Exploring Potential Seams Issues Between Proposed Western Day-Ahead Electricity Markets

Prepared for WPTF & PGP

January 2024

WPTF WESTERN POWER TRADING FORUM

PGP PUBLIC GENERATING POOL

Caitlin Liotiris
Principal, Energy Strategies
ccollins@energystrat.com

Carrie Bentley
Co-Founder & CEO, Gridwell
cbentley@gridwell.com

Kallie Wells
Co-Founder & Head of Analysis, Gridwell
kwells@gridwell.com

Gridwell CONSULTING ENERGY STRATEGIES

Outline

- **Executive Summary**
- **Overview of Current Market Development and Regional Coordination Efforts in the West**
- **Western Seams Issue Overview & Focus on Seams Exploration**
- **Seams Within a Day-Ahead Market**
- **Seams Between Two Day-Ahead Markets**
  - Economic Seams Issues
  - Transmission Availability
  - Contracting Barriers
  - GHG Dispatch & Accounting
  - Market Power Mitigation
- **Key Takeaways**

Executive Summary

Overview of Seams Evaluation and its Intended Purpose

- **The Western Power Trading Forum (WPTF) and the Public Generating Pool (PGP), along with others, have expressed an interest in exploring the potential for "seams" and "seams issues" that might arise with the establishment of multiple day-ahead markets operating in the West**
- **The Seams Evaluation is not intended to convey a position about how the West should proceed in market development (including whether one or two day-ahead markets are ultimately stood up)**
  - There are many considerations that will go into market participation decisions and this work is not intended to cover the various aspects that will go into individual participant decision making
- **The Seams Evaluation aims to *provide a framework for understanding the key seams areas and seams issues that may exist between the two proposed day-ahead markets in the West***
  - When applicable, the evaluation provides background on how similar seams issues have been addressed by RTOs in the East, while recognizing that Western day-ahead markets will likely require unique solutions
- **The work is also not intended to *propose specific solutions* to seams issues, nor is it comprehensive of all the seams that will likely exist in the West**

Seams – generally refers to the physical or commercial boundaries or interfaces between electricity markets, control areas, or other electricity systems

Seams issues – represent the inefficiencies, costs, or challenges that emerge due to differing rules, regulations, and procedures on each side of a seam

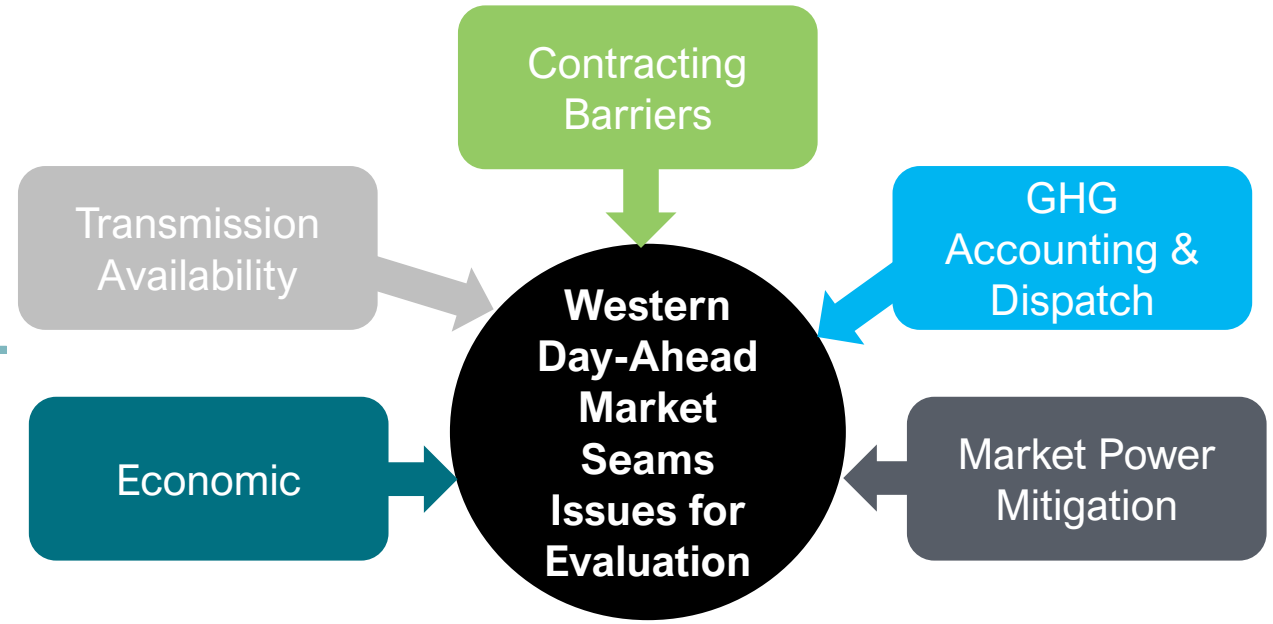
Day-Ahead Markets are Fundamentally Different than RTOs

- **The day-ahead markets proposed in the West are fundamentally different than RTOs in the East**
- **These differences impact the "seams areas" that are most applicable for Western day-ahead markets**
- **They also impact how seams might be addressed and whether the mechanisms used in the East can be used as a template, or whether they require modification**

Key Differences Between Day-Ahead Markets & RTOs

- RTOs Involve Balancing Authority (BA) Consolidation and Full Participation
- RTOs Fully Coordinate Resource Adequacy (RA)
- RTOs Consolidate Interconnection Processes and Transmission Planning
- Day-Ahead Markets Lack Full Co-Optimization of Ancillary Services
- OATT Consolidation Would be Required to Fully Optimize Transmission Use in Day-Ahead Markets

Key Day-Ahead Market Seams Areas



There are Existing Tools to Address Economic Seams, but They Require Modification for the West and Require Certainty that Economic Transactions Can Occur Between Markets

- **The proposed day-ahead market constructs have the potential to improve economic outcomes relative to the status quo in the West**
- **However, economic seams will persist in a future with two-day ahead markets**
- **Interface pricing is the pricing mechanism used to facilitate flows between RTO markets**
  - It is unclear whether interface pricing will be fully implemented at Markets+ and EDAM boundary locations and uncertain whether economic trades will be permitted between the two markets under the current design for EDAM
- **Interface pricing, and economic exchange, will be needed in order for the West to build on/modify the economic seams tools that are relied on by RTOs (which include various tools in day-ahead and real-time)**
- **While the West should be able to build on the concepts used between RTOs, these tools are currently untested under non-RTO day-ahead market frameworks, and may not directly translate given the seams *within* the day-ahead markets**
  - Additionally, we expect that the West will require more parties and/or more seams agreements (including between BAs and Market Operators) given the nature of day-ahead markets

Economic Seams

The existence of two day-ahead market footprints/ market operators and the friction associated with economic trading between the two markets will ***impede fully optimized dispatch and unit commitment***

Western Day-Ahead Market Paradigms also Present Other (Indirect) Seams Considerations

- **In addition to economic seams, there are other types of seams unique to Western day-ahead markets which may warrant consideration and potential resolutions (if feasible) in a future seams agreement**

Transmission Availability	Contracting Barriers	GHG Accounting & Dispatch	Market Power Mitigation
Full transmission optimization will be ***more challenging*** with multiple day-ahead markets, especially given the ability to withdraw transmission capacity from the market optimization.	There will be ***risks and uncertainties*** in transacting across day-ahead market seams. These ***may deter entities from entering into long-term transactions across the boundaries***, eroding the diversity of resources entities may rely on. These uncertainties will persist even if various economic seams tools are implemented.	GHG pricing zones do not exist in other organized markets, and they ***add to the unique and challenging nature of seams*** in the West. Addressing GHG pricing and accounting could ***add another layer to seams agreements***, including how to model and price GHG adders across the market seam.	Smaller market footprints reduce competition and ***increase the potential for uncompetitive conditions*** at a system level. Additionally, two market power mitigation approaches may result in differing levels of mitigation which ***creates disparate incentives*** to participate in one market or another and may create challenges with modeling interface prices.

What we learned

Eastern Markets Have Developed Tools to Address Seams

1. Eastern RTOs have Joint Operating Agreements (JOAs)/seams agreements that help manage seams, including economic seams, transmission planning seams and more
2. JOAs have taken years (decades) to develop and continue to evolve
3. There are a variety of tools that have been developed to reduce the impact of seams between RTOs (including tools to reduce economic seams)
4. While these tools continue to evolve and improve, there are some inefficiencies that will persist simply because of having two market operators (from economic seams and other seams categories)

Western Seams are Different!

1. The *TYPES* of seams that are expected to exist between Western day-ahead markets differ from the types of seams between RTOs
2. Market operator functions are different/limited in a day-ahead market, which means the parties to seams agreements will be different (and likely more numerous in terms of parties involved and # of seams agreements)
3. As a threshold matter, day-ahead markets designs need to evolve in order to be able to build on (and modify) the economic seams tools used in the East for application in the West
4. The economic seams tools used in the East will require modification and special consideration to be applied in the West (they can't simply be "copied and pasted")
5. Additional seams areas may need to be addressed (to the extent possible) in the West including GHG accounting, contracting barriers, transmission availability, and more

With two day-ahead markets in the West, there are several seams issues that will need to be addressed. The East offers a starting place for developing tools/processes to address some of the those (particularly economic seams). But there are unique features of day-ahead markets that will require changes to those tools, which remain untested in the day-ahead market construct.

Overview of Current Market Development & Regional Coordination Efforts in the West

Overview of Current Market & Regional Coordination Efforts

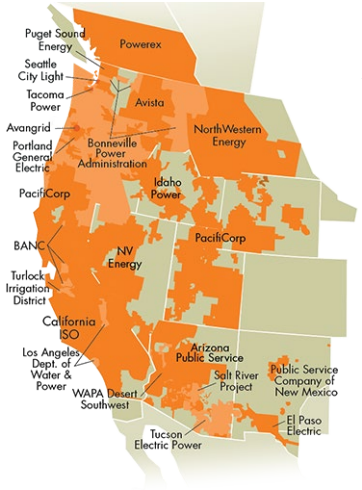
Other emerging or related activities:

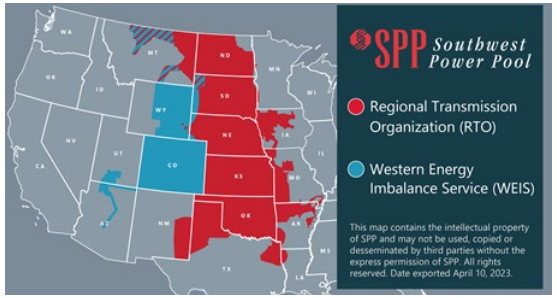
- CO and NV laws on RTO participation
- Western Transmission Expansion Coalition (West-TEC)

Developing Markets/Coordination Efforts

- SPP RTO Expansion to the West
- SPP Markets+
- CAISO Extended Day-Ahead Market (EDAM)
- Western Resource Adequacy Program (WRAP)

Existing Markets





Overview of the Day-Ahead Market Concept & Timeline

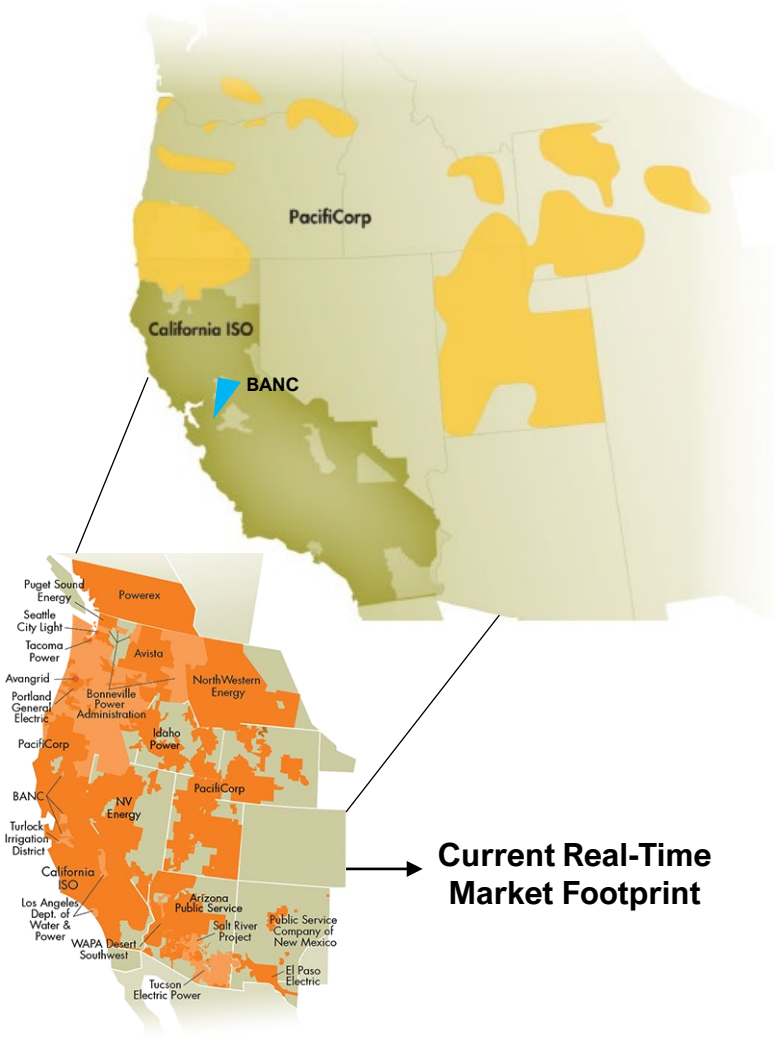
- **The unique concept of a day-ahead market, outside of a full RTO, would include the following features:**
  - A centrally optimized day-ahead unit commitment process, financially binding day-ahead schedules, and real-time dispatch
- **In the day-ahead market approach, participating utilities would continue to administer their own transmission tariffs and transmission planning functions and would retain operational/functional control of their transmission systems and portions of the fleet that are not offered into the market**
  - Reaching a full RTO would require Balancing Authority Area (BAA) and Open Access Transmission Tariff (OATT) consolidation
- **But, given the unique needs of the West, RTO formation is not currently being widely pursued and instead, two day-ahead markets are under development in the West:**

Topic	EDAM	Markets+
Market Design Finalized	EDAM Final Proposal published in December 2022. Approved by CAISO Board/EIM Governing Body in February 2023.	Final Service Offering published in November 2022 . "Phase One," which will result in a tariff filing at FERC, is underway and may be filed with FERC in early 2024.
Tariff Filed	Tariff approved by FERC in December 2023.	Targeting Q1/Q2 2024 filing with FERC.
Go-Live	Targeting early 2026 (*recently changed from 2025).*	Targeting early 2026.

CAISO Extended Day-Ahead Market (EDAM)

- **CAISO's EDAM was developed through a multi-year stakeholder process and tariff provisions were filed with FERC in August 2023 (Docket ER23-2686) and approved by FERC (with one exception) in December 2023**
- **EDAM did not require the same funding commitment to result in a tariff filing and, thus, there is no "apples-to-apples" comparison to the map shown for Markets+ (in the next slide) and those entities that are interested in participation in EDAM, but we know**
  - PacifiCorp, has committed to joining EDAM at go-live (now likely 2026) and the Balancing Authority of Northern California (BANC) has recommended joining EDAM (though final participation is subject to decision by its individual members)
  - Many potential market participants joined in the open EDAM stakeholder process
- **EDAM policy design status:**
  - Many EDAM policy design elements are known, as they are contained in the CAISO's tariff that is filed with FERC
  - Various design details are yet to be determined, with key elements forthcoming from EDAM Entity tariff provisions (which are not yet available for review)
  - Numerous details also remain to be developed through ongoing CAISO stakeholder processes (e.g., EDAM ISO balancing authority areas participation rules") and in business practices, etc.

Footprint of Announced EDAM Participants



SPP Markets+

- **SPP's Markets+ Final Service Offering was published in November 2022 after a nearly year-long stakeholder process with interested Western Parties**
- **SPP's Markets+ secured $9.7M in funding from 22 utilities* to fund finalization of the day-ahead market design and filing of a proposed tariff with FERC with a target deadline of Q1 of 2024**
  - This "Phase 1 effort" will continue through protocol development, and Markets+ is working to secure funding for implementation ("Phase 2")
- **Markets+ policy design status:**
  - Many Markets+ policy design elements were outlined in the Final Service Offering, but were further developed and/or modified during the course of this work through the "Phase 1" effort, which is still ongoing
  - Expect a FERC filing with many key policy details outlined in Q1/Q2 2024
  - Many market design details remain to be determined in the "market protocols" and, to a lesser extent, in how individual participants will implement the market and modify their transmission tariffs

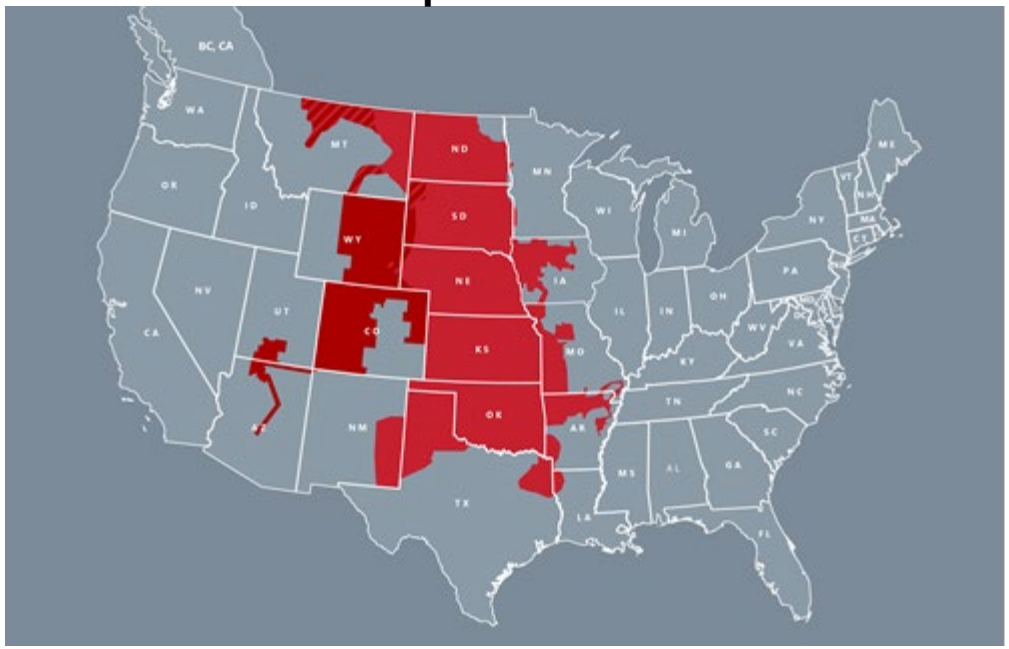
Footprint Funding Markets+ "Phase One"

*Some funding also came from "independents" seeking to participate in the Markets+ design process

SPP RTO-West

- **At present, SPP operates an RTO in the Eastern Interconnection, and a relatively small number of Western entities have signed on to the "RTO-West" initiative**
- **RTO-West will extend the footprint of SPP's RTO, using the DC ties between the Eastern and Western interconnections to provide some connectivity between two parts of the market**
- **For the most part, the same provisions that apply in SPP's existing RTO would apply in RTO-West, with a few modifications, including:**
  - In the Western Interconnection, transmission facilities under the SPP tariff will be defined as those at or above 100 kV (defined as at or above 69 kV in the East)
  - Special provisions included to address WAPA customers (especially on the Colorado River Storage System or "CRSP")
  - Special treatment for the DC tie facilities is provided for
- **Entities that opt to join RTO-West will <u>not</u> be part of the day-ahead options (Markets+ or EDAM)**
  - But it is possible there will be some level of coordination (especially between RTO-West and Markets+), though details are unknown and market timelines could complicate coordination
- **RTO-West is targeted to go live in Q1 2026**
- **This has the potential to introduce seams with both EDAM and Markets+ depending on the footprints of each**
  - However, these seams are not the focus of this work

Footprint for RTO-West



SPP RTO-West Potential Participants (dark red in map)			
Basin Electric Power Cooperative	Municipal Energy Agency of Nebraska (MEAN)	WAPA (Upper Great Plains, RMR & CRSP)	Platte River Power Authority (PRPA)
Deseret Power Electric Cooperative	Tri-State	Colorado Springs Utilities	

Western Resource Adequacy Program (WRAP)

- **WRAP has been in development by the Western Power Pool (WPP), which was formerly the Northwest Power Pool (NWPP), for years**
- **WRAP's tariff was approved by FERC in February 2023 and the program is being stood up with business practice development and more**
  - A "Detailed Design Document" is available here with more program details
- **Current participants are:**

APS	EWEB	PNM	Snohomish PUD
Avista	Grant PUD	Portland General Electric	SRP
BPA	Idaho Power	Powerex	Tacoma Power
Calpine	NorthWestern	PSE	The Energy Authority
Chelan PUD	NV Energy	SCL	
Clatskanie PUD	PacifiCorp	Shell	

- **WRAP is designed to address concerns about looming capacity shortages in the West and to address the fact that there was no central Resource Adequacy (RA) requirement and thus no party ensuring there was not "double counting" of resources**
- **It is the "first of its kind" RA program and will operate outside of an ISO/RTO, which results in unique requirements**
  - WRAP was designed, initially, to operate within the bilateral/OATT framework but it must also interact with different wholesale energy markets, as WRAP participants are likely to span a number of different market paradigms,
    - The interaction of WRAP with markets has been referred to as "interoperability"

Resource Adequacy (RA), Day-Ahead Markets, and Interoperability

- **At present, the West is poised to have multiple, inconsistent RA frameworks in operation**
  - This includes, most notably, the WRAP and the California Public Utilities Commission (CPUC)/CAISO and RTO-West RA paradigms
  - It is important to recognize that the development of more coordinated approaches to RA (such as WRAP and RTO-West) will lead to efficiencies over the prior RA paradigms in the West (where there was no real coordination)
  - However, there remain inefficiencies and "seams" that may result from having multiple RA frameworks in operation in the West
- **Additionally, there is <u>not</u> expected to be complete alignment between RA programs and market participation**
  - For instance, some WRAP participants plan to join EDAM, while others plan to join Markets+, and yet others may not participate in any organized day-ahead market at all
    - And some market participants within a given day-ahead market may participate in different RA programs
  - This means that WRAP must be able to operate effectively across the day-ahead markets and the bilateral/OATT market (for which it was designed), which creates an added level of complexity in market design and coordination
- **It is important to recognize that the existence of multiple RA paradigms, which do not have the same boundaries as day-ahead markets creates additional complexity; however, the focus of this effort is on seams *between* day-ahead markets and the RA/interoperability issues are beyond the scope of seams strictly between day-ahead markets**

Stakeholder Impacts of Various Forums

- **As illustrated in the prior slides, the West is headed towards multiple regional markets and RA programs each with their own stakeholder process, governance structure, tariffs, set of market rules, and unique terminology**
- **There are a host of reasons that these differing venues have evolved and a number benefits that they offer, including optionality for potential participants**
- **However, there are also costs and inefficiencies from the duplication of venues where similar discussions take place and from not fully capturing the economies of scale that would result from procuring a wide range of services from a single entity in the West**
  - Participant, stakeholder, and state involvement in multiple venues requires additional time commitment from these entities, relative to a more comprehensive set of services and geography being covered
    - The proportional impact of this incremental effort is likely to be felt most acutely by small entities
  - There is also additional effort and time required to understand varying terminology and interactions between different markets/program
    - And there may be more venues required to address these interactions (the PJM-MISO “Joint & Common Market Initiative” is an example of a group stood up to address these types of interactions)
  - There is also an incremental cost to the region as a whole of having the same functionality performed by multiple entities
    - If the same functionality were performed by a single entity, economies of scale may be maximized

Market Designs are in Development → Uncertainty on Seams

- **Evaluation of Western seams issues reviewed herein was completed during a time of rapid change in the West**
- **Details of future market structures, and market footprints, are dynamic with some elements unknown and others expected to be subject to evolution**
  - This introduces a considerable level of uncertainty in seeking to evaluate the seams between markets or programs
- **Market designs for EDAM and Markets+ are in various stages, but both lack full and complete details on market design and functionality (which further complicates evaluating their interactions and seams)**
  - These details will be developed in final tariff language, business practices, etc.
- **Additionally, these designs have been evolving while work has been ongoing on this seams evaluation**
  - Thus, while this evaluation aims to assess seams based on the details of the most recent market designs, in some cases the market designs may evolve or be changed in a way that alters the seams issues reviewed as part of this effort
- **There is a need to continue to evaluate potential seams as the market designs, business practices, and protocols evolve and are finalized**

Western Seams Issue Overview & Focus of Seams Exploration

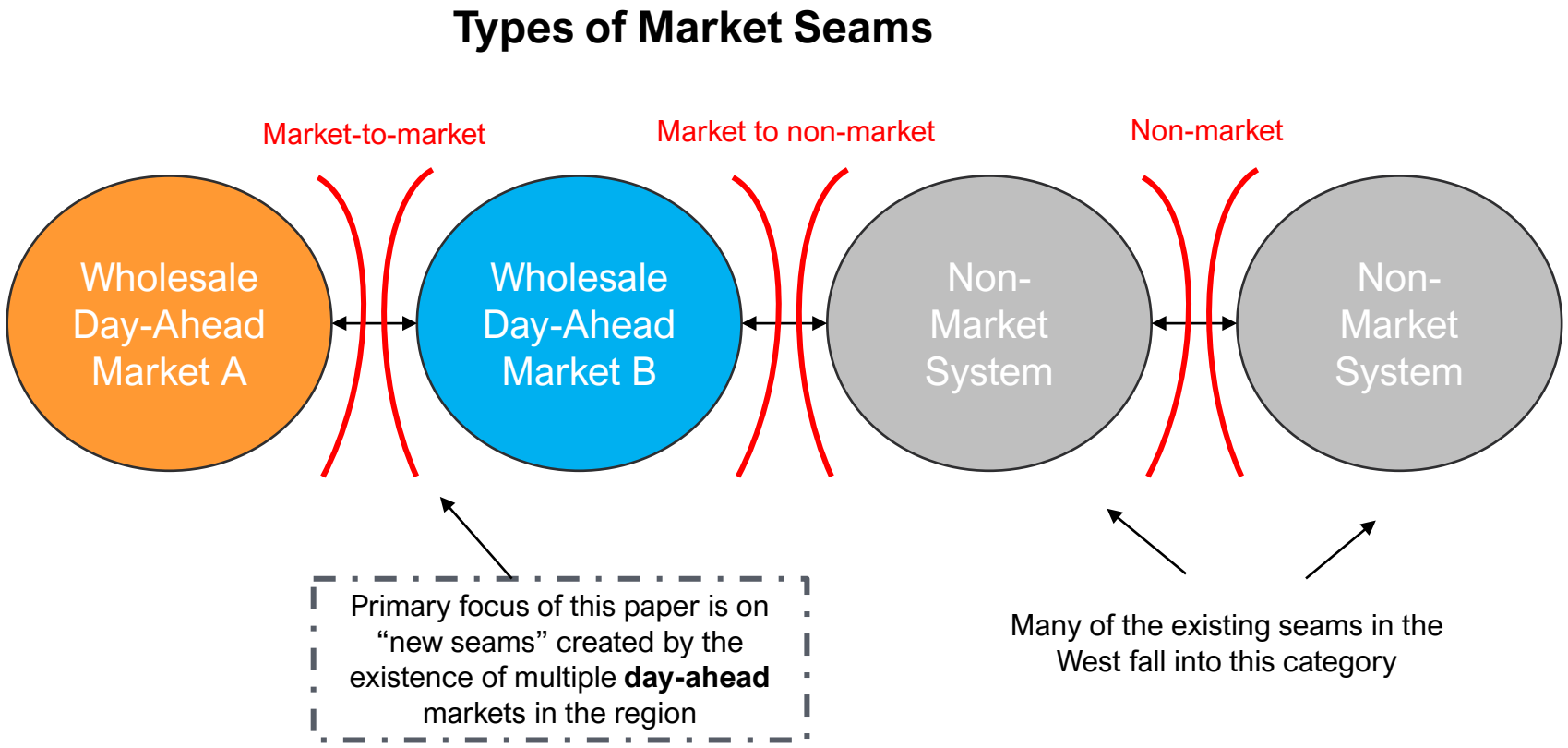
Overview of Seams Evaluation and its Intended Purpose

- **The Western Power Trading Forum (WPTF) and the Public Generating Pool (PGP), along with others, have expressed an interest in exploring the potential for "seams" and "seams issues" that might arise with the establishment of multiple day-ahead markets operating in the West**
- **Goal of this work:**
  - Acknowledge the development of new markets, as well as other regional programs (e.g., WRAP), can offer benefits and reduce seams issues that exist in the West today
  - Provide a framework for understanding the key seams areas and seams issues that may exist ***between the two proposed day-ahead markets in the West***
    - When applicable, provide background on how similar seams have been addressed by RTOs, while recognizing that Western dynamics and/or the structure of day-ahead markets will likely require unique solutions
- **What the work is <u>not:</u>**
  - Effort is <u>not</u> intended to *resolve or propose solutions* to the identified seams issues
  - It is <u>not</u> *comprehensive of all seams* that may exist in the West (e.g., between day-ahead markets and RTOs/ISO, between day-ahead markets and non-markets, or between different RA programs)

Seams – generally refers to the physical or commercial boundaries or interfaces between electricity markets, control areas, or other electricity systems

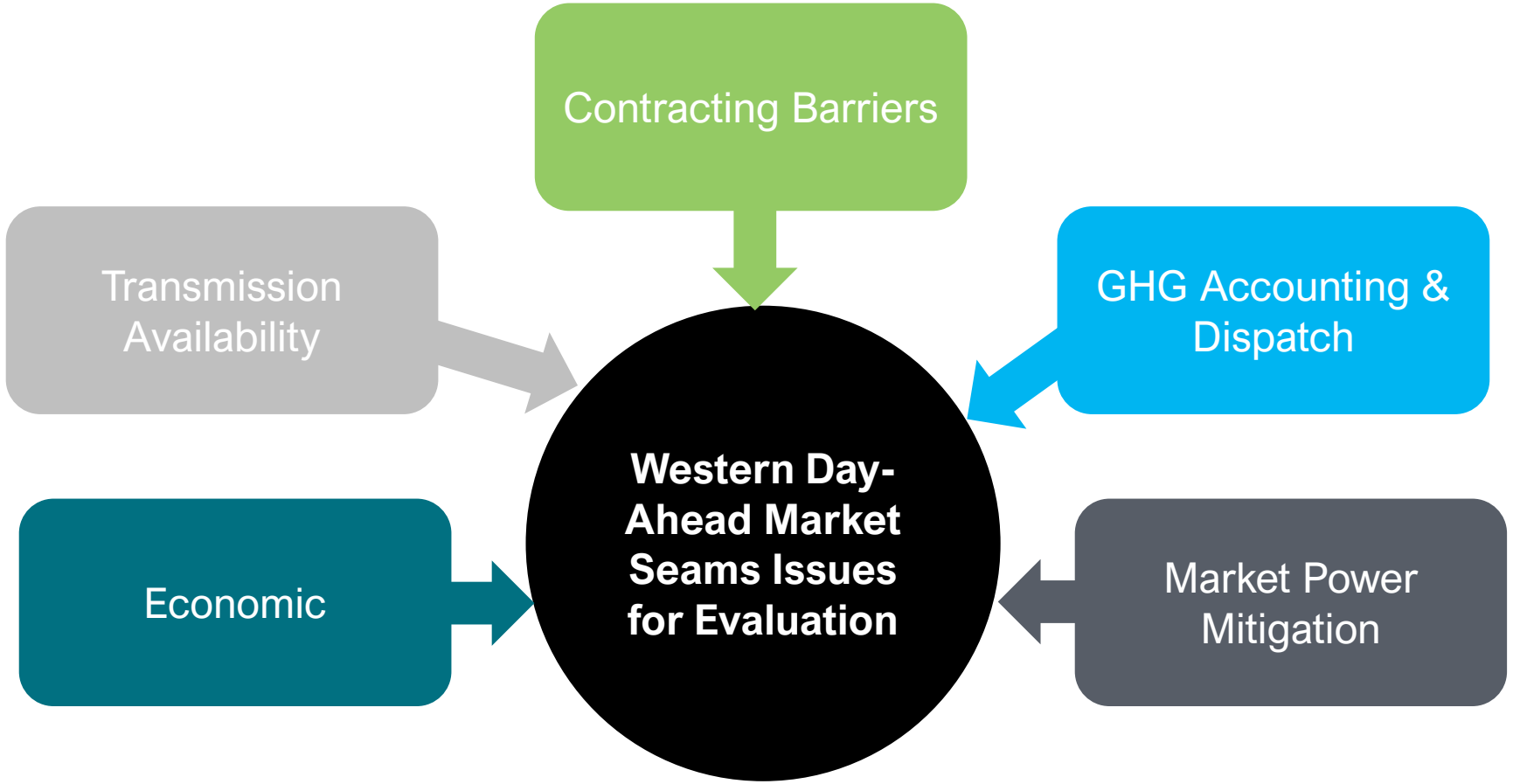
Seams issues – represent the inefficiencies, costs, or challenges that emerge due to differing rules, regulations, and procedures on each side of a seam

Types of Seams & Focus of this Effort



There are many other types of seams as well, including between other markets (e.g., RTO-West or Markets+ and CAISO, interactions with the Western Energy Imbalance Market) and day-ahead markets. However, this work focuses primarily on key seams areas between the two day-ahead markets proposed for the West.

Types of Western Seams Issues Explored in this Work



Other Areas of Consideration

- Lost efficiencies and other impacts that persist ***within*** a given day-ahead market relative to an RTO (e.g., seams within a day-ahead market)

A number of "seams issues" that are often discussed in the RTO context were not included in this review. That is because some of the functions that RTOs perform, such as generator interconnection and transmission planning, are not part of a day-ahead market paradigm and thus would not materially change solely as a result of day-ahead market implementation.

High-Level EDAM Design Issues Relevant to the Seams Evaluation

Topic	California ISO EDAM Design/Specifics
Entry Timing and Participation Model	EDAM Entities (BAAs) can choose to join on a phased/staggered schedule (just as occurred with the WEIM). Some WEIM participants may opt to remain only in the WEIM, while other can elect to join EDAM. Once a BAA joins, all load and generation within the BAA must transact through the market.
Transmission Uses and Carve Outs	Transmission within the footprint will become available to the EDAM optimization through one of three "pathways" (with sub-options available). Ability for transmission to be carved out from the market is included in the market design but details are TBD and will be included in the EDAM Entity tariff revisions.
Congestion Revenue Allocation	Congestion (and transfer) revenue allocation will occur to participating Balancing Authorities (BAs) and will then be "sub-allocated" to individual customers in a way that will be determined in individual EDAM Entity tariffs.
GHG Accounting/Dispatch	GHG accounting uses a resource-specific method to account for imports into GHG regulation areas (California or Washington).
Economic Interchange Transactions	The ability to economically transact at the EDAM borders is not broadly enabled in the initial EDAM design to address accurate accounting of supply and support reliability (and given the market dynamics at the time the policy was designed). Economic interchange at the border can be enabled by an EDAM Entity opting in to intertie bidding (something which has not occurred for any WEIM Entities to date). CAISO intertie bidding (at non-EDAM intertie points) will remain but is not the focus of this evaluation.
Addressing Resource Sufficiency	Includes a Resource Sufficiency Evaluation (RSE) which is necessary given the multiple RA programs that will be operating in the footprint (including the CPUC/CAISO RA and WRAP) and the limited must offer for those not within the CAISO boundaries. RSE includes a BA-level test of adequate supply.

High-Level Markets+ Design Issues Relevant to the Seams Evaluation

Topic	Markets+ Design/Specifics
Entry Timing and Participation Model	Market Participants will generally elect to join on the same schedule (given the need for a critical mass of participants to fund the market start-up). Once a BAA has joined Markets+, individual load-serving entities and resources will have direct participation agreements with the Market Operator. Participation in Markets+ will involve real-time and day-ahead market participation from the onset. Thus, any participants in WEIM today that elect to join Markets+ will transition from WEIM to the Markets+ real-time and day-ahead markets simultaneously, upon commencement of the Markets+.
Transmission Uses and Carve Outs	Transmission within the footprint will become available to the Markets+ optimization unless it is carved-out via rules defined in the Markets+ tariff. Market design includes additional rules for prioritization of transmission and import/exports.
Congestion Revenue Allocation	Congestion revenues will (primarily) be allocated to transmission rights holders (both point-to-point and network) based on the specifics of the transmission rights. Some “excess” congestion rents will be allocated to the Transmission Service Providers (TSPs) for sub-allocation in a TBD manner which will be determined in TSP tariffs.
GHG Accounting/Dispatch	GHG accounting includes resource-specific and unspecified pathways to identify and account for imports to GHG regulation areas from Markets+.
Economic Interchange Transactions	Markets+ includes the ability to economically transact at its borders with key rules (including requiring transmission service to make import or export bids/offers) and market prioritization for uncommitted imports/exports from the footprint included in the market design to better address certainty of supply.
Addressing Resource Sufficiency	Eligible Markets+ participants must participate in WRAP, creating a consistent RA paradigm across the footprint. A limited Must-Offer Obligation, considering WRAP obligations, has also been developed.

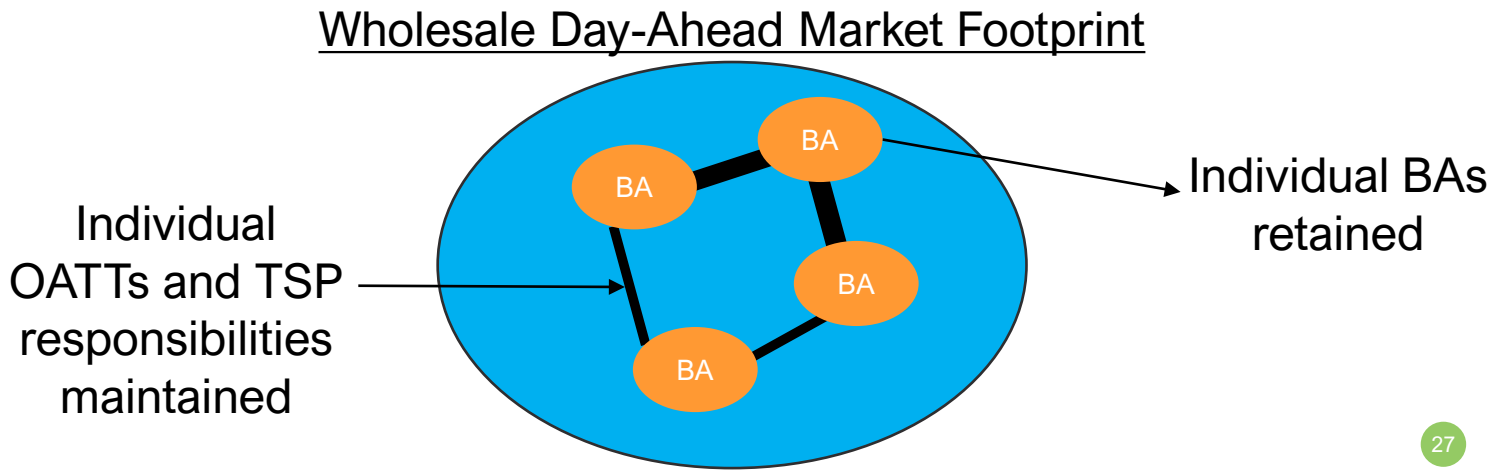
Considering Western Seams in the Context of Other Seams Agreements

- **Seams issues exist in other regions and, particularly at the seams of different RTOs, tools have been developed to help address seams issues and lessen their impact**
- **Joint Operating Agreements (JOAs)/seams agreements help to establish methods for managing various types of seams between two market operators**
  - The JOAs between eastern RTOs took time to negotiate and continue to evolve, with new filings and modifications being a relatively common occurrence
  - Additionally, in the East groups exist which support evaluating JOAs and seams issues and considering improvements (including the Seams Advisory Group and Seams Liaison Committee for SPP/MISO, the MISO/PJM Joint and Common Market Imitative, etc.)
- **In the East, JOAs generally cover a fairly comprehensive set of topics, including:**
  - Transmission planning
  - Interconnection agreements and Affected System issues
  - Reliability/operations coordination
  - Market to market interactions/coordination
- **In some instances, similar types of seams may exist between day-ahead markets in the West, and there may be tools/processes from the East that can be used as a starting point for addressing these issues in the West**
- **However, it is important to note that the day-ahead markets are unique and differently situated than RTOs and there are also other Western Interconnection dynamics (e.g., congestion management processes) that differ from the East**
  - Thus, the tools used by eastern RTOs to manage seams issues may not be entirely portable to the West, may require modification, or may not be applicable
  - Additionally, seams agreements for day-ahead markets in the West are likely to involve additional parties/agreements, given the retention of BA and TSP responsibilities

Seams ***within*** a Day-Ahead Market

Seams *within* Day-Ahead Markets

- **The day-ahead market constructs proposed for Markets+ and EDAM have the potential to improve economic outcomes relative to the status quo in the West by:**
  - Optimizing unit commitment decisions across each footprint
  - Optimizing day-ahead and real-time dispatch across each footprint using the resources that are voluntarily offered
    - Including minimizing or eliminating hurdles to trading (e.g., pancaked transmission rates)
  - Optimizing/sharing certain ancillary services within their respective footprints
    - Most notably, different types of flexibility reserves are included in the respective day-ahead market design
- **However, day-ahead markets are not as comprehensive at achieving full optimization as other market structures, such as an RTO, because they do not involve all of the services and features of those markets**
- **This creates inefficiencies (or seams) of different types that are expected to persist, to varying degrees, *within* each day-ahead market**
- **Because of the seams *within* each market, seams *between* each market are different than those in existing RTOs**



Seams *within* Day-Ahead Markets

Day-Ahead Markets Lack Full Co-Optimization of Ancillary Services

- **Generally, the proposed day-ahead markets are <u>not</u> designed to include the co-optimization of ancillary services (at least initially)**
- **This leaves the potential for lost benefits within a day-ahead market relative to more comprehensive market structures (e.g., RTO)**
- **Both proposed day-ahead markets would include some form of flexibility/imbalance reserves *within* the market footprint**
  - But, relative to an RTO, the ancillary services optimized within a day-ahead market will be only a subset of ancillary services

OATT Consolidation Would be Required to Fully Optimize Transmission Use

- **A day-ahead market differs from an RTO in that it doesn't involve consolidation of transmission tariffs and the current OATT structure will be retained**
  - Different RTOs have approached OATT consolidation differently, based on negotiated outcomes to minimize cost-shifts between regions
- **The ability to fully utilize transmission within a given day-ahead market footprint is limited by persistence of OATT constructs and ability to exercise OATT rights under the markets**
- **As a result, there may be less transmission availability under EDAM and Markets+ than there would be under an RTO scenario in the same respective footprint(s)**
  - This is also closely intertwined with the separate RA programs within the West which were designed assuming separate OATTs

Seams *within* Day-Ahead Markets

RTOs Involve BA Consolidation and Full Participation

- **A day-ahead market differs from an RTO in that it doesn't involve the transfer of operational control or the consolidation of reliability responsibilities, and it may not require the full participation of loads & resources**
- **Both EDAM and Markets+ envision the use of constraints available to BAs to ensure reliability obligations can continue to be met and are not compromised by market participation, while enabling a voluntary participation framework**
  - This may affect the extent to which BAs rely on the market for imports and commit units within their own footprint, which can reduce overall benefits through lack of full optimization of the fleet
- **Additionally, novel concepts in both markets will require new and different levels of BA-to-BA coordination and communication across various functions**

RTOs Fully Coordinate Resource Adequacy (RA)

- **Day-ahead markets do not have to include standardized RA across the footprint**
  - This is in contrast to an RTO where consistent RA obligations are generally included and accompanied by Must-Offer Obligations (MOO)
- **Given the lack of a consistent RA and full MOO, other mechanisms must be designed to address sufficiency of resources by individual market participants or BAs in a day-ahead market**
  - E.g., the EDAM's RSE, or the Markets+ Limited MOO
- **Lack of a consistent RA program within the day-ahead market can result in seams issues**
- **Lack of a full must-offer adds a level of complexity to day-ahead market seams that may not exist in an RTO paradigm**

Seams ***Between*** Day-Ahead Markets: Economic Seams

Economic Seams Summary

Economic Seams:
Inability to fully optimize dispatch and commitment due to the existence of two day-ahead market footprints/market operators and the friction associated with economic trading between the two markets

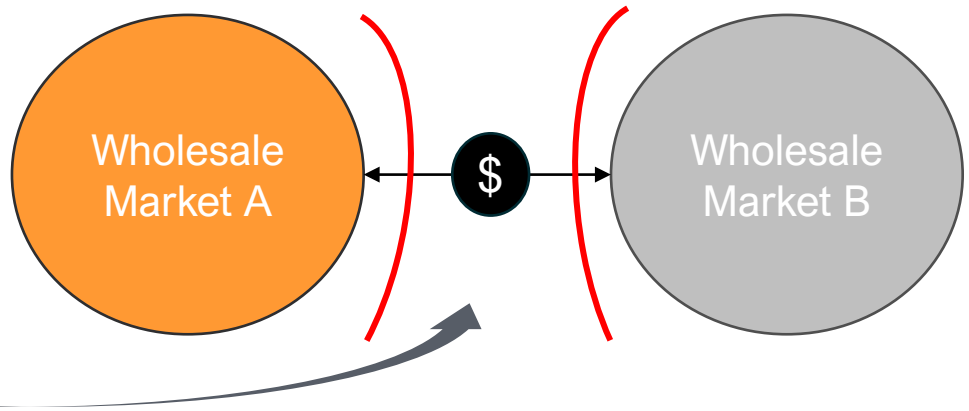
- **Economic seams result from multiple entities coordinating unit commitment, dispatch, transmission use, co-optimization of applicable ancillary services, and managing physical system congestion within a broader footprint**
- **Interface pricing is the pricing mechanism used to facilitate flows between RTO markets (can be in day-ahead or real-time)**
- **Building off of interface prices, there are a number of tools to mitigate economic seams between RTOs in other regions:**
  - Interchange scheduling
  - Day-ahead firm flow entitlement exchange
  - Coordinated transaction scheduling (CTS)
  - Market-to-Market (M2M) coordination
- **While the West should be able to build on these concepts, these tools are currently untested under the non-RTO day-ahead market frameworks and may not translate directly given the seams *within* the day-ahead markets**
  - These constructs also require market design with stakeholders from both markets agreeing on a negotiated outcome
  - Additionally, given the nature of day-ahead markets, we expect that there will be more parties and/or more seams agreements required (including between BAs and Market Operators) than is seen in the context of Eastern RTOs

Multiple Dispatch & Commitment Engines

- **Creation of two day-ahead markets in the West (EDAM and Markets+), which will have different market operators, will result in a lack of joint dispatch and unit commitment across the footprints**
- **This dynamic can reduce economic optimization by inhibiting the most theoretically optimal commitment and dispatch decisions and management of physical transmission congestion across the footprints, creating an economic seam**
  - Degree to which markets can optimize unit commitment and dispatch *between* one another is still relatively uncertain
    - And may be minimal under current market structures (see later in this section for more on economic imports/exports between the day-ahead markets)
  - Optimization between footprints is also impacted by the application of export charges for energy leaving one market footprint to serve load in another
    - Both EDAM and Markets+ will require transmission service to wheel-through or export from the footprints, resulting in a "hurdle" for trade between the two
- **While there are seams costs from the lack of joint dispatch & commitment, it is also important to note that, compared to current economic optimization in real-time only markets, there may still be benefits of multiple day-ahead markets**
  - Currently economic optimization in these areas is limited to real-time (WEIM and WEIS)
  - Addition of day-ahead unit commitment and financially binding schedules may provide increased benefits over today's structure
    - Modeling of different footprints and market structures is necessary to understand the likely impacts of shifting market offerings and footprints
    - Splitting the existing real-time economic optimization of the current WEIM footprint into smaller pieces also has the potential to reduce the benefits currently experienced

Interface Pricing for Economic Imports/Exports Between RTOs

Interface pricing (established via market design & protocols) is a price signal for imports and exports from each market



- **Interface pricing is used as a means of facilitating efficient flows between RTO markets at their boundaries to help reduce economic seams**
- **While exact methods vary from RTO to RTO, determining interface prices typically requires an RTO to attempt to model areas outside its system (which presents inherent challenges)**
- **Analyses, such as those performed by Potomac Economics (referenced below), found that there are inefficiencies in interface pricing between RTOs, despite ongoing efforts to improve them; these inefficiencies can stem from:**
  - Modeling approaches used for the modeling of the other RTO's system
  - Differences between market protocols and approaches
  - Requirements for interchange transactions to pay for transmission service to effectuate a transaction
  - Instances when constraints on the other RTO's system are binding, pricing can become economically inefficient because each side includes approximated congestion in the neighboring system component, resulting in double congestion charges/payments
  - Imperfect definition of the interface (which is used to determine interface pricing and can be based on specific buses, distributed across the footprints, etc.)

A useful evaluation of interface pricing and associated issues can be found in the *OMS-RSC Seams Study: Interface Pricing* from Potomac Economics (here)

Economic Imports/Exports Between Day-Ahead Markets

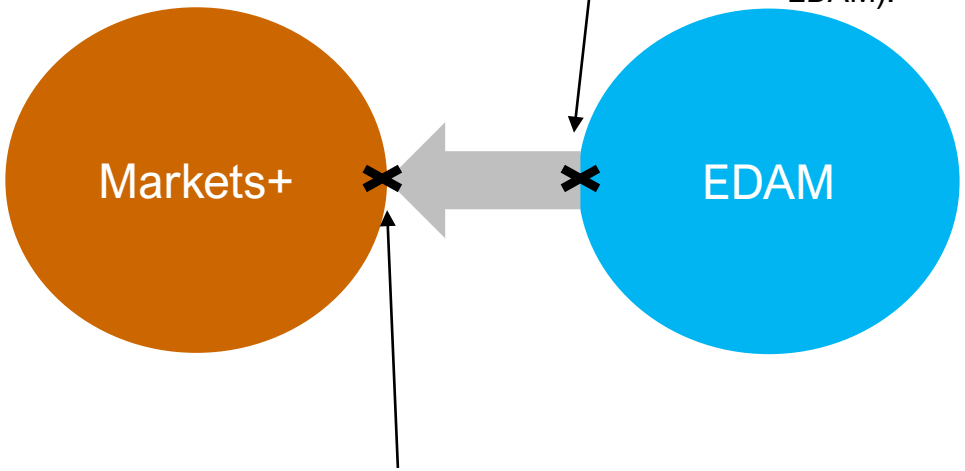
- **The ability to optimize flows between day-ahead markets will help to reduce the economic seams experienced**
- **Under existing day-ahead market designs, the ability to *economically* transact between EDAM and Markets+ may be severely limited, absent modifications to the designs or election of intertie bidding by participating EDAM Entities**

	EDAM Economic Imports/Exports*	Markets+ Economic Imports/Exports
Transmission Service Requirement	Imports, exports, and wheel-throughs require transmission service.	Imports, exports, and wheel-throughs require transmission service. Additionally, as presently designed, all these transactions require transmission service in order to submit a bid/offer (even if not cleared in the market).
Ability to Economically Transact Day-Ahead	Not permitted unless an EDAM Entity enables intertie bidding. Transacting via import/export/wheel-through must therefore be done using a self-schedule (price-taker).	Permitted, if the interchange requirements (such as transmission service) are met. Economic/low-priority imports and exports are expected to have a lower priority than internal load/high priority exports.
Ability to Economically Transact in Real-Time	Not currently envisioned for imports, exports, and wheel-throughs to EDAM Entities unless explicitly enabled by the EDAM Entity.	Not currently envisioned for imports, exports, and wheel-throughs in Markets+.

**Note that the rules around economic imports and exports for EDAM (i.e., intertie bidding) were developed to address concerns about uncertainty of supply being delivered at the interties. And the policy around these transactions in EDAM was developed at a time when considering interactions with another day-ahead market was not the priority focus (and may not have been viewed as likely by some stakeholders). Thus, EDAM's import/export rules were designed primarily to address transactions between EDAM and the bilateral market and were not specifically designed for transactions between EDAM and Markets+.*

Illustration of Economic Imports between Day-Ahead Markets*

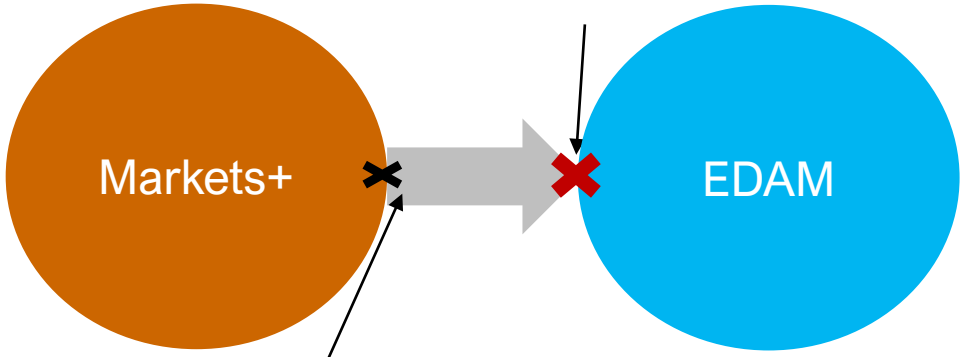
Economic Import to Markets+ (from EDAM)



Economic imports into Markets+ are permitted (can be to an identified load or a generic "centroid") but must have transmission service to submit an interchange bid and e-Tag with all necessary transmission legs to reach the load/centroid.

No *Economic* Imports to EDAM (from Markets+)

Economic imports are ***not*** permitted at the EDAM borders (unless enabled by the EDAM Entity) to ensure confidence in supply. And self-scheduling of imports is only permitted with a contract and associated transmission service.



Economic exports offers from Markets+ are permitted (can be from an identified source or a generic "centroid") but must have transmission service to submit an interchange export offer and e-Tag with all necessary transmission legs to reach the Markets+ boundary. These transfers will be subject to lower priority to enable confidence in internal supply.

**Note there are different dynamics for facilitating transactions between Markets+ and CAISO intertie points, but those are not reviewed herein as they are not entirely day-ahead market to day-ahead market seams*

Economic Imports/Exports Between Western Day-Ahead Markets Expected to be Minimal without Additional Action

- **Given the limitations discussed and illustrated in the prior slides, economic transactions between the two proposed day-ahead markets (EDAM and Markets+) may be highly limited or non-existent absent a (1) seams agreement, (2) market design changes to facilitate efficient transactions between the two footprints, and/or (3) the enabling of intertie bidding by EDAM Entities, each of which may help to improve the facilitation of more efficient transactions between the two footprints**
  - RTO interfaces in other regions generally have processes in place to establish interface pricing and facilitate relatively efficient power flows between the two markets (some of the tools used in these regions are outlined later in this section)
  - These processes may be more challenging to implement in the West, given the unique structure of the day-ahead market designs
  - And until they are implemented, there is a potential for limited liquidity between markets to increase congestion and cause price formation challenges on the seams
- **Additionally, if changes are made to enable economic transactions between the two-markets, the implementation and efficiency of interface pricing to facilitate those transactions could be impacted by:**
  - The unique nature of day-ahead markets including rules regarding when and how economic exchanges are permitted between markets
  - The persistence of multiple BAAs, which may impact how interface pricing is determined and the number of interface pricing locations that exist, among other things
  - The limited must-offer obligations in the markets with back-up supply existing in each footprint (and potentially each BAA), which would not be part of the pricing for exchanges between markets

Tools for Addressing Economic Seams in Other Regions

- **RTOs that share a seam have a JOA between the two Market Operators**
  - These JOAs, together with individual RTO market designs, impact how the markets interact and realize economic efficiencies across their borders
    - They address far more than just economic issues, as the market operators, under an RTO construct, also have reliability responsibilities and perform the BA and transmission service provider functionalities
  - JOAs have taken years to implement and are generally evolving documents, with ongoing filings to amend and improve them occurring over time
- **Interface pricing is the means used to facilitate economic exchanges between markets (though exchanges may take place in day-ahead or real-time and there are different tools used in each timeframe)**
- **Several tools have been identified to help minimize economic seams between RTOs in the East and are reviewed in the following slides, including:**
  - Economic interchange scheduling
  - Day-ahead firm flow entitlements
  - Coordinated transaction scheduling
  - Market-to-market coordination & congestion management
- **The JOAs and tools used by eastern RTOs (discussed on the following slides) may be informative to addressing economic seams in the West, but the construct of day-ahead markets are unique (including multiple BAAs)**
  - These tools may not be as easily implemented in the West and/or unique elements may be needed

Overview of Tools for Mitigating Economic Seams

Economic Interchange Scheduling

- The economic day-ahead scheduling of exports or imports at the boundaries of two market footprints in the day-ahead timeframe that occurs when the interface price differential is substantial enough to warrant exchanges

Day-Ahead Firm-Flow Entitlement Exchange

- Allows the effective exchange of transmission rights on a day-ahead basis, with the intention of better optimizing trade between and across two markets

Coordinated Transaction Scheduling

- Interface bidding tool used to facilitate economic transactions between two markets during the real-time market
- Also known as "interchange optimization"

Market-to-Market Coordination*

- Coordination process that allows market operators to assist one another in managing physical transmission congestion more cost-effectively on elements that are impacted by flows from both markets

Tools in the Day-Ahead Timeframe

Tools in the Real-Time Timeframe

Solutions in Other Regions: Economic Interchange Scheduling

- **Economic interchange scheduling (or dispatchable interchange schedules) is facilitated by the ability of market participants to submit bids and offers for importing and exporting energy in the day-ahead timeframe**
- **Specific rules and restrictions on interface scheduling are generally contained in the market protocols or business practices for a given market**
- **The efficiency and effectiveness of interchange scheduling is impacted by interface pricing between the two markets**
  - Interface pricing was previously discussed in the presentation, but is generally not capable of being as accurate as prices would be if there was a single operator and set of rules that governed transactions
- **<u>Applicability to Western Day-Ahead Markets:</u> As discussed in prior slides, the current day-ahead market designs in the West would not allow economic (or dispatchable) interchange scheduling between the two markets as presently envisioned**
  - Thus, enabling this tool will require market design changes and/or the election of EDAM Entities into intertie bidding
  - Assuming such changes are made, there are likely to be unique impacts, especially around the pricing of these interchanges, that will need to be considered

Economic Interchange Scheduling

- **The economic day-ahead scheduling of exports or imports at the boundaries of two market footprints in the day-ahead timeframe that occurs when the interface price differential is substantial enough to warrant exchanges**

Rules around interchange scheduling are generally found in the market protocols or business practices of RTOs (for instance, *MISO's BPM 007 – Physical Scheduling*, discusses rules for interchange scheduling and can be located here)

Solutions in Other Regions: Day-Ahead Firm Flow Entitlement Exchanges

- **Day-Ahead Firm Flow Entitlement Exchanges are intended to better optimize trade between market footprints, allowing one market to exchange its firm flow entitlement (similar to transmission rights) to the other market in the day-ahead process**
  - These firm flow entitlements effectively allow additional transmission use (beyond the firm flow limits that already exist)
- **This tool has been implemented between some Eastern RTOs, but not all, as some RTOs have opted to focus on improving other tools instead**
  - Used by PJM and MISO (after its addition to their JOA in 2015)
  - Has not been implemented between MISO and SPP
    - Ongoing informational reports to FERC in Docket ER13-1864 indicate that SPP and MISO continue to work on other improvements to M2M coordination that are required to assess the value of implementing this tool
- **<u>Applicability to Western Day-Ahead Markets:</u> This tool could be useful to explore in the context of the West, especially if the market footprints have significant flow across one another's systems, as it would allow the markets to exchange transmission use across one another's systems**
  - This could be challenged by the persistence of individual OATTs and the transmission service requirements of the current market designs which, among other things, require more parties to the agreement/solution
  - Additionally, application in the context of the Western contract/rated path model would need to be evaluated

Day-Ahead Firm-Flow Entitlement Exchange

- **Allows the effective exchange of transmission rights on a day-ahead basis, with the intention of better optimizing trade between and across two markets**

More about the reasons for enacting Firm Flow Entitlement Exchanges (and the associated processes) can be found in the filing to approve this tool in the PJM/MISO JOA (see PJM filing documents here)

Solutions in Other Regions: Coordinated Transaction Scheduling

- **Coordinated Transaction Scheduling ("CTS" or Interchange Optimization) is a bidding tool that allows market participants to submit price-based bids and offers for importing and exporting energy between markets <u>in real-time</u>**
  - Offers can result in real-time interchange schedules between two markets if the ***forecasted*** price difference is at or above a designated amount
  - Transactions are based on the ***forecasted/projected*** price differential between the markets and yet the transactions are ***financially settled by the actual clearing price*** (which can vary substantially based on actual system conditions); this introduces risk and complexity to this tool
- **CTS has been implemented between some Eastern RTOs, but not all**
  - Used for transactions between MISO and PJM
  - But has not been implemented between SPP and MISO, with a study finding its implementation may not be cost-effective with the then-current market designs
    - When it is not in place between two RTOs (such as SPP and MISO), then price-based optimization for interchange is generally limited to the day-ahead timeframe and real-time interchange transactions are price-takers
- **Benefits of CTS can be limited by fee structures, inaccuracy of price forecasts, and volatility in price differentials between markets, particularly during tight conditions which can lead to high risk-premiums**
- **<u>Applicability to Western Day-Ahead Markets:</u> CTS could be challenging to implement in the Western day-ahead markets due to retention of OATTs and BA responsibilities (with the need to coordinate these real-time flows with individual BAs)**

Coordinated Transaction Scheduling

- **Interface bidding tool used to facilitate economic transactions between two markets during the real-time market**
- **Also known as "interchange optimization"**

A useful evaluation Coordinated Transaction Scheduling and associated issues can be found in the *Coordinated Transaction Scheduling Study* by the SPP-MMU (here)

Solutions in Other Regions: Market-to-Market Coordination

- **Market-to-Market (M2M) Coordination is a tool used between RTOs in the East that helps facilitate the East's process for managing physical transmission congestion (more on physical transmission congestion and associated congestion management on the next slide)**
  - M2M Coordination is a mechanism for efficiently implementing and coordinating real-time physical congestion management on constraints affected by flows from multiple RTOs
  - M2M Coordination allows the markets to be used to more cost-effectively to assist one another in reducing flows to address the limits of the transmission system
  - Allows markets to coordinate in real-time to economically relieve physical congestion of elements impacted by flows from both markets
    - Necessary because while firm-flow entitlements (effectively transmission rights) are generally respected in the day-ahead process, they are not actively enforced in real-time
    - Instead, M2M is utilized to address real-time physical congestion (when transmission elements are approaching their limits)
- **M2M Coordination processes are generally contained in all RTO-to-RTO seams agreements/JOAs**
  - M2M exists for all RTOs in the Eastern Interconnection and the processes are subject to ongoing evolution and improvements
  - Reviews have found that no matter how efficient M2M is made, ***some congestion cannot be avoided because of the inherent lag in exchanging information between two market operators (one study found this unavoidable congestion accounts for >7% for SPP-MISO*)***
- **<u>In the West</u>, the success of M2M coordination will depend on implementation of seams agreements and the underlying congestion management approach and may be complicated by the persistence of multiple BAs and TSPs in the day-ahead market constructs**

Market-to-Market Coordination*

- **Coordination process that allows market operators to assist one another in managing physical transmission congestion more cost-effectively on elements that are impacted by flows from both markets**

*A useful evaluation of M2M Coordination and potential improvements can be found in the *OMS-RSC Seams Study: Market-to-Market Coordination* from Potomac Economics (here)

Background: Managing Physical Congestion on the System

- **The actions of one participant in an interconnection can affect the transmission system of others and there must be rules in place to address this use**
- **There are a variety of tools in place (in both the Eastern and Western Interconnections) to help ensure that transmission system use stays within allowable limits**
  - In the West, allowable limits are most commonly defined by the "contract path" or rated based basis (using MOD-029's approach) in planning for future flows
  - But in the East, TSPs sell their transmission service on a flow basis (using MOD-030's Flowgate approach)
  - Both approaches generally help define the limits of flows across one another's systems in day-ahead and longer horizons
- **In the East, the tools for managing transmission congestion in real-time are built on the flow-based approach and on the rules around congestion management that have been established in the East**
  - This includes the Congestion Management Process (CMP) and the Interchange Distribution Calculator (IDC), which provides instructions (in real-time) to the lowest priority schedules to reduce their flows over a physically congested element
- **In the West, managing transmission congestion in real-time is different than in the East**
  - In addition to local controls, the West relies on the Western Interconnection Unscheduled Flow Mitigation Plan (WIUFMP) to provide curtailment instructions on a limited number of key paths (presently four) when they become physically congested
  - In contrast to the East, the WIUFMP is not fully comprehensive of all elements that are impacted by flows from other systems
- **Why are congestion management tools important to effective M2M Coordination?**
  - M2M Coordination in the East is based on the identification of "Coordinated Flowgates," or flowgates that one market impacts, and when a reduction in flow is needed on a Coordinated Flowgate, M2M coordination can more efficiently provide that relief
  - M2M Coordination is built upon the Congestion Management Process, a fairly comprehensive agreement for congestion management in the East
  - Thus, it is reasonable to conclude that the West may need to augment its congestion management practices and the WIUFMP in order to efficiently implement M2M Coordination processes in the West

Key Takeaways on Economic Seams Between Day-Ahead Markets

- **The existence of multiple markets with different commitment and dispatch engines and special rules for transacting between markets results in the potential for economic inefficiencies across the footprints**
- **In the East, a number of tools have been developed to help facilitate more efficient transactions between markets (in both the day-ahead and real-time timeframes)**
  - Not all the tools used in the East are utilized at each RTO seam
    - For instance, Coordinated Transaction Scheduling and Day-Ahead Firm Flow Entitlement Exchanges are not currently part of the SPP-MISO seams management toolkit
  - These tools and the underlying agreements continue to evolve over time
- **These tools, or variations of them, may be able to be utilized between day-ahead markets in the West with some *unique considerations*, including:**
  - There are likely to be more parties involved in the seams agreements for Western day-ahead markets (given the retention of BA and TSP responsibilities in the day-ahead market constructs)
  - There may need to be additional considerations of pricing formation and economic interchange given the day-ahead market designs, which include limitations on economic transactions and, by design, will have some generators held back from economic offering (for addressing reliability, ancillary service provision, etc.)
  - The West's current congestion management approach and potential modifications to accommodate better M2M coordination

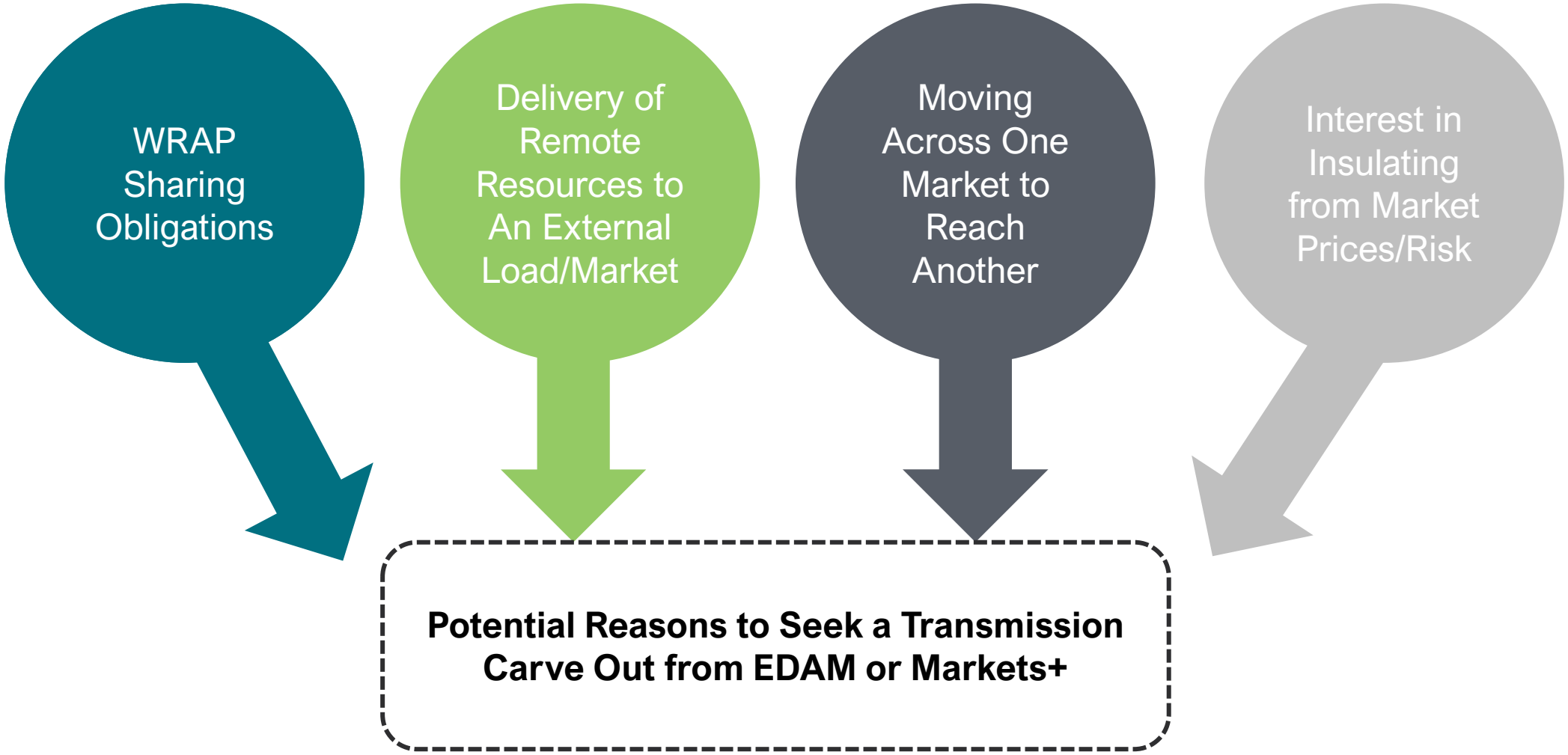
Seams ***Between*** Day-Ahead Markets: Transmission Availability

Transmission Availability Seams Summary

- **As already discussed, day-ahead markets, relative to RTOs, are expected to have less transmission available within them, but the existence of two day-ahead markets in the West may further the need for transmission carve outs within each day-ahead market**
- **Both EDAM and Markets+ will include provisions to allow transmission capacity to be "carved out" from their respective market optimizations. This transmission may be used by those that have transmission rights that interconnect/traverse markets, for non-market use, delivering RA, and more**
  - In EDAM, this carve-out could be accomplished with a self-schedule or through yet-to be-developed provisions in the individual EDAM Entity tariffs that are enabled through the CAISO tariff
  - In Markets+, carve-outs may be accomplished with pre-day-ahead market activities or through a transmission opt out and associated Service Flow Constraint
- **These transmission carve-outs will result in transmission capacity that is unavailable for day-ahead or real-time optimization within a given market**
  - This transmission may or may not be used by its owner for non-market or other market flows

Transmission Availability Seams: Impacts of reduced transmission availability from preserving transmission capacity/access across interconnected systems due to the existence of two separate day-ahead markets

Reasons for Transmission Carve-Outs in Day-Ahead Markets



Seams ***Between*** Day-Ahead Markets: Contracting Barriers

Contracting Barriers Seams Summary

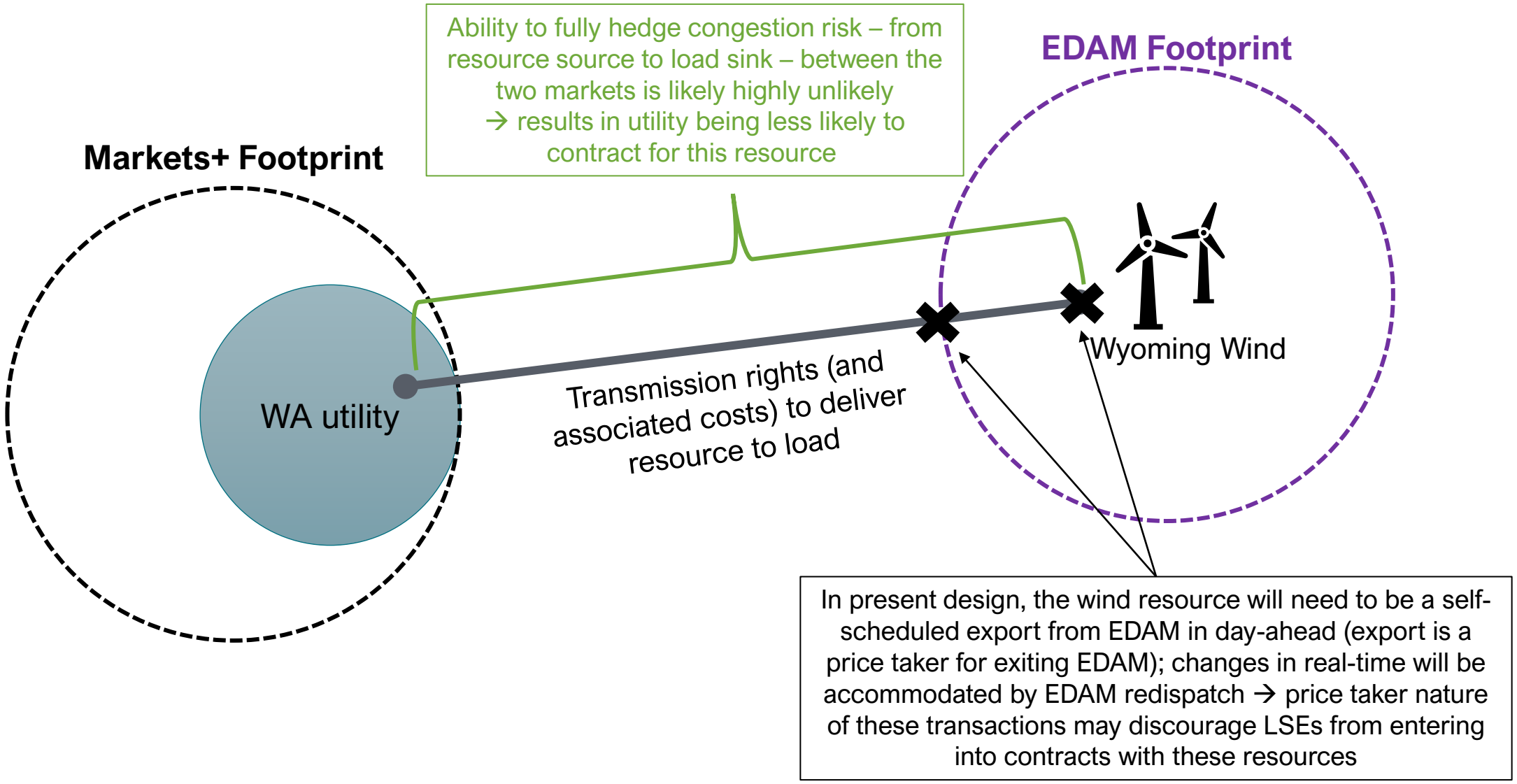
- **Being able to contract for high-quality and diverse renewable resources is increasingly important to achieving the policy objectives of many western states and utilities**
- **Uncertainties around the ability to transact for resources between the two day-ahead markets (EDAM and Markets+), along with transmission requirements to transact through them, could result in higher prices and create (or retain) barriers to accessing diverse clean energy resources that are important to achieving state policy objectives or other programs**
- **Presence of two day-ahead markets may create complexities, increase costs, or introduce new risks to contracting for resources outside of a given market footprint. Two primary challenges contribute to this dynamic:**
  - Cost and contracting impacts from economic uncertainty in transacting between markets
  - Uncertainty in demonstrating delivery (when delivery is required) across new markets and/or multiple markets

Contracting Barriers Seams:
Potential challenges arising from the interaction between two day-ahead markets when seeking to contract across or between markets to meet state policy objectives or other programs that include resources in a different market footprint

Costs and Contracting Impacts from Transacting Between Two Markets

- **As two day-ahead markets form across the West, it may become more difficult for load serving entities to contract for resources that are not *within* the footprint of the market they have elected to participate in, which could result in a loss of availability/contractability for diverse and high-quality resources**
- **Presence of two day-ahead markets will require transmission payments to transact across the market seam in all instances under the current designs**
  - This same dynamic exists in the West today, and will be retained for inter-day-ahead market transactions while not always being applied within a day-ahead market footprint
  - Together with other factors, this dynamic may make load-serving entities looking to contract for new resources more likely to look *within* the footprint of the day-ahead market they are participating in than to seek contracts/procure resources in the other day-ahead market footprint
- **Additionally, different approaches to allowing imports/exports to the footprints may exacerbate the dynamic discussed above**
  - For example, EDAM is not planning to universally allow economic optimization of inter-market transfers, at least during initial implementation, which may make imports of resources in Markets+ to EDAM more costly (due to requiring self-scheduling rather than economic optimization)
- **And different allocation of congestion revenues within each market could further increase uncertainty, increase cost risks, and create additional hesitancy to contract for resources that must interact with the two markets**
  - Congestion rent allocation differs between EDAM and Markets+, making it more challenging for those transacting across them to efficiently manage congestion risk
- **Future market enhancements and/or seams agreements may be needed to address this but are not expected to eliminate these types of seams between the two day-ahead markets**

Example of Contracting Risks for Resources Traversing Markets



Uncertainty in Demonstrating Delivery (when required)

- **Certain programs (such as the WRAP) and state clean energy policies require demonstration of delivery of resources to load**
  - This can include WRAP requiring demonstration of delivery of generation resources to load with certain transmission rights
  - Or it can include requirements to demonstrate delivery of clean or renewable resources to a load or a state:
    - For instance, the California's RPS requires at least 75% of resources to demonstrate delivery to a California BAA using a pseudo-tie, dynamic schedule, or transmission schedules and e-Tags
- **Under existing structures in the West, many entities have become comfortable with contracting and compliance mechanisms necessary to demonstrate delivery of remote resources for these programs and policies**
- **However, there may be uncertainty about how such demonstrations will work within and between the new day-ahead markets that could inhibit contracting for resources between the two markets**
  - Additional certainty on the structure of e-tagging and availability of dynamic scheduling within and between day-ahead markets may be required
  - Details are generally not finalized at this time
  - The presence of uncertainty may create additional challenges to contracting for diverse resources that are in another day-ahead market footprint if delivery demonstrations are required under the applicable state policy/program rules
  - Different practices between EDAM and Markets+ may need to be addressed
- **At the same time, the day-ahead market paradigms may present an opportunity to improve upon current delivery demonstration structures**
- ***GHG-specific elements are discussed more in the next section***

Seams ***Between*** Day-Ahead Markets: GHG Accounting & Dispatch

GHG Accounting & Dispatch Seams Summary

- **Markets+ and EDAM currently have different market designs for Greenhouse Gas (GHG) pricing signals within each market**
- **GHG accounting and dispatch inefficiencies result from the absence of a single day-ahead market to produce coordinated GHG pricing signals and establishment of similar treatment to all imports into GHG-regulated areas, even under linked carbon pricing programs**
  - Economic and policy seams issues would be further exacerbated if economic interchange is ultimately enabled to allow for use of some of the seams management tools
- **Seams issues include:**
  - GHG accounting for transfers between markets (when/if economic interchange is enabled between the two day-ahead markets)
  - Lack of coordinated price formation and resulting price signals
  - Lack of coordinated approach to minimize and account for secondary dispatch
- **No existing RTO seams management construct contemplates GHG and non-GHG pricing zones within each market**

GHG Accounting & Dispatch Seams:
Issues arising from having two different approaches for quantifying GHG emissions and identifying imports into a zone that regulates GHG emissions for each market

Price Formation and Market Signals for GHG Accounting

- **Creation of two day-ahead markets (EDAM and Markets+), each with different designs for GHG accounting and dispatch, will result in marginal GHG signals that are not directly comparable**
- **While both markets will have a GHG cost component in the nodal energy prices, the components will reflect different variations of marginal GHG costs, not lending them to direct comparisons**
  - EDAM will have some of the marginal GHG costs embedded in the marginal energy cost component due to the bidding structure, whereas Market+ will have the entirety of the marginal GHG costs in the GHG cost component
  - The differing formation of GHG cost components makes direct comparisons of costs between the two markets challenging and creates an environment where the market signals used to inform planning and investment decisions from the two markets are not well-aligned, leading to potential long-term inefficiencies from either ignoring the GHG costs or using misaligned costs for comparison
- **While both markets have mechanisms to minimize secondary dispatch (also referred to as "redesignation"), the market which ultimately achieves the least amount of secondary dispatch will send more appropriate price signals**

Seams ***Between*** Day-Ahead Markets: Market Power Mitigation

Market Power Mitigation Seams Summary

- **Market power mitigation inefficiencies can result both from the absence of a single market footprint to increase competitive conditions and from different mitigation designs creating disparate incentives for voluntary supply**
- **Seams issues include:**
  - Potentially higher instances of uncompetitive conditions due to optimizing over two smaller footprints as opposed to one larger footprint
  - Disparate incentives for voluntary supply when able to sell into both markets

Market Power Mitigation Seams: System level market power mitigation challenges resulting from areas that are smaller than they would be under a single market, and issues arising from the two different proposed approaches to market power mitigation

Increased Likelihood of Mitigation & Disparate Incentives

- **Increased likelihood of mitigation:**
  - Creation of two day-ahead markets (EDAM and Markets+), which results in supply being offered to serve load over two smaller footprints rather than one larger footprint, increases potential for uncompetitive conditions at a system/BAA-level
  - Increased number of suppliers representing the total available supply to serve load over a larger connected footprint naturally increases overall competitive conditions
- **Disparate incentives**
  - Creation of two ways to address system/BAA-level market power mitigation will naturally result in areas being exposed to differing levels of over and/or under-mitigation
    - While Markets+ is in the process of developing a BAA-level market power mitigation framework, it may differ from the approach that CAISO uses
    - Relative to one another, one market will likely mitigate more than the other, which will create inefficiencies in a competitive market
  - Differing levels and approaches to market power mitigation between the two markets creates disparate contracting incentives
    - To the extent voluntary supply can decide which market to sell its energy to, there is a natural incentive to sell to the market with the lowest potential for price suppression either form over-mitigation or lower mitigated offer curves (additionally, load may have the opposite incentive)

Conclusions & Key Takeaways

Key Takeaways

- **Two day-ahead market designs are under development in the West, providing Western parties with different options for their future market participation**
  - Based on stakeholder input, the markets will have differences in design related to price formation, economic imports/exports, the role of transmission, short-term offer requirements, market products, GHG design, and Market Power Mitigation, among other concepts
    - Though there have been some efforts to help align the designs, particularly as the likelihood of two day-ahead markets in existence has increased
- **The incremental, day-ahead approach of each individual market does not tackle BA consolidation, full ancillary service optimization, OATT consolidation, or RA alignment with a full MOO (all of which are part of RTO market constructs)**
  - The lack of full consolidation introduces internal market seams that add complexity and have the potential to reduce efficiency, though the specifics remain unknown at this time
- **RTOs offer tools and mechanisms that can be used to reduce economic seams between markets through optimizing economic interchange between the markets in day-ahead and real-time**
  - These tools are managed through JOAs between RTOs (in addition to market rules/protocols); JOAs require significant joint policy development and ongoing maintenance, and continue to evolve to improve interchange and minimize seams issues between markets
  - These economic seams management tools have not yet been applied to the day-ahead market construct and may not translate for direct use in seams management between the two day-ahead markets under consideration
  - Currently, EDAM is not designed for this type of economic interchange at non-CAISO seams, and Markets+ has rigorous transmission requirements and a reduced priority for these flows
    - At least initially, this dynamic combined with other unique aspects of Western Interconnection operations do not structure the markets in a way to utilize the RTO tools and mechanisms
- **Along with economic seams issues between two day-ahead markets, there are indirect seams issues that may increase the challenges associated with transmission optimization, policy compliance/resource procurement, GHG design, and competition in markets**

Thank You!

www.energystrat.com