Western Flexibility Assessment and Implications for the Northwest

CETA Markets Stakeholder Work Group

August 28, 2020

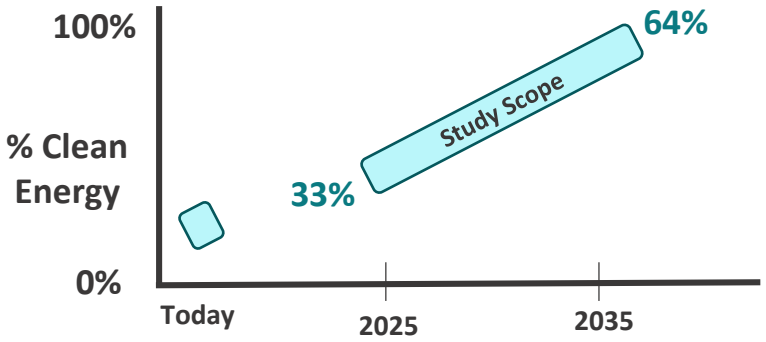
ENERGY STRATEGIES

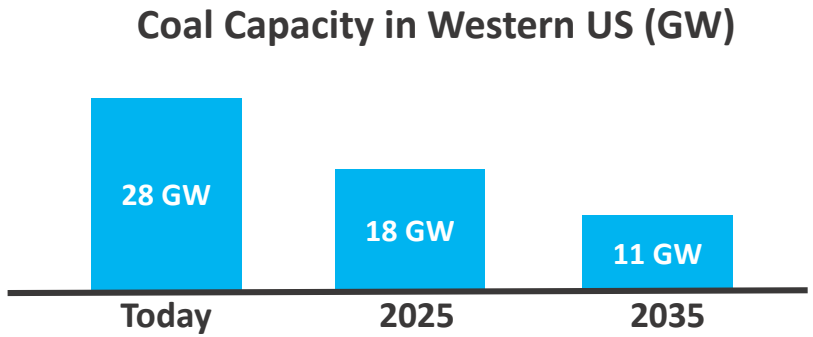
Agenda

1. Western Flexibility Assessment, key findings, and potential implications for the Northwest
2. Thoughts on flexibility needs in light of CETA
3. Flexibility implications of wholesale power markets

Western Flexibility Assessment was motivated by a surge in state policy that will impact future generation mix

- **New state policies will change the West's resource mix, which will impact the operational and transmission dynamics of the grid**
- **The Western Interstate Energy Board (WIEB) engaged Energy Strategies to investigate a high-renewable future driven by state policy goals, investigating potential demand for renewables, resulting operational/transmission challenges, inter-region power flows, capacity issues in the Northwest, and effectiveness of integration strategies**
- **Voids the study sought to fill through independent study work:**
  - ☑ Is the power system flexible enough to operate with penetrations of variable renewable generation consistent with state/provincial policies?
  - ☑ If not, what steps can be taken to make the system more flexible?





Assumed RPS and Clean Energy Policies for Western States:

Modeling western policies to help investigate system flexibility needs

Clean/Renewable Penetration Requirements in Baseline Case

Key

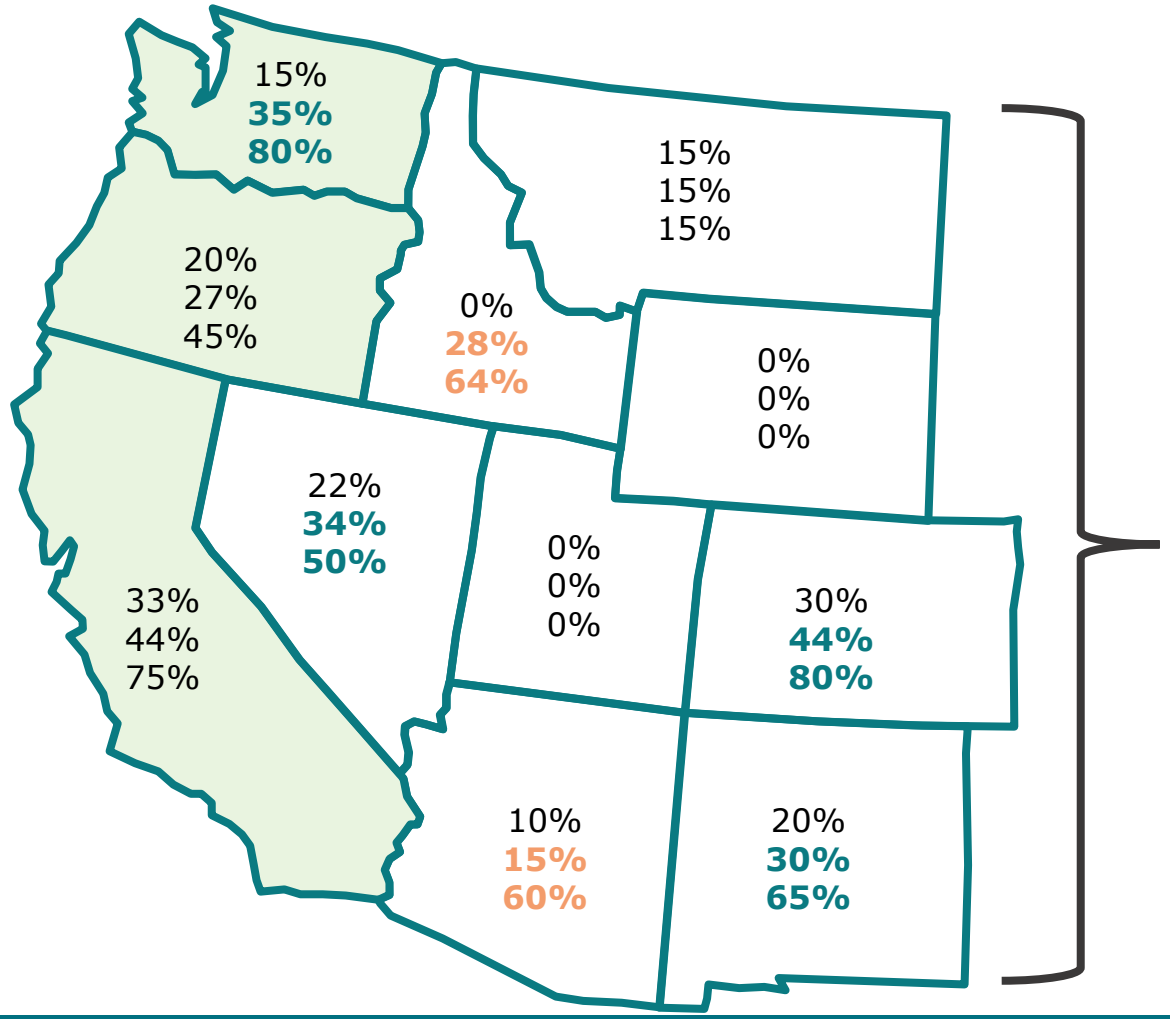
Existing policy

Recently enacted policy

Conceptual policy

Study year: 2020, 2026, 2035 → **22% 34% 50%**

Assumed coordinated cap-and-trade in 2026



Clean Energy Target Based on Assumed Policies

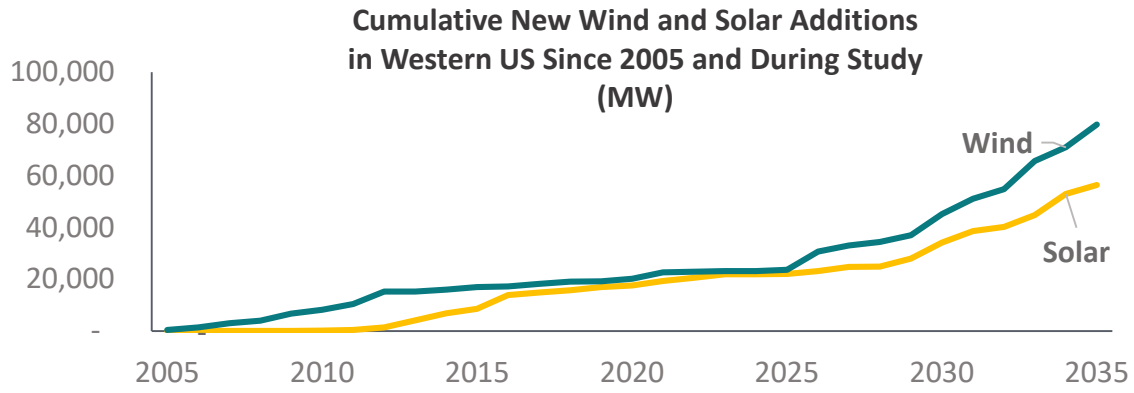
2026	2035
33%	64%

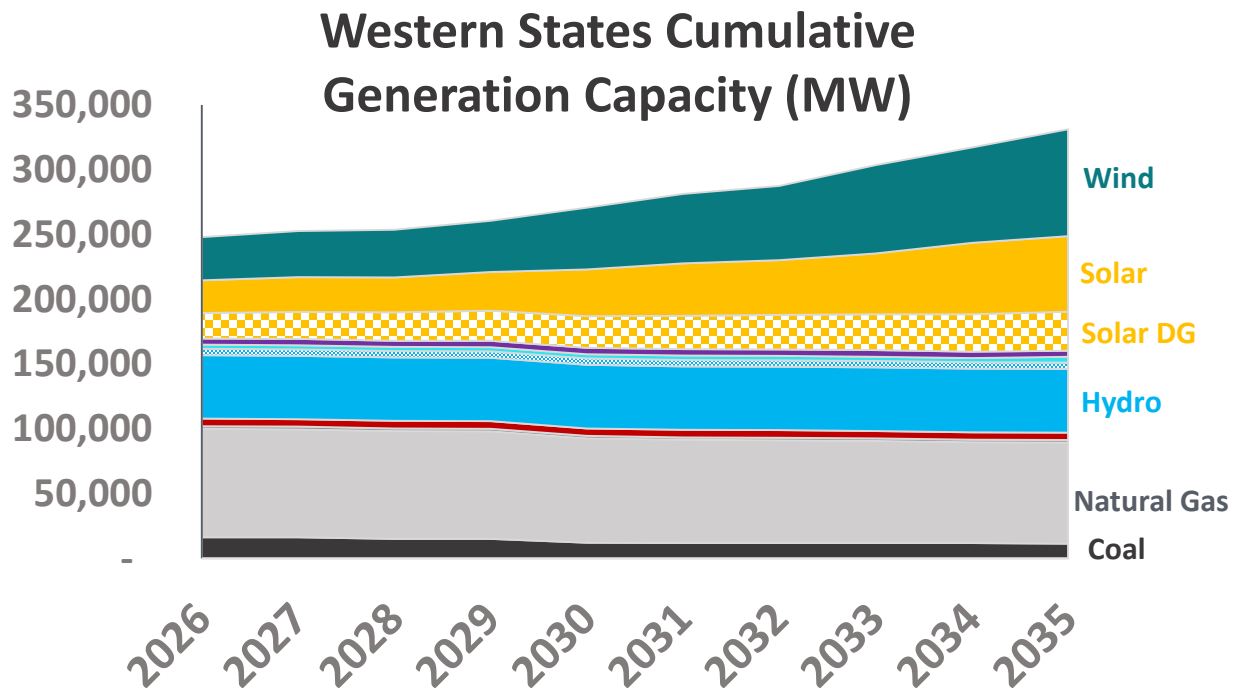
What makes this study unique?

- ✓Incorporates significant **recent state energy policies** across the West
- ✓Wide-ranging, investigating **flexibility challenges from multiple technical perspectives** over an extended study horizon
- ✓Includes a **granular representation of the transmission system** and captures interregional **transmission flow effects**
- ✓Considers both **institutional and physical strategies** for system flexibility needs

Baseline Case represents "default" amount of system flexibility

- **Renewable resources** are deployed to meet modeled state clean energy policy requirements
- **Regionalization** of energy markets occurs (i.e. no transmission service charges between BAAs)
- **Load growth** occurs consistent with recent regional and balancing area forecasts – 165 GW by 2035
- Assumed near-term integrated resource portfolios (IRPs) resources are constructed, then capacity expansion modeling (AURORA™) **added resources** for remainder of study period
- Announced and assumed **coal retirements** total 7 GW by 2026
- Assumes a small set of **"near-term" transmission projects** with a direct path to cost recovery are built
- **8.3 million new electric vehicles** (EVs) are deployed by 2035 (3.7 GWa of added load)





Scenarios consider flexibility levels higher and lower than the Baseline Case

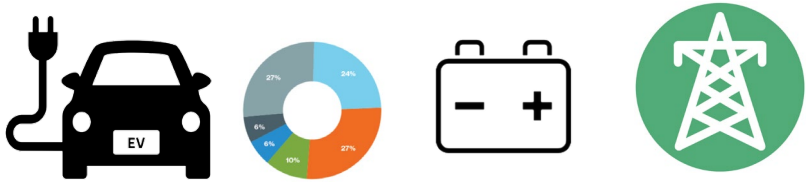
Default level of system flexibility

Baseline

Integration Strategies

Limited Regional Coordination

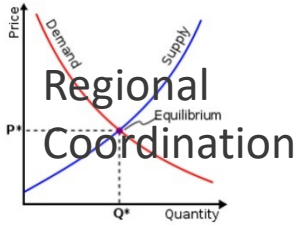
Added to Baseline:



Increases system flexibility

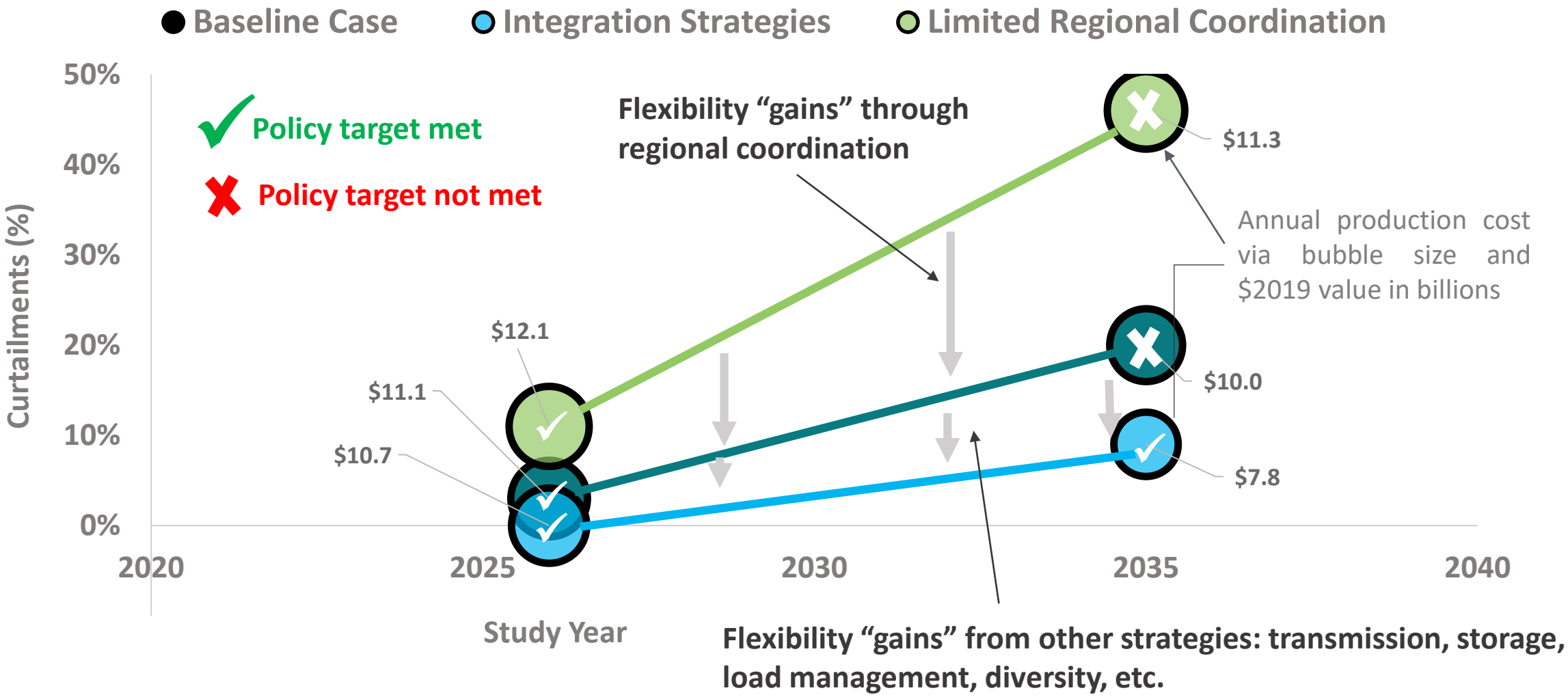
Decreases system flexibility

Removed from Baseline:

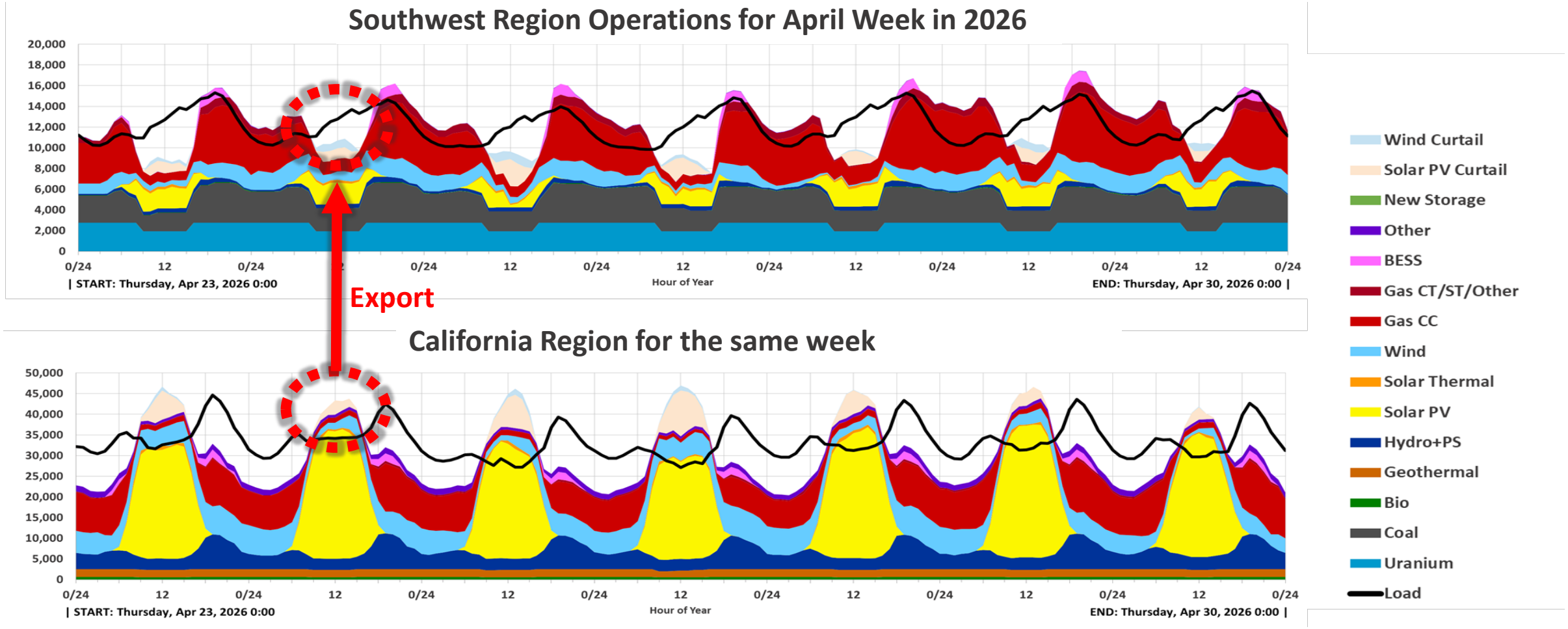


Regional Coordination

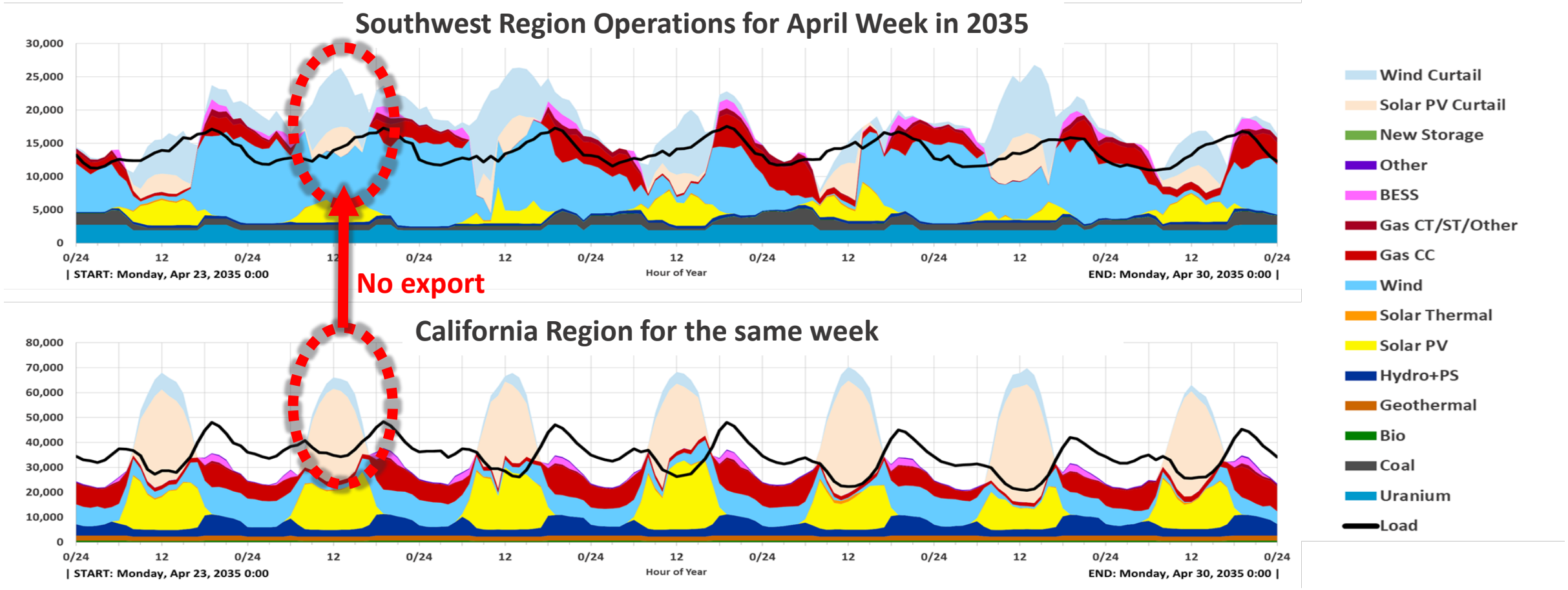
Summary of Key Study Metrics



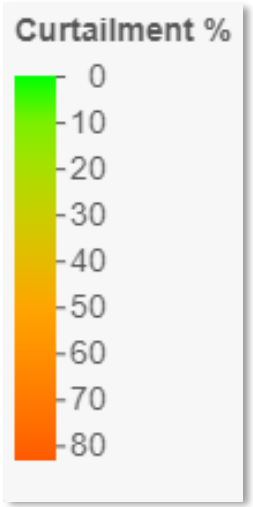
In the 2020's, interregional exchange is viable and a common flexibility strategy, however…

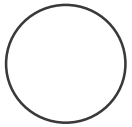


…a lack of buyers for excess renewable power is partially to blame for the flexibility challenges apparent in the 2030s

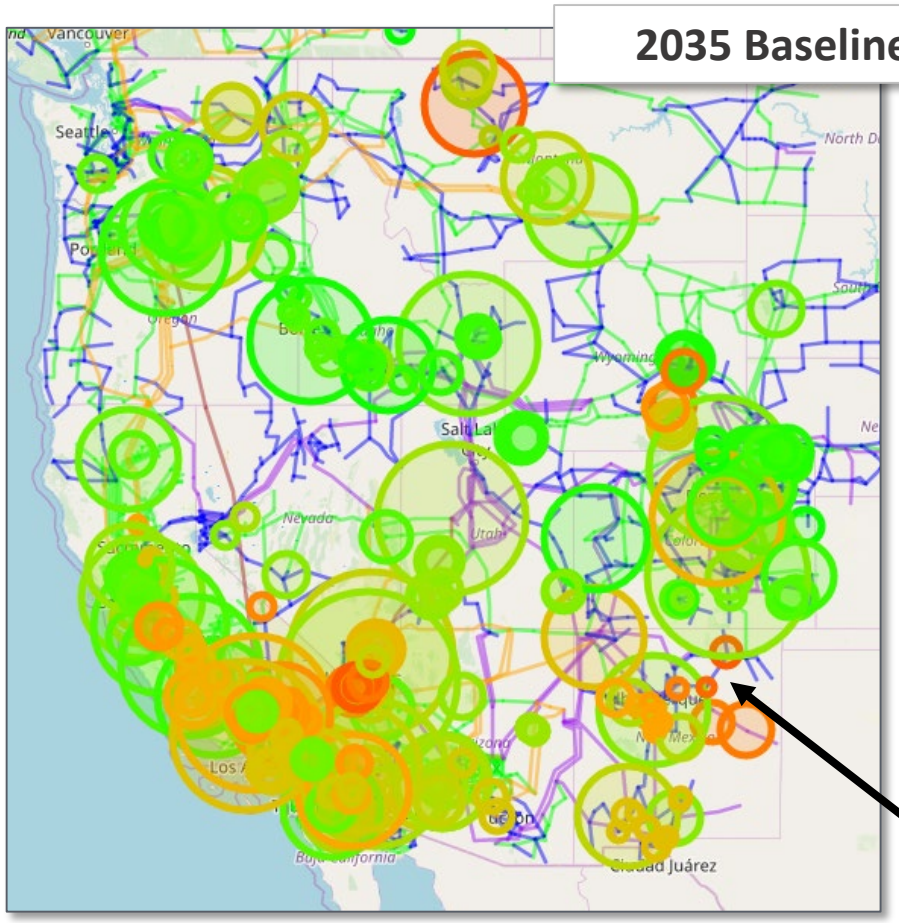


Transmission "shortages" increase into the 2030s and significant build-outs may be required

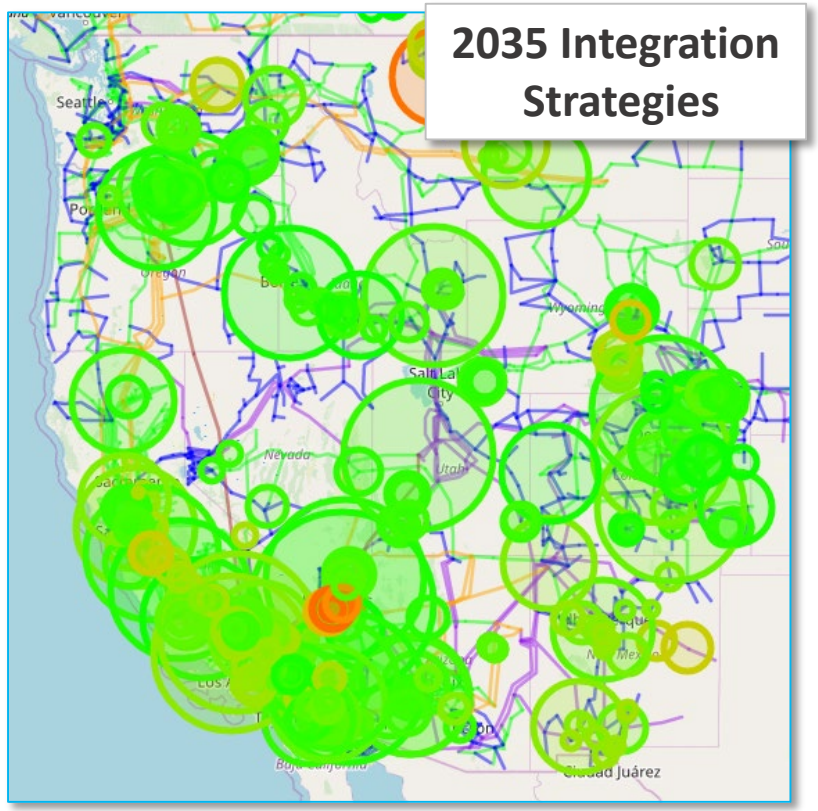




Circle size indicates interconnected renewable capacity



More transmission



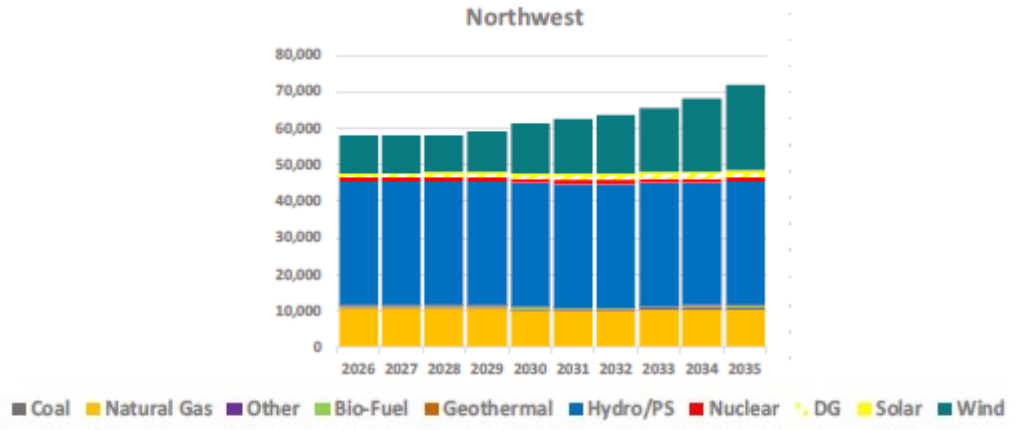
Integration Strategies scenario included substantive transmission builds in California, Colorado, New Mexico, Wyoming/Utah, and Montana, with minor upgrades in the rest of the NW region

Localized curtailments are caused by a lack of transmission

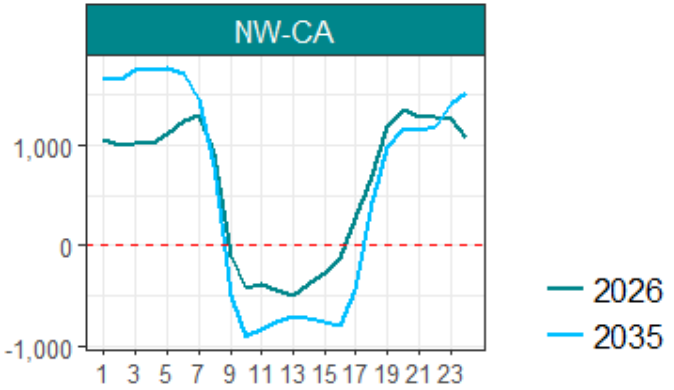
Baseline Case Results for the Northwest

- **Even with regionalization, curtailments in the Northwest grow from 1% in 2026 to 12% in 2035 as the region reaches a 60% clean energy penetration (excluding hydro)**
  - ❖ The largest proportion of inflexibility conditions continue to occur in the spring and fall
- **High penetrations of renewables cause 3-hour net load ramps of over 11 GW in the region**
  - ❖ This means the region needs to increase generation or imports by nearly 4,000 MW per hour
  - ❖ For context, the largest ramp due to changes in gross loads is 8,000 MW over 3-hours
- **Huge daily and hourly swings in interregional powerflows are required to cost effectively balance loads and resources**

NW Mix is Mostly Wind, Hydro, and Solar by 2035



Average NW-CA Interregional Flow



Scenario results for the Northwest

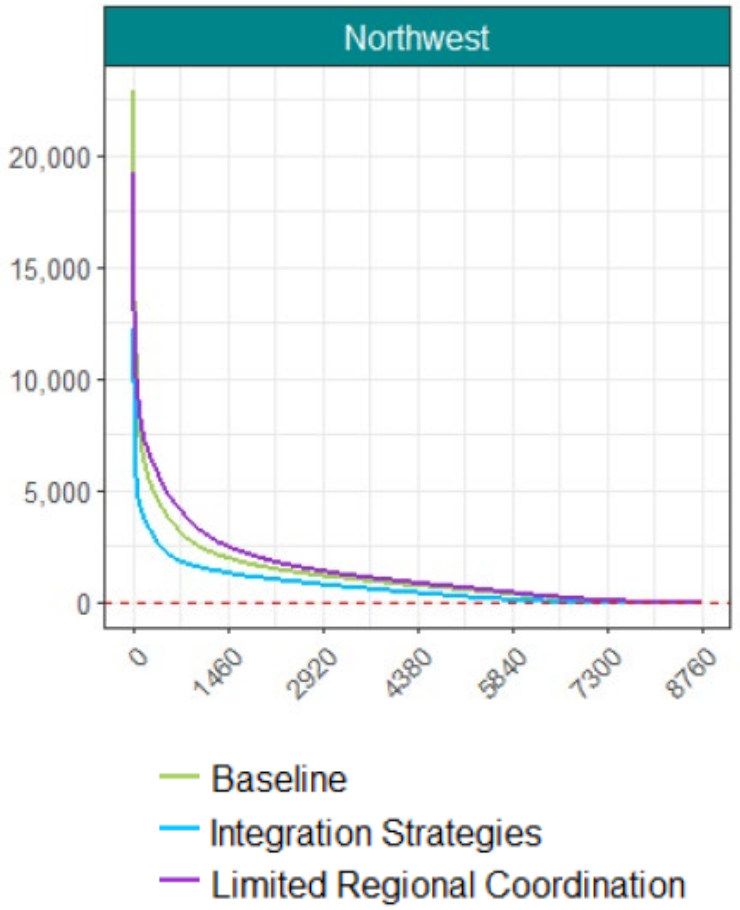
Integration Strategies Scenario

- **Invest in system flexibility by:**
  - ADDING 2 GW of 4-hour storage and 1 GW of long-duration (12-hour)
  - ADDING solar to make the resource mix more diverse
  - ADDING smart charging shape for EV's
  - OPTIMIZING locations for new resources
  - ADDING small amounts of new transmission
- **Causes 2035 curtailments to DECREASE from 12% to 7%, with a 68% clean energy penetration**
- **LOWER WECC-wide emissions**

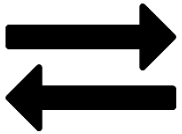
Limited Regional Coordination

- **Remove system flexibility from Baseline Case by:**
  - Adding wheeling costs back for day-ahead transactions between balancing areas
  - But, continue to assume flexibility currently offered by EIM for optimizing real-time dispatch
  - Constrain flow and ramping to historical limits (proxy for contract path and scheduling limitations of today's system)
- **Causes 2035 curtailments to INCREASE from 12% to 15%**
- **Higher WECC-wide emissions**

Curtailment Duration Curve

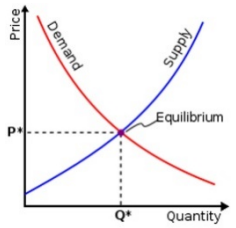


Study Findings and Potential Implications for the Northwest

Study Finding	Northwest Implication
 West can achieve near-term (2020's) policy targets. But over time policy targets become more difficult to achieve and more system flexibility is needed.	+5-10 year goals may be met with status quo system and plans, but 2030 targets will require additional actions.
 An all-of-the-above approach to system flexibility is likely needed to hit policy targets (64% by 2035). If no action is taken, the West may lack sufficient grid flexibility to achieve state energy goals.	Start planning for regionalization, storage, diverse resources, and enhanced customer engagement now to meet aggressive long-term goals.
 Economic transfers are one of the most effective tools for increasing system flexibility. Exporting and importing excess power saves $$$ on both sides of the transaction.	Consider how much you can rely on your neighbors for economic interchange when making investment decisions, and consider market and transmission options that make this possible.

Note of caution: This strategy, alone, fails in the long run!

Study findings and implications for the Northwest (cont.)

Study Finding	Northwest Implication
 Coordinated wholesale markets are effective at increasing system flexibility across the West and lead to operational cost savings and reduced emissions (both between 9-13% reductions).	While not technically *required* in the near-term, results indicate that might be difficult to efficiently achieve west-wide policy targets without enhanced market coordination.
 Significant work must be undertaken to build out renewables (9 GW per year) to meet West-wide policy objectives.	A diverse resource mix benefits the Northwest region. Montana wind was first resource selected in portfolio expansion.
 In the 2030s, the need for transmission becomes more obvious and resources face material grid constraints.	Consider local needs for infrastructure, including transmission, storage, and other assets that add flexibility to the system.

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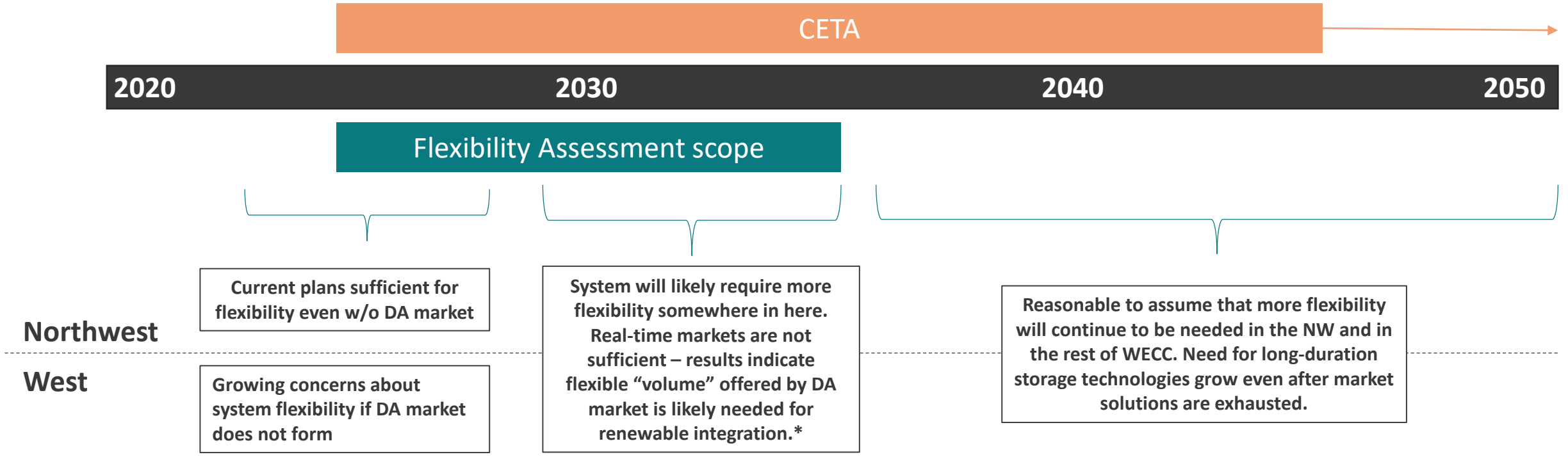
CETA Timing and the Flexibility Assessment:

An informal comparison



*The above commentary is from the regional perspective – each BA or utility may have different needs

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Wholesale market constructs provide varying degrees of operational flexibility

Wholesale Market Construct	Liquidity and market access	Operating and contingency reserves	Market optimization	Wheeling Costs	Transmission Availability	Flexibility Benefits
Bilateral	Low	Status quo	None	Pancaked	Artificially constrained	**N/A**
Real-time (EIM)	Medium	Status quo	Intra-hour dispatch	Free (with opportunity cost)	Very Limited	**Low**
Day-ahead	High	Status quo	Day-ahead commitment & dispatch, intra-hour dispatch	Varies	Limited	**Medium**
RTO	Highest	Consolidated, optimized	Day-ahead commitment & dispatch, intra-hour dispatch	None	Maximized	**High**

Increasing market access and depth improve efficiency of operations

Lower overall requirement and potential to decommit unneeded generation

Flow-based congestion management results in more efficient use of transmission system in both planning and operational horizons

***This list is not exhaustive.**

ENERGY STRATEGIES

THANK YOU

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