E3 Study assumed $5/MWh hurdle rates. This is incorrect.

From original E3 BPA WMEG Follow-Up Analysis (Nov 2024)



*added annotations

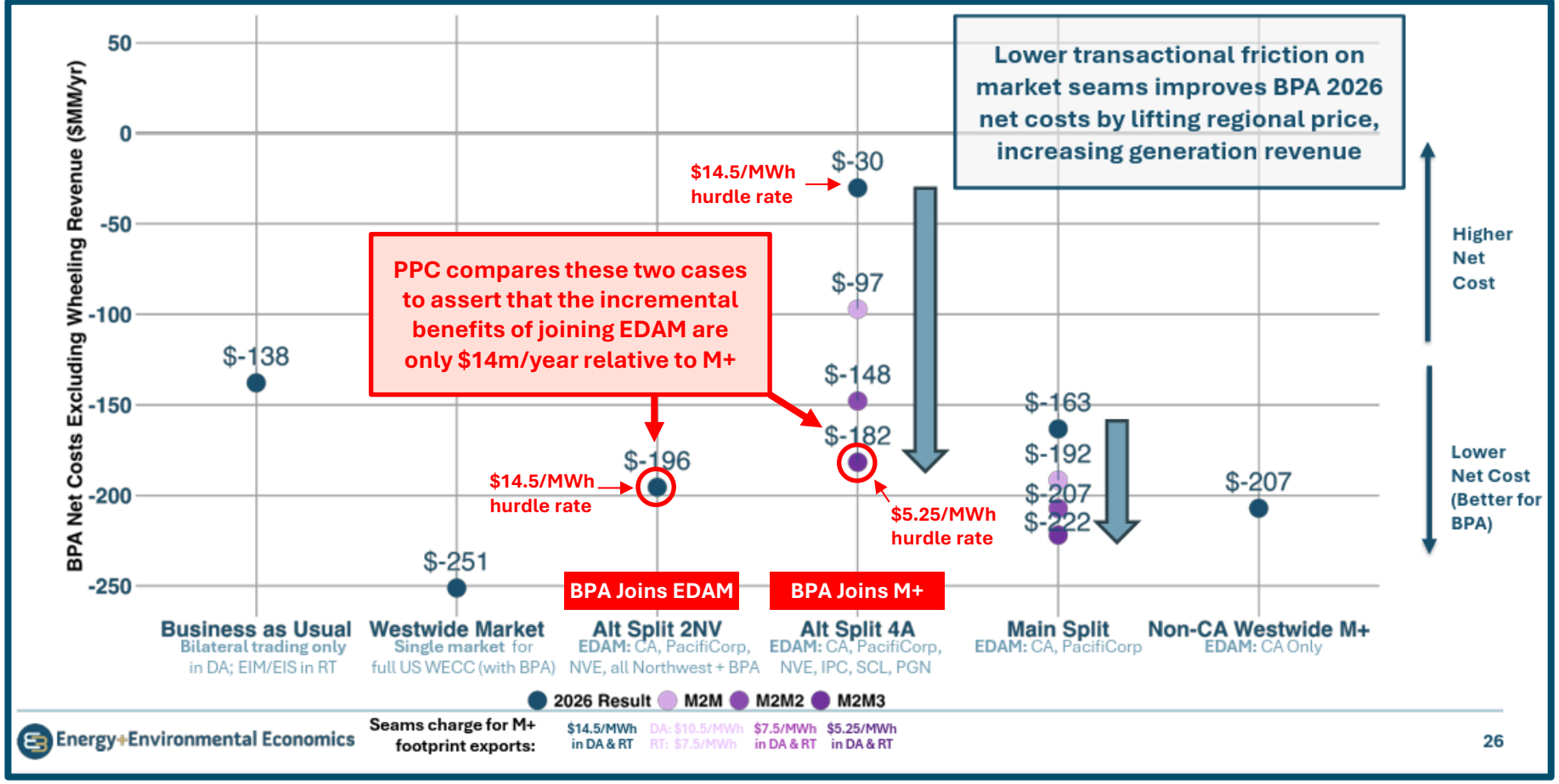
The $15/MWh hurdle rate was determined by the WMEG members as appropriate and likely representative of cross-seam market friction

It is driven by a combination of both transmission wheeling charges (~$5), as well as $10/MWh for a market friction or risk adders associated with the risk of an entity choosing to take on the risk of scheduling an export from M+ to EDAM before the price in either market is known

Original E3 BPA WMEG Follow-Up Presentation: https://www.bpa.gov/-/media/Aep/projects/day-ahead-market/2024/E3Presentation-bpa-stakeholder-meetingnov4-2024.pdf

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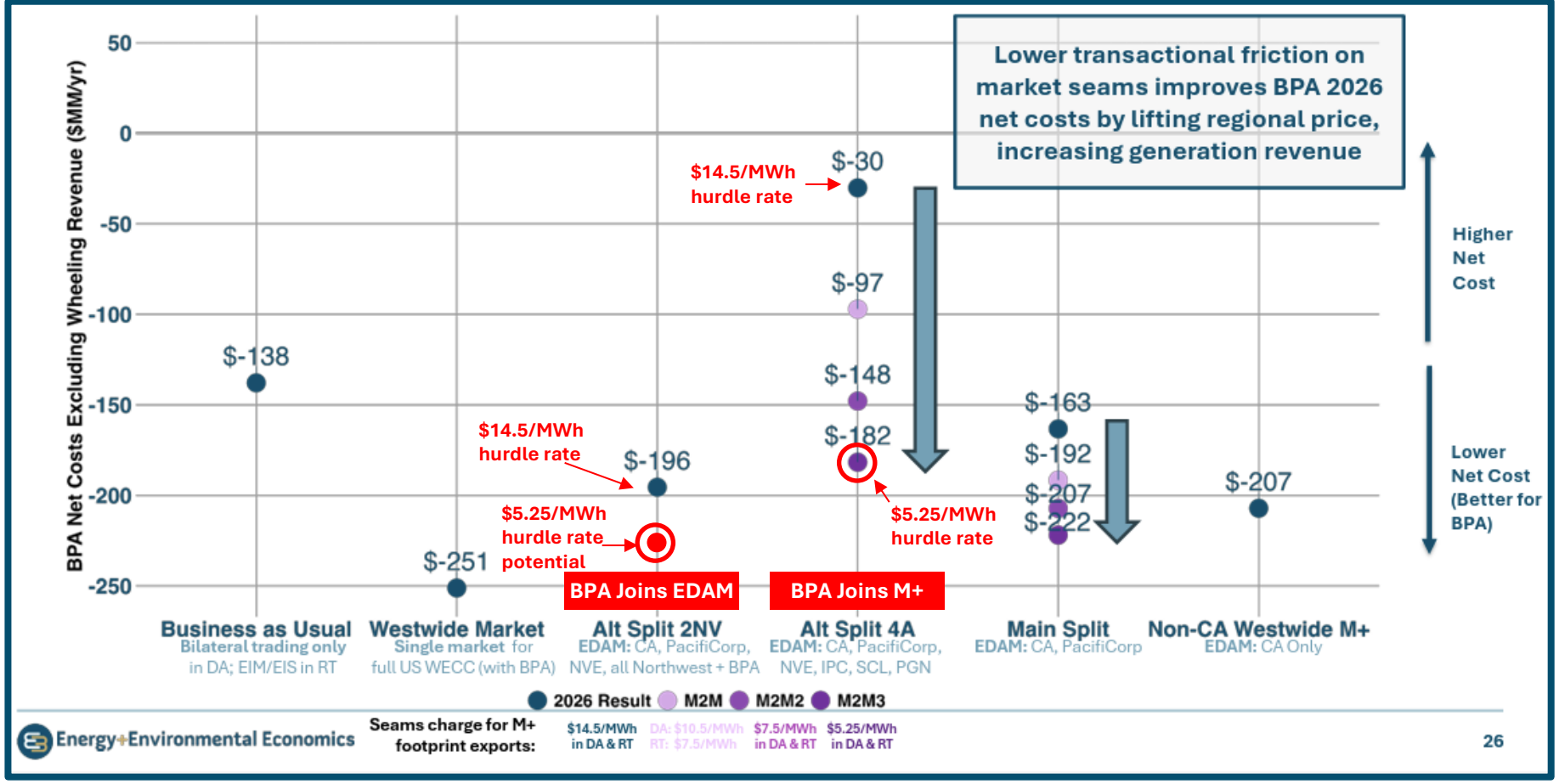
*added annotations

These two cases (Alt Split 4A M2M3 vs. Alt Split 2NV) are fundamentally not comparable due to different hurdle rate assumptions on market seams

Original E3 BPA WMEG Follow-Up Presentation: https://www.bpa.gov/-/media/Aep/projects/day-ahead-market/2024/E3Presentation-bpa-stakeholder-meetingnov4-2024.pdf

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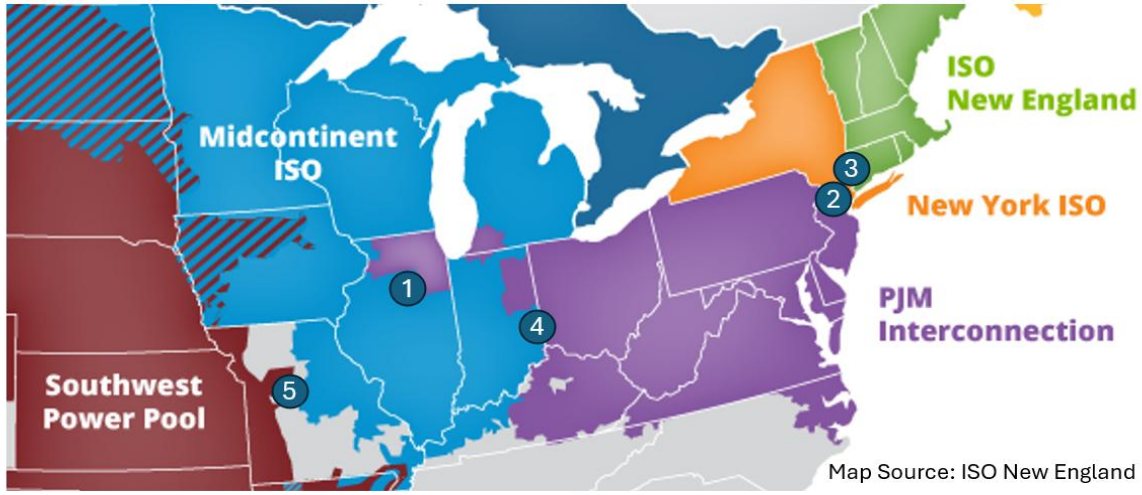
*added annotations

A case where BPA joins EDAM and faces a low hurdle rate to external trades would result in *more* benefits to BPA

A reasonable guess is that BPA benefits would be in between a higher hurdle rate case and a full Westwide market case (illustrated to left)

Seams challenges: There are significant and persistent price differences at the seams between markets in the East

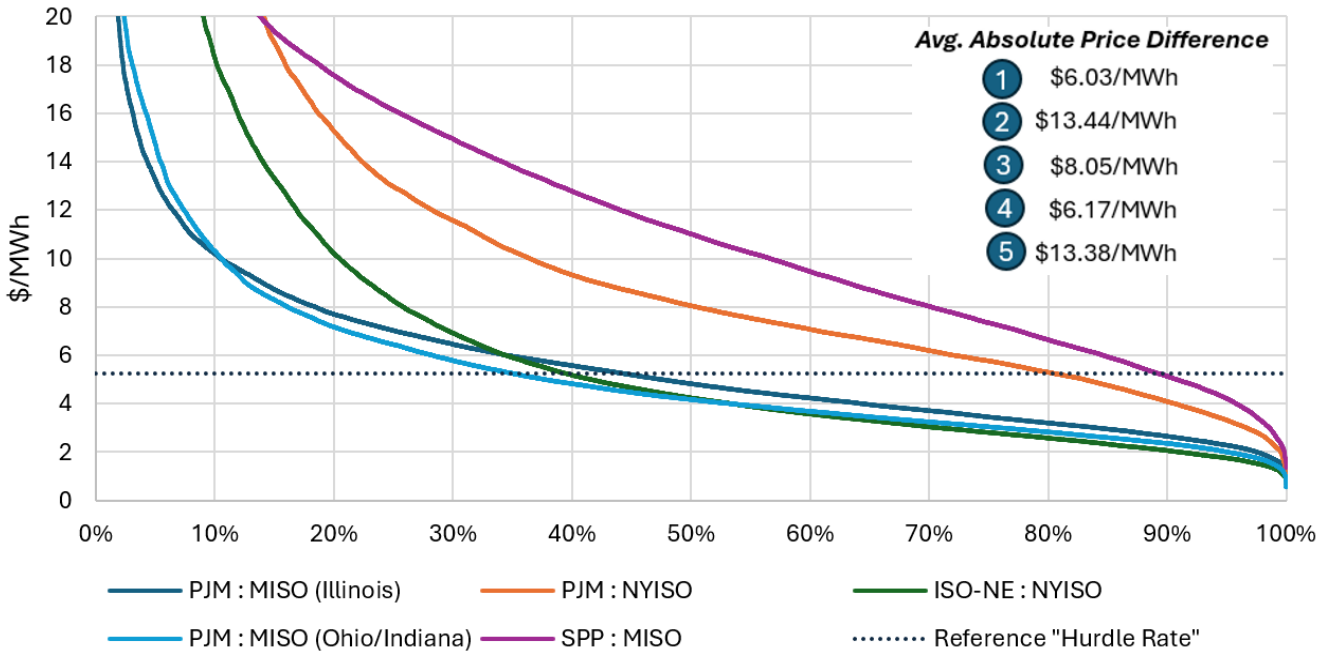
- Real-world data from neighboring eastern markets support the notion that there are significant friction that prevents trading and price convergence
- These types of price separations would otherwise suggest high levels of interregional intertie utilization



Map Source: ISO New England

1. PJM : MISO (Illinois) – COMED/AMEREN IL
2. PJM : NYISO – PSEG/HUD VL (ZONE G)
3. ISONE : NYISO – CONNECTICUT/HUD VL (ZONE G)
4. PJM : MISO (Indiana/Ohio) – DEOK/INDIANAPOLIS P&L
5. SPP : MISO – SPP SOUTH HUB/ENTERGY ARKANSAS

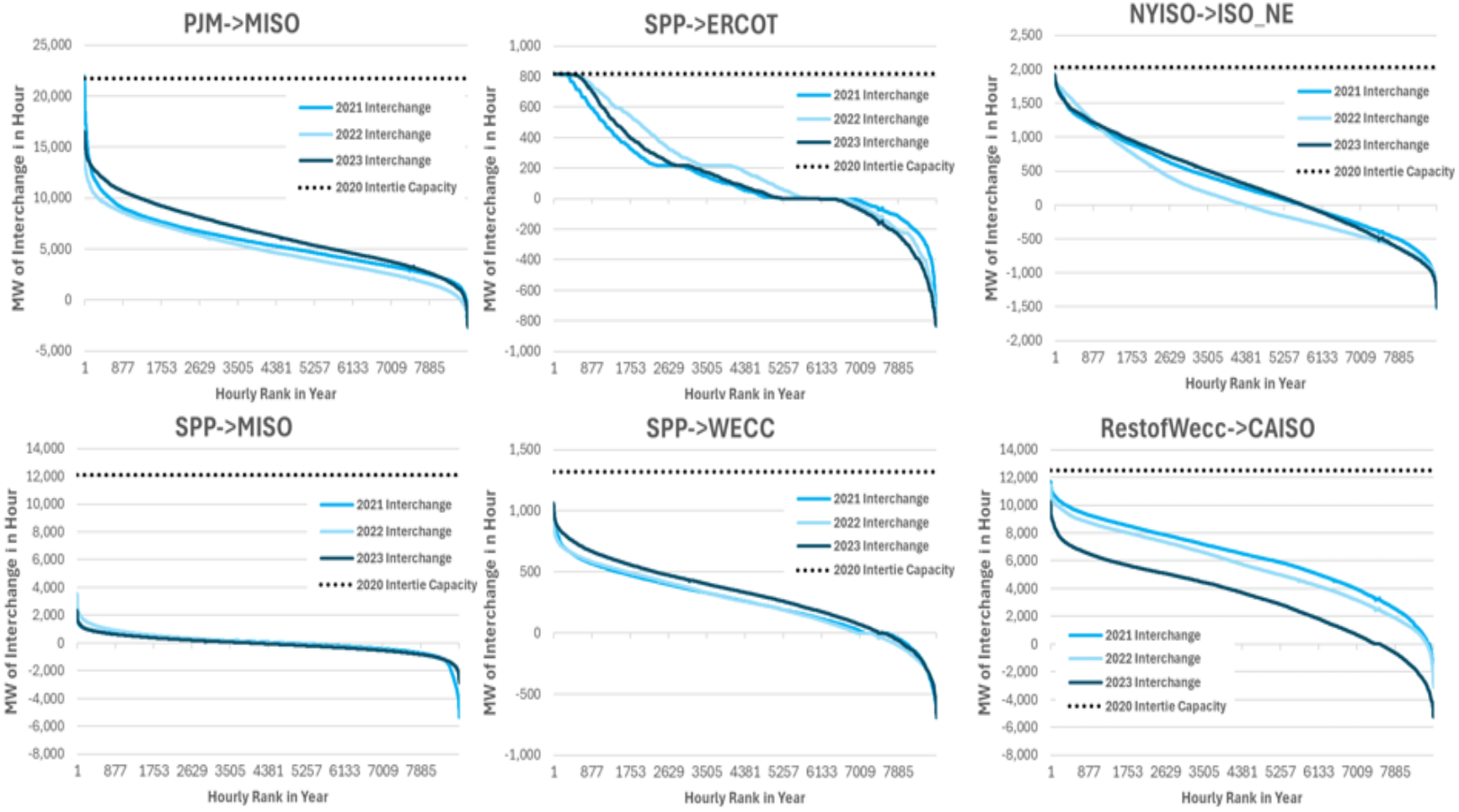
Duration Curves of Rolling 24-Hour Avg. Absolute Price Differences Across Markets Seams ('23-'25)



Seams challenges: existing seams are underutilized in Eastern markets despite the fact that significant price spreads exist

- Interregional intertie capacity has historically been underutilized, leaving economic savings and resiliency benefits unrealized
- If existing seams were frictionless, we would expect to see:
  - (a) no persistent price spreads between adjacent markets, or
  - (b) persistent transmission congestion
- In fact, we see the opposite: persistent high price spreads and few economic transactions

Interregional Hourly Interchange MW vs. Intertie Capacity



Data Source: https://www.eia.gov/electricity/gridmonitor/dashboard/electric_overview/US48/US48

Seams challenges: a large share of transactions across existing seams are uneconomic

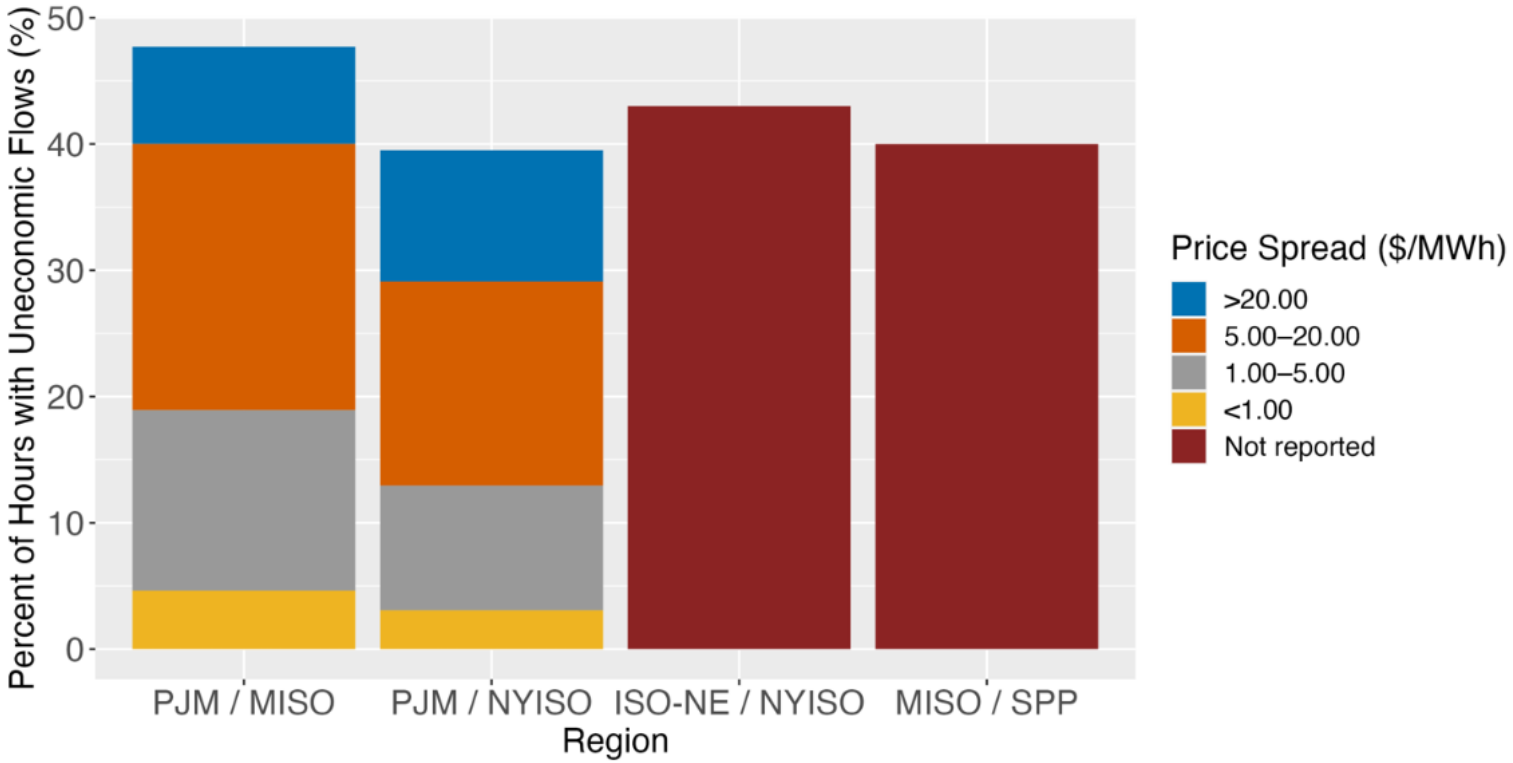


Figure 2. Hours with uneconomic power flow across major interregional seams in 2022

Price spread means the difference in average hourly locational marginal prices between regional interfaces

- NREL analysis finds nearly 50% of interregional flows in 2022 were "uneconomic"
- "Uneconomic" means the transaction flows against the hourly LMP price spreads
- In nearly 10% of hours, the uneconomic price spreads exceed $20/MWh

Day-ahead vs. Real-time Price Differences



Energy+Environmental Economics

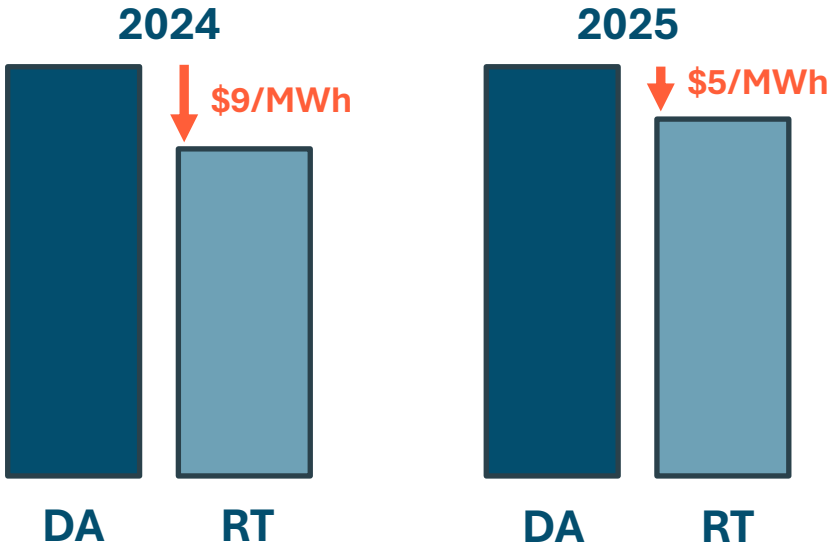
Day-Ahead vs. Real-Time Price Differences

PPC asserts that differences between historical Day-Ahead Mid-C bilateral pricing and Real-Time WEIM pricing is predictive of expected price differences between Markets+ and EDAM

"From 2021 through 2025, Western Energy Imbalance Market (WEIM) real time market prices for Pacific Northwest balancing areas averaged $10–20 per megawatt-hour (MWh) below the Mid-Columbia day-ahead bilateral price. That gap cannot be simply explained by organized market efficiency gains; it reflects design choices … The design features that suppress WEIM prices (no fast-start pricing, capped scarcity mechanisms, BAA-level mitigation, operator out-of-market actions) carry forward into EDAM's day-ahead price formation."

- **Comparing Day-Ahead Mid-C bilateral prices and Real-Time WEIM prices is inappropriate as these are two different products, traded in different timeframes, through different mechanisms (bilateral vs. centralized)**
- **The differences reflect risk premiums, block-energy conventions, liquidity, commitment considerations, and more.**
- **Previous analysis from E3 also found that Mid-C prices are affected by California's CO_2 pricing, with a $1/metric ton increase in the price equating to a $0.41/MWh increase for Mid-C[3]**
- **In fact, in 2024, average Day-Ahead Mid-C prices were greater than average Real-Time Mid-C prices by approximately $9/MWh[1] and in 2025 the price difference was $5/MWh[2]**

Bilateral Mid-C Pricing



[1] Page 132, https://www.caiso.com/documents/2024-annual-report-on-market-issues-and-performance-aug-07-2025.pdf
[2] Page 138, https://www.caiso.com/documents/2025-annual-report-on-market-issues-and-performance.pdf
[3] https://www.sciencedirect.com/science/article/abs/pii/S0301421517304901

Day-Ahead vs. Real-Time Price Differences (Cont.)

PPC asserts that E3's model cannot be trusted because it does not accurately reflect bilateral Mid-C day-ahead prices

"This suggests that the impact of "seams" and incremental hurdle assumptions are overstated in the production cost modeling and other factors are not materially represented. A model with assumptions that get the sign wrong on the central observable relationship should not anchor a $100 million claim. "

- **The question facing BPA and other market participants – and the question E3 evaluated for the WMEG members including BPA – is "What is the production cost difference between joining EDAM and joining Markets+?"**
- **Modeling market dynamics and price formation under the status quo of a bilateral Mid-C market was not a significant consideration in the WMEG study**
- **Day-ahead and real-time prices in EDAM and Markets+ in E3's modeling reflect expected relationships**
- **PPC agrees with WMEG members and other observers in stating "PPC does not believe the status quo of bilateral trading is a sustainable future." (page 24)**

Fast-Start Pricing



Fast Start Pricing Impact

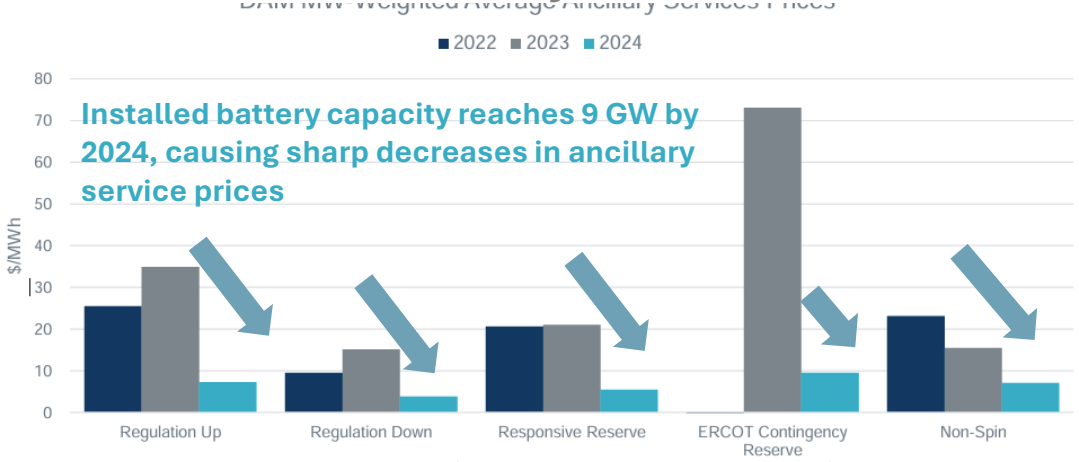
PPC claims that "[w]ithout fast-start pricing … markets undervalue physical capacity resources and dilute the investment signals needed to build them", based on paper funded by PPC and PowerEx.

1. **PPC relies on a study that materially overstates the impact of fast-start pricing**
   - Claimed $20/MWh value for fast-start pricing is based on reviewing hours when fast-start units were operating, ***not a market study***.
   - The actual impact of fast-start pricing is much lower. SPPs Market Monitoring Unit found that there "was very little change in revenues to fast start units due to the new fast-start pricing" in 2022, with estimated increases of 1.5% and 0.5% for the DA and RT, respectively.
   - It is logically inconsistent to assert that a $20/MWh price delta between EDAM and Markets+ would persist with a $5/MWh hurdle rate

2. **Increased competition will likely limit BPA's ability to benefit from fast-start pricing in either market over time**
   - Growth in flexible, fast-start batteries in CA and AZ has led to declines in ancillary service prices and real-time volatility
   - SPP observed a sizable decrease in the utilization of fast start resources in 2025 compared to previous years[1]
   - NW market will have ample supply of flexible hydro and the M+ portion of the NW becomes a flexible generation pocket

3. **All of E3's Markets+ cases included an adder for fast-start pricing in the Markets+ footprint (but not EDAM)**
   - Increases Markets+ benefit for BPA by $30 million in 2026

Example of Price Impact of Battery Additions: ERCOT Ancillary Service Prices



Source: https://www.ercot.com/files/docs/2025/01/27/9-3-commercial-markets-update.pdf

[1] Page 93, 2022 annual state of the market report.pdf
Page 80, 2025_annual_state_of_the_market_report.pdf

Importance of Fast-Start Pricing in Market Design by EnergyGPS: https://powerex.com/sites/default/files/2022-06/The%20Importance%20of%20Fast%20Start%20Pricing%20In%20Market%20Design%20-%20June%202022.pdf

Scarcity Pricing

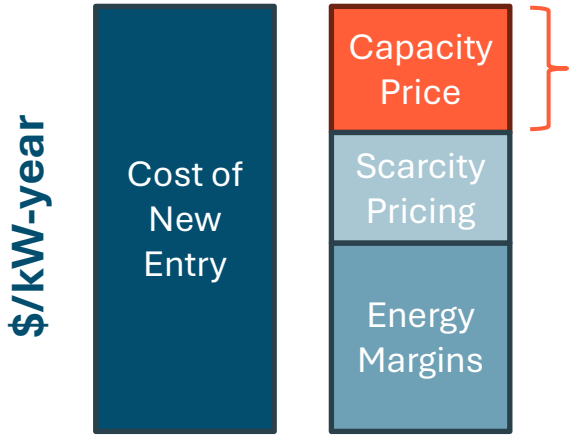


Scarcity Pricing

PPC claims that Markets+ contains superior scarcity pricing, which increases the value of BPA surplus sales and dilutes investment signals for new capacity

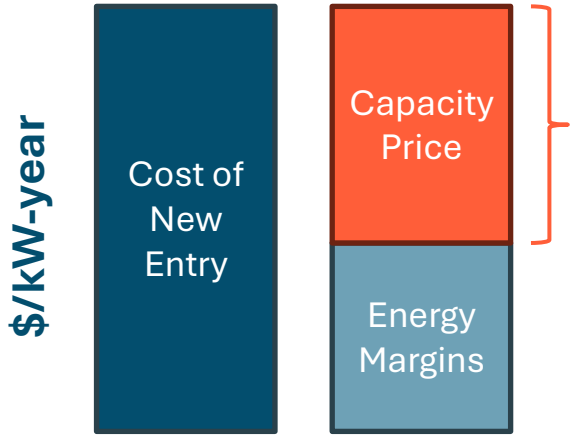
- **Scarcity pricing in the energy market is one way to send economically efficient price signals for investment – the other is through a capacity product. In a market, if scarcity pricing increases, the value of the capacity product will decrease.**
- **BPA, as a seller of surplus capacity should be indifferent between lower energy and higher capacity pricing vs. higher energy pricing and lower capacity pricing.**
- **Additionally, periods in which BPA is likely to have surplus hydro generation are structurally more likely to be periods of low scarcity. And vice versa, years where BPA has low hydro and is likely to be a net buyer will structurally have more scarcity.**

Market Design with *High* Energy Scarcity Pricing



Scarcity pricing increases the energy market revenues that a resource can earn but decreases the capacity market revenues that a resource can earn

Market Design with *Low* Energy Scarcity Pricing



In a market, the capacity price is expected to clear at the difference between the cost of new entry (CONE) and energy margins. This is often referred to as "net CONE" or the "missing money"

Scarcity pricing should have only a small impact, if any, on BPA surplus sales revenue

Greenhouse Gas Accounting



Energy+Environmental Economics

Carbon Pricing

PPC claims that EDAM market rules enable clean generation in non-GHG-regulated regions to bid to be attributed as imports to GHG regulated regions (in CA & WA) too easily because EDAM doesn't require those resources to "demonstrate delivery". PPC claims this is estimated to reduce EDAM market prices by up to $5/MWh, and reduce BPA savings by $2-25 million vs. M+

+ **This overstates the impact of GHG pricing on BPA's benefits in EDAM vs. M+ and misses GHG-related value to being in the same market as California**
  - **Applied to overly large BPA sales volume.** PPC applies its assumed GHG price difference to a large volume of BPA surplus sales (4-5 TWh annually), but much of BPA's volume is transacted bilaterally under BPA's status as an Asset Controlling Supplier
  - **GHG Pricing in California would still affect BPA revenue if BPA is in Markets+.** BPA will not be able to monetize its carbon-free attributes in sales to Arizona, and California will remain the largest market and largest source of value for GHG-free power even if BPA is in Markets+.
  - **In M+, BPA would face a market seam for making low-GHG sales to CA.** A market seam that increases the cost and reduces the risk of selling hydro to California could inhibit BPA's ability to monetize the low carbon attributes of its sales