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Western Transmission Expansion Coalition "WestTEC"

Public Webinar

February 28, 2025

Agenda Overview

- WestTEC Overview and Announcements
- Study Execution Update
- Updates from Committees, States and Tribes
- Capacity Expansion Modeling Overview and Status Update
- Scenario Development Status and Feedback
- Action Items and Next Steps

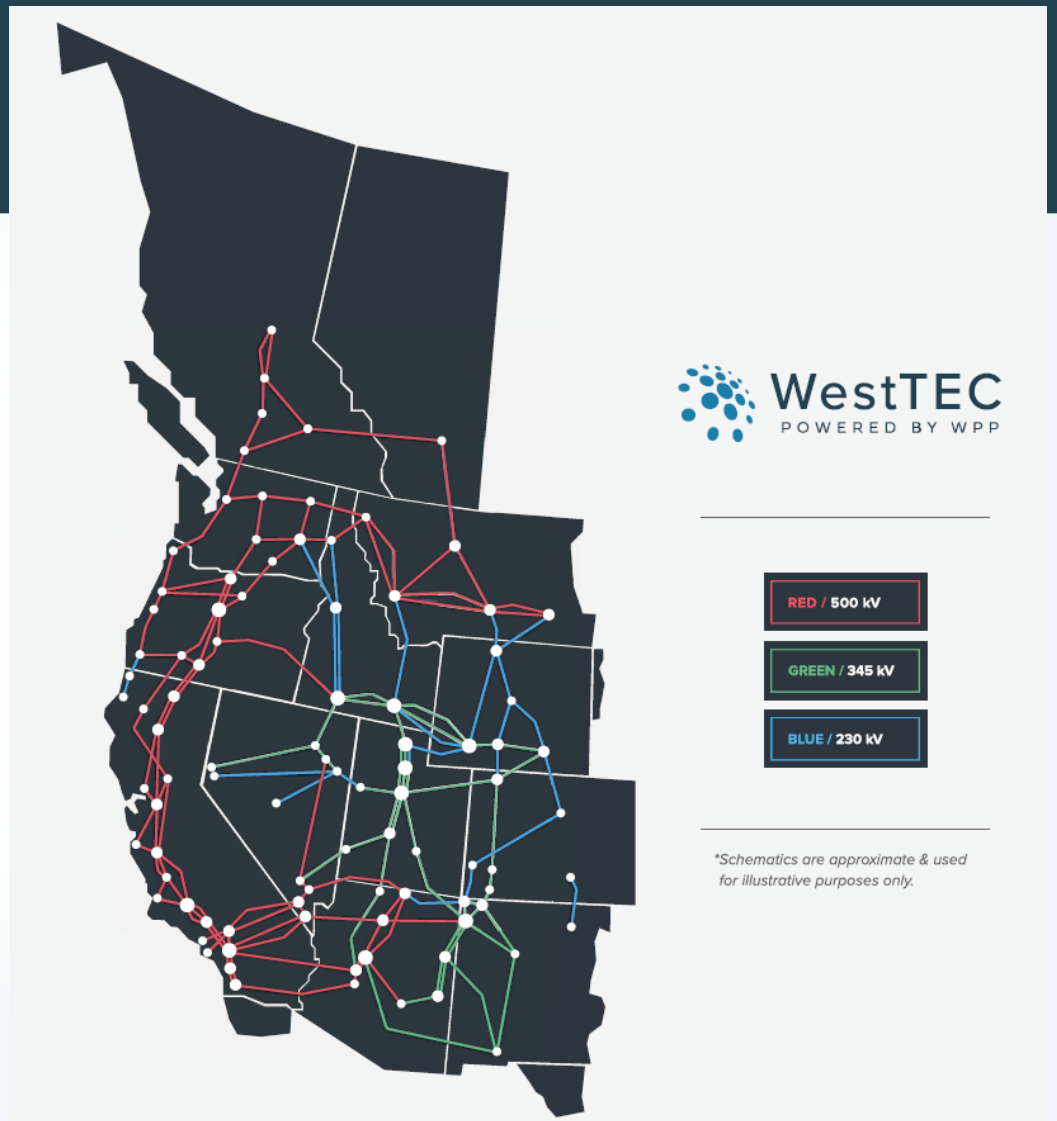
The Presentation Team

- **Western Power Pool:** Sarah Edmonds
- **Consultants:**
  - **Energy Strategies:** Keegan Moyer and John Muhs
  - **E3:** Jack Moore
  - **GDS Associates:** Gillian Biedler
- **Steering Committee Co-Chairs:** Kelsey Martinez, PNM, John Martinsen, Snohomish PUD
- **WATT Co-Chairs:** Jennifer Galaway, Portland General Electric, Jeff Billinton, CAISO, Ben Fitch-Fleischmann, Interwest Energy Alliance
- **Regional Engagement Committee (REC) Co-Chairs:** Vijay Satyal, Western Resource Advocates, Robb Davis, GridLiance
- **Tribes:** Donald Williams, From the Light Consulting
- **CREPC TC:** Robin Arnold, Western Interstate Energy Board

WestTEC Overview

What is the Western Transmission Expansion Coalition?

- *"WestTEC"*
- *Not a FERC process*
- *West-wide 20-year transmission study (10-year look)*
- *Industry-led with unprecedented regional partner inclusion*
- *Goal is to produce an actionable transmission study*



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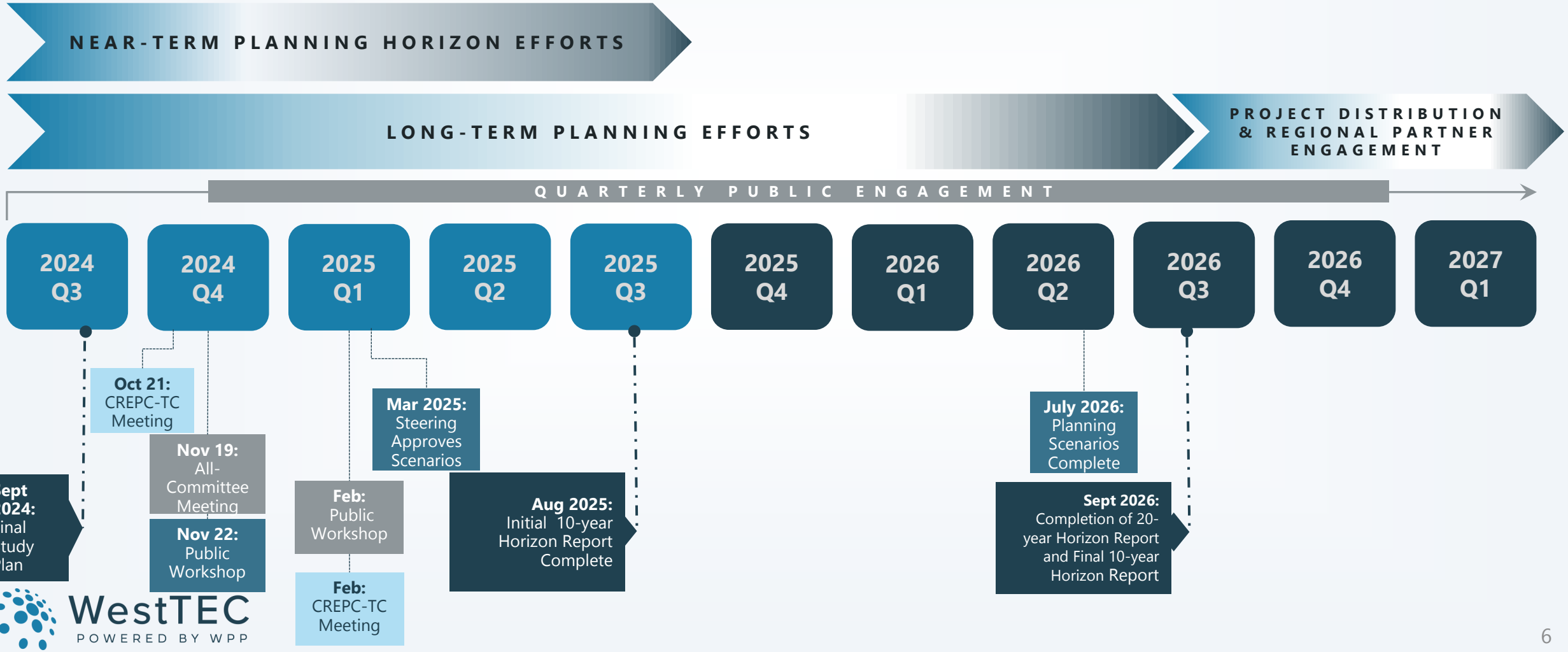
WestTEC Project Timeline



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Study Execution Update

What are the study's goals?

» The primary goal is to produce an **actionable transmission study** that is useful to planners, developers, regulators and the study's regional partners

Study Goals

Develop Actionable Portfolios: Create transmission portfolios addressing 10-year and 20-year needs, useful for planners, developers, and regulators.

Ensure Reliability: Meet NERC compliance, provide operational flexibility, and identify necessary transmission capacity for reliable operations.

Improve Efficiency: Reduce congestion and meet future energy needs, considering planning reserve margins for reliability.

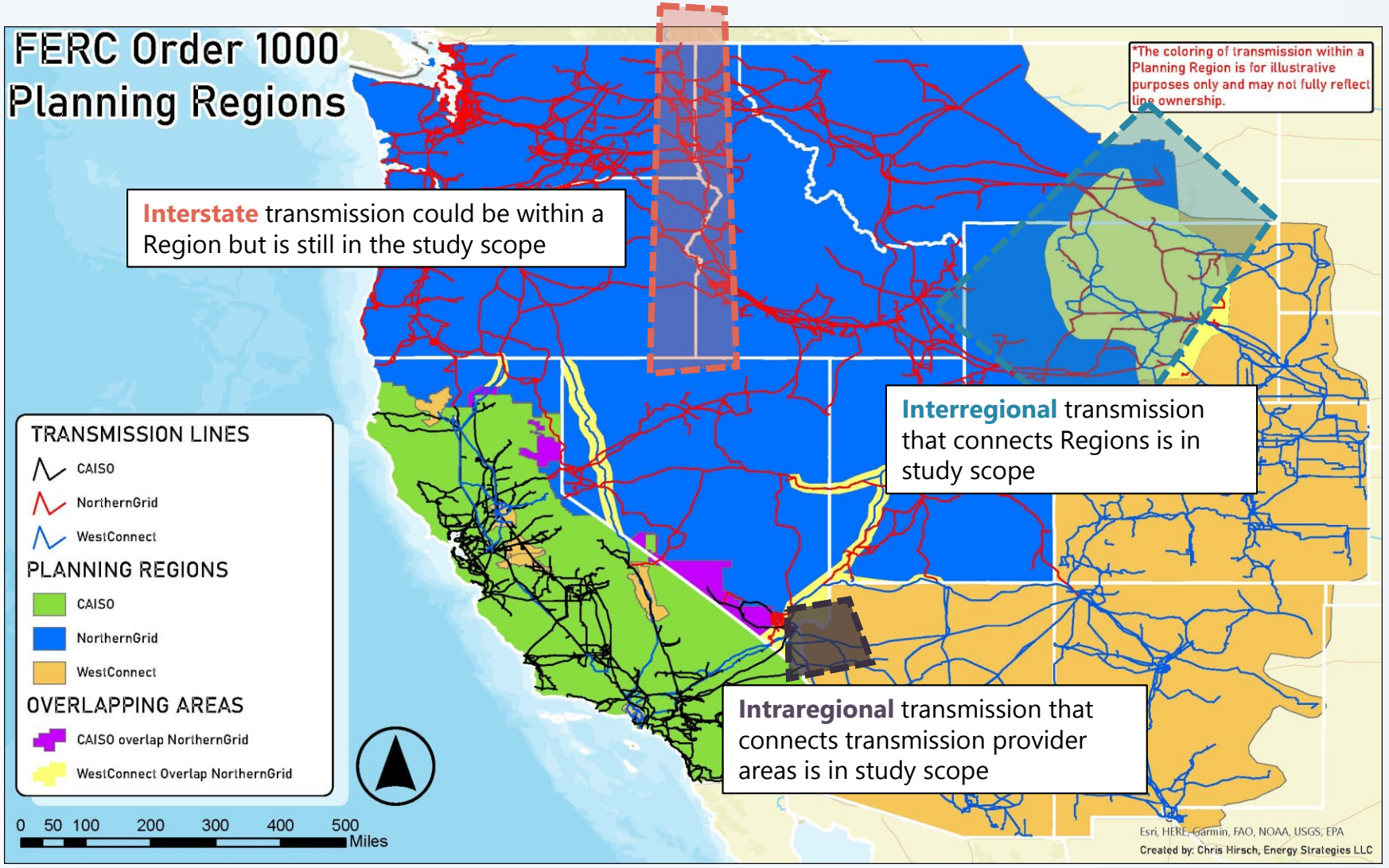
Increase Affordability: Enable investment savings through coordinated transmission portfolios and better infrastructure utilization.

Enhance Visibility and Coordination: Provide a clear view of combined capabilities and requirements to support informed planning and solutions.

Support Cost Allocation: Offer regional-level information to assist in cost allocation discussions for future projects.

Ensure Fairness: Develop an unbiased plan that aligns with regulations and benefits all resource types and stakeholders.

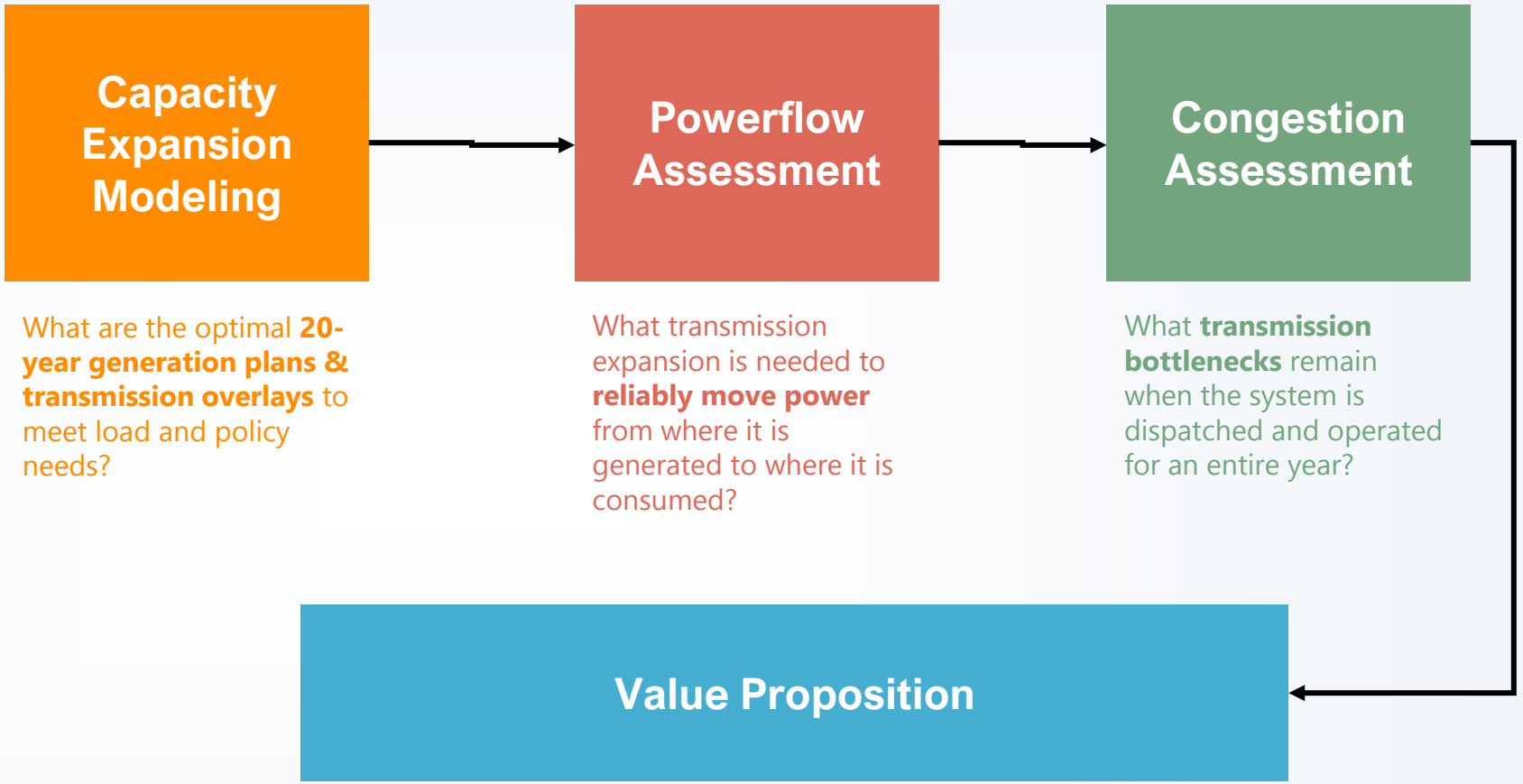
What transmission will the study address?



Source: WestConnect

Map highlights transmission associated with each Order 1000 Planning Region ("**Region**" in the Study Plan)

Modeling Environment



Study Execution Update

Where we are at now…

- **10-year horizon (Reference Case):** Data collection of load forecast, near-term resource plans, and transmission topology is complete. Finalization of study methods and assumptions being addressed at WATT.
- **20-year horizon:** Capacity expansion model development underway, with stakeholder input on major assumptions and study approaches. Load forecast is complete.
- **Scenarios:** Sub-team identified drivers and four scenarios that are being refined through stakeholder input.

What to expect next…

- Preliminary Powerflow Assessment and Congestion Assessment results will begin to identify any potential needs for interregional expansion in March and April
  - Model refinement expected throughout early summer
- Draft resource and transmission overlay results will be presented to WATT in March & April
  - Goal is to finalize resource plan by May 1st
- Approved by Steering Committee in March, with subsequent efforts focused on parametrization of scenario narratives
  - Scenarios ready for transmission analysis in fall, 2025

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Committees, States, and Tribes Update

Capacity Expansion Modeling Overview and Status Update

Capacity Expansion Modeling Update

- **E3 is leading the capacity expansion analysis, utilizing the PLEXOS LT model to co-optimize 20-year case resource portfolios, and inter-zonal transmission over the entire Western Interconnection**
- **Model functionality is working and is being adapted to best represent the latest data from the region & WATT / other WestTEC committee input, as well with to align with data in the 10-year year reference case built by Energy Strategies**
- **Key Recent updates**
  - Zonal Model Topology
  - Reference Case Load Forecast
  - Policy Requirements
  - Candidate Generation for Additions
  - Candidate Transmission Expansion

Capacity Expansion Problem Formulation

+ **For this work, E3 is performing perform the capacity expansion as a constrained optimization:**
  - **Select new resources & transmission** to
  - **Minimize the cost** of
    [generation build cost + transmission build cost
    + system operations cost (fuel cost, O&M cost, emissions permit cost, etc.)
  - **Subject to**:
    - **Hourly energy balance**: Generation + net imports for each zone = load for each zone
    - **Reliability requirements**: Planning reserve margin or other proxy for minimizing target loss of load
    - **Policy requirements**: GHG and/or RPS targets
    - **Build limits** to resource & transmission available potential given to model by zone
+ **Model optimizes resource additions that reduce total cost of build and operations while satisfying the constraints**
  - Will use sampled chronology of selected days & years to make model computable for the large Western footprint

Key capacity expansion inputs

Existing Transmission

+ Zone definition
+ Existing (& Planned) zone-to-zone transmission capability (in MW) Transmission
+ Hurdle rates for wheel out/through

Existing Loads

+ Total load Growth & Load Shapes

Initial Resources

+ Existing Resources built
+ Planned resources & assumed retirements
+ Characterization of existing resources operating capability & cost
+ Fuel costs, GHG permit costs

Constraints:

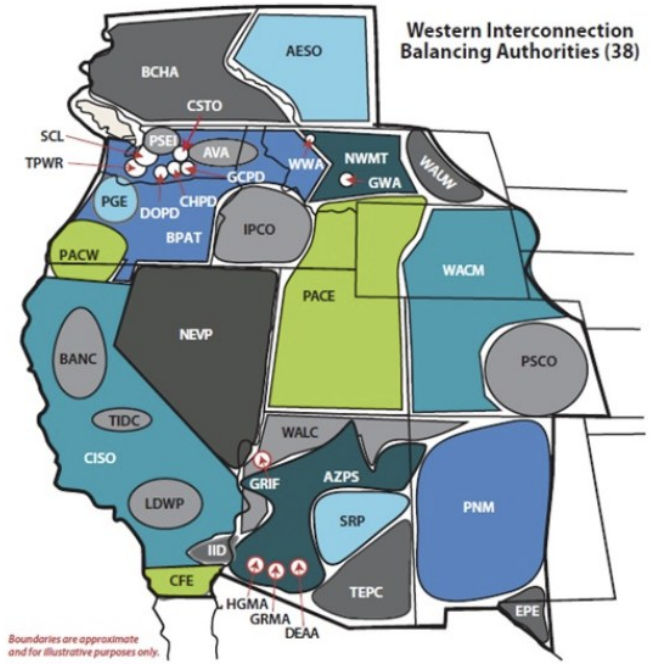
+ Reliability requirement target
+ Policy goal target (e.g. CES % of retail load)

New Candidate Resoruces (available to select)

+ Technologies available by period
+ Candidate cost (build cost, operating cost)
+ Candidate potential available to select (MW by technology by zone)

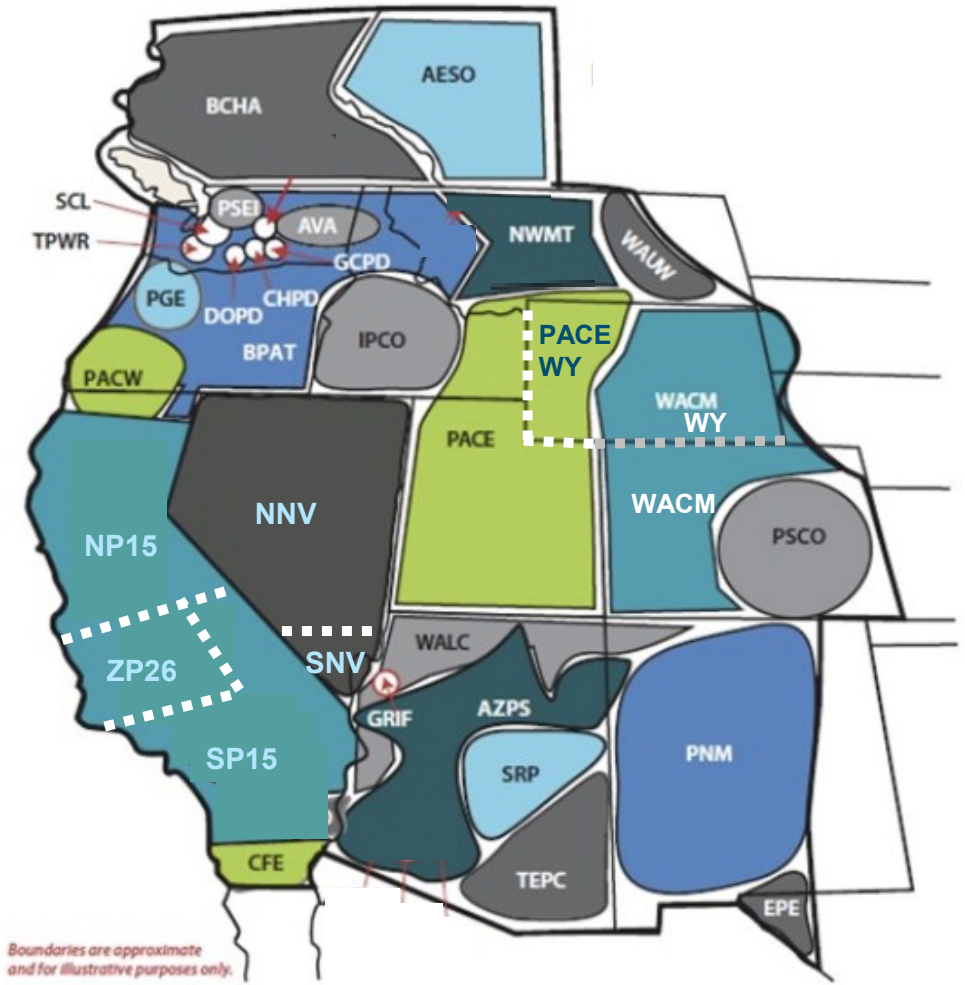
New Candidate Transmission

+ Transmission candidate potential availability (max MW of additional capability by selected zonal pair)
+ Cost of transmission candidate potential (capital & operating in $/MW of additional capability)



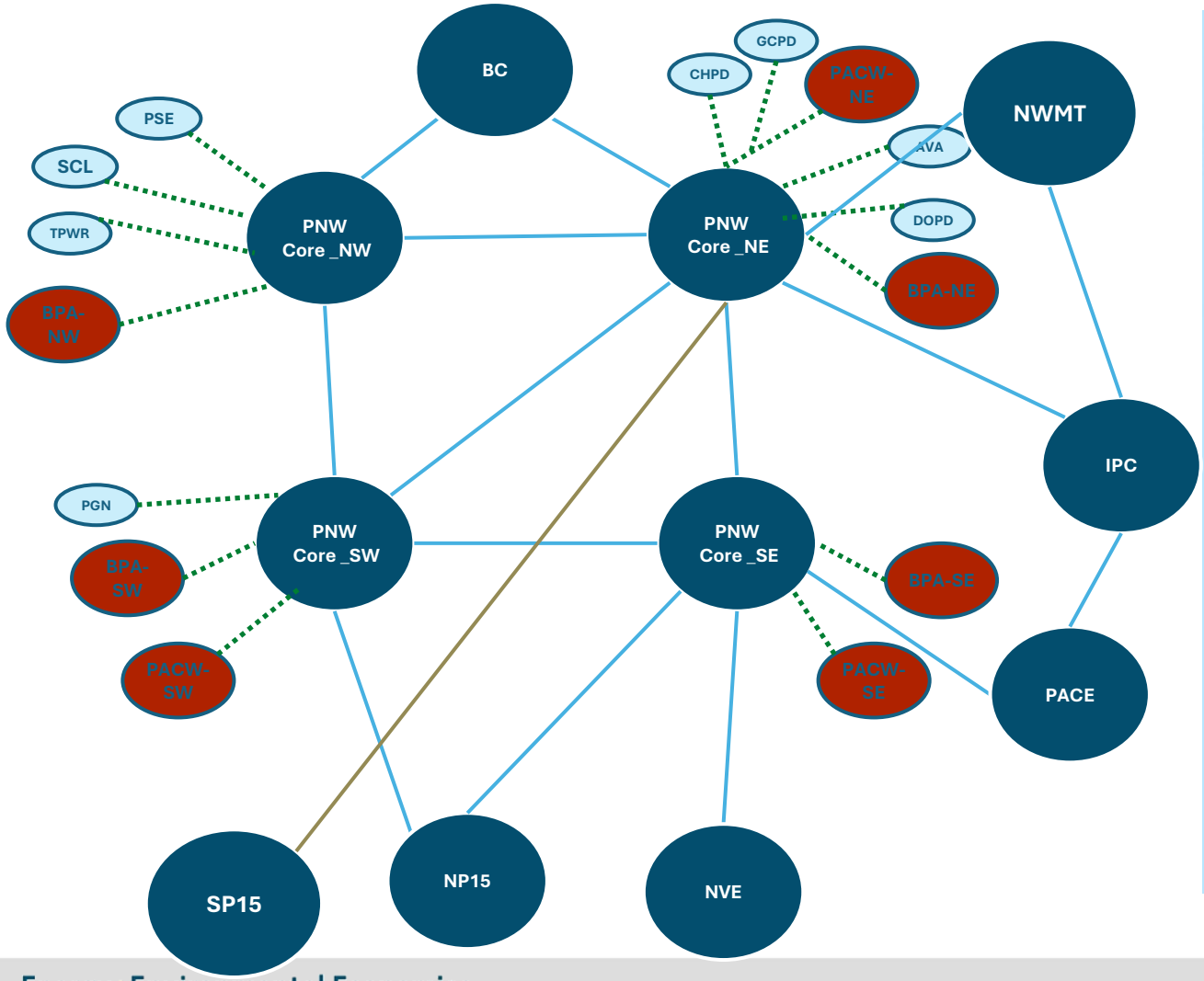
Remote Resource Modeling example

- Zonal topology is primarily based on BAA boundaries with selected exceptions
- Sub-division of certain zones (NVE, PACE, WACM)
- California Zones regrouped into NP-15, SP-15, and ZP-26
- Updated Pacific Northwest representation (shown in next slide)
  - (Note: model will assuming near-zero hurdle rates for transactions across footprint)

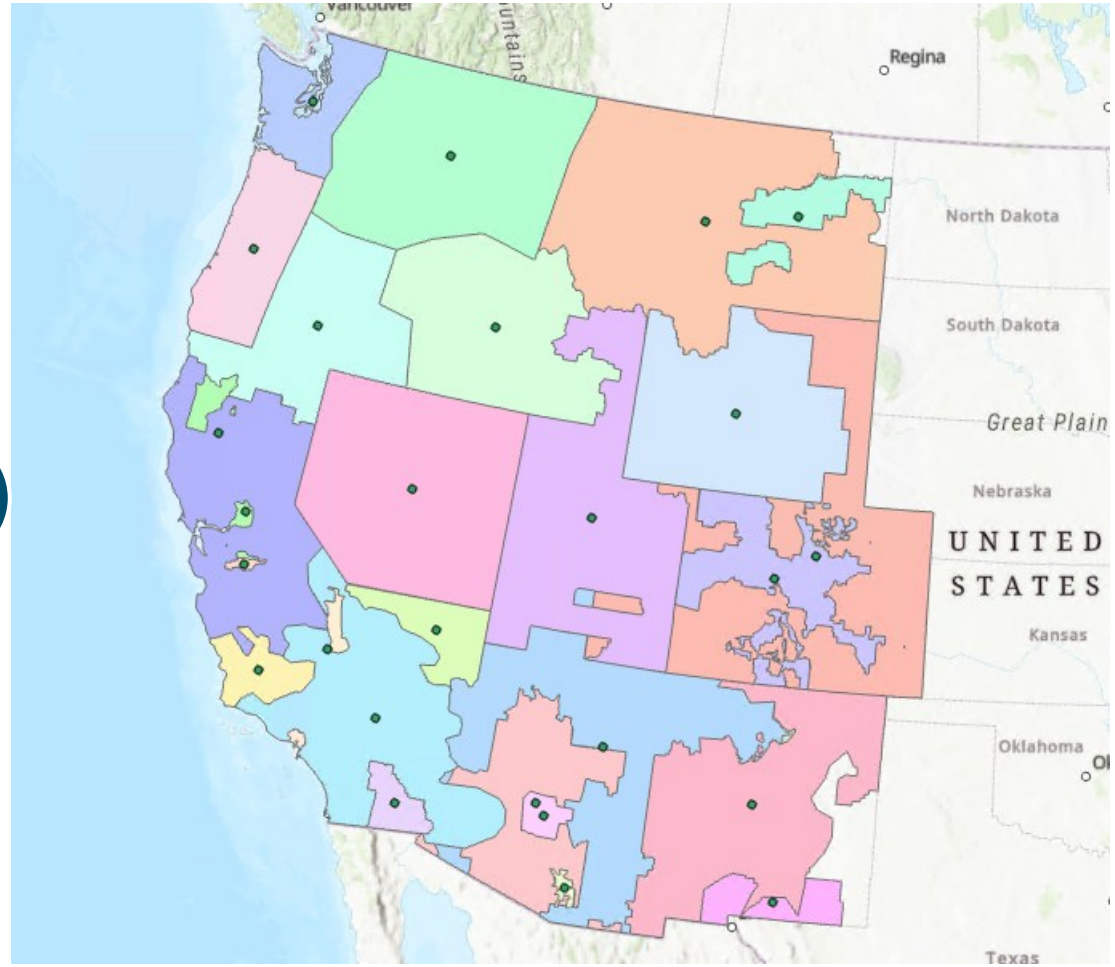


Revising Northwest Topology to Better Represent Northwest Physical Constraints vs. BAAs

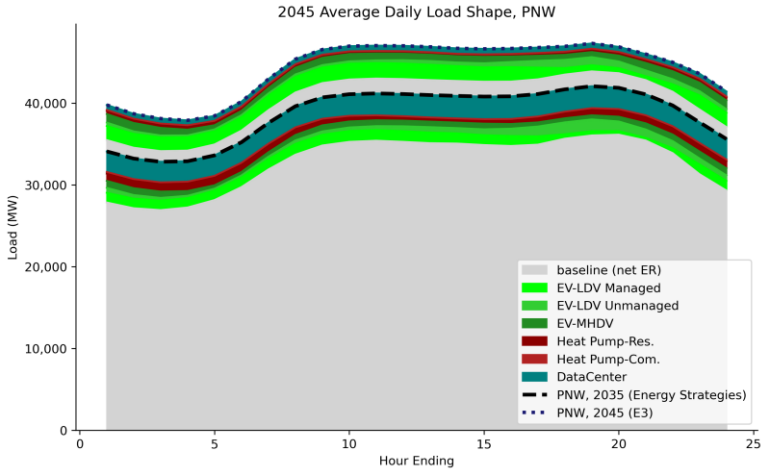
Updated Zonal Topology for Northwest

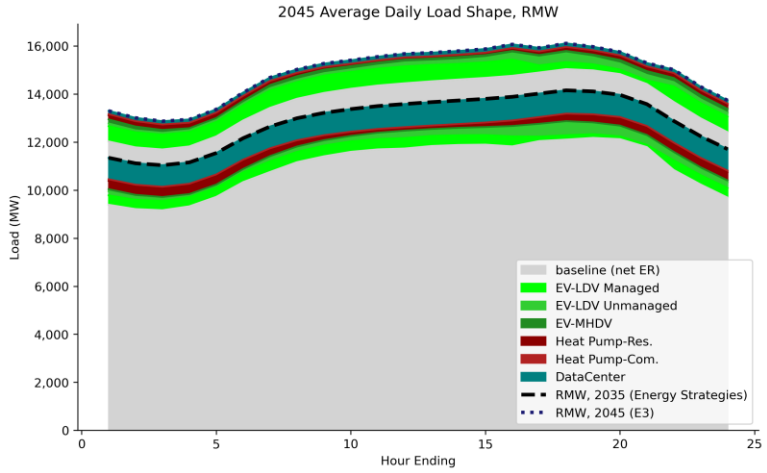


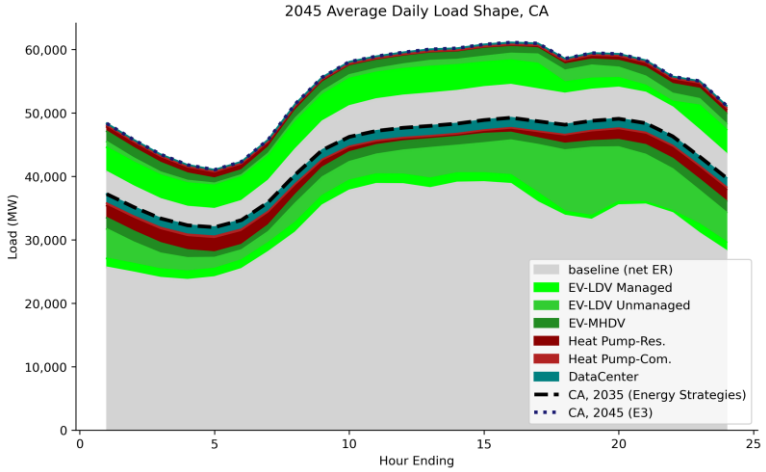
Updated US-Wide Geographic Boundaries

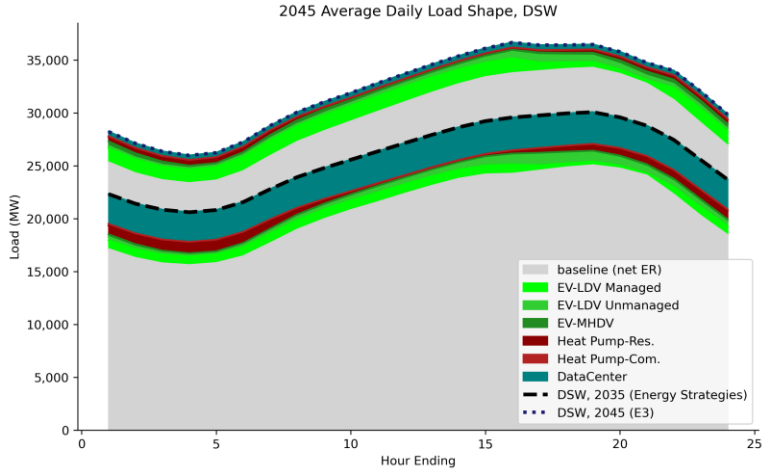


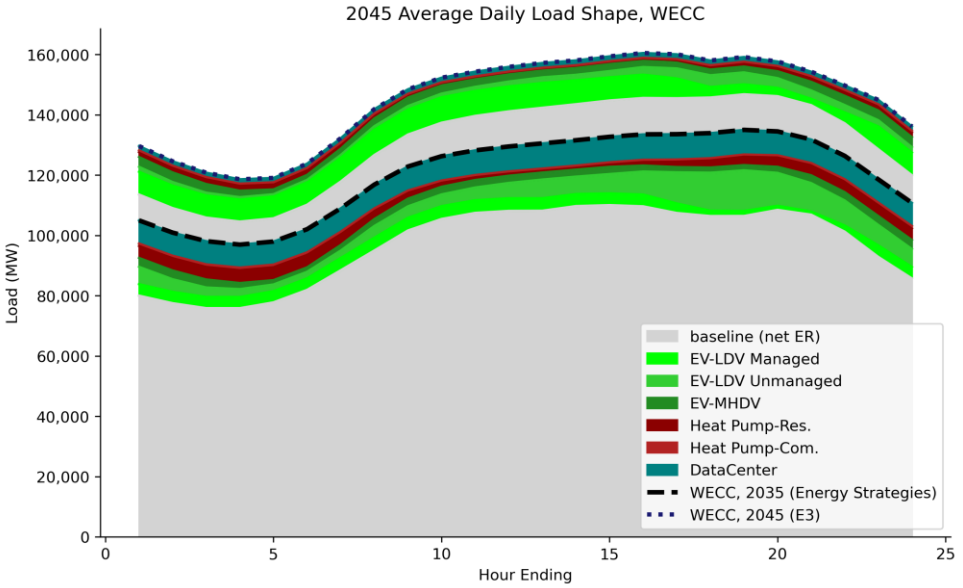
2045 Load Projections include specific additions for data centers, industrial growth, and electrification





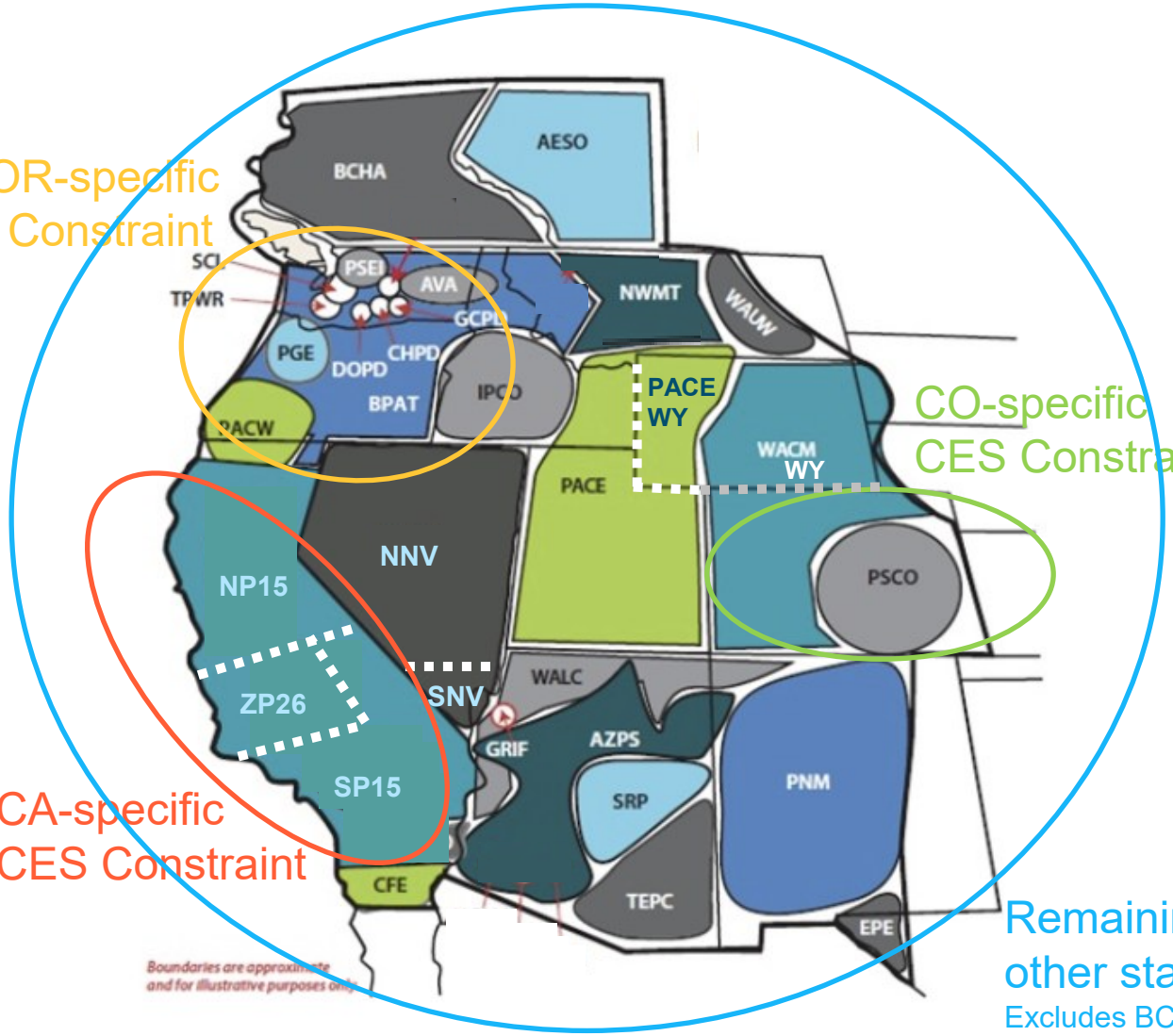






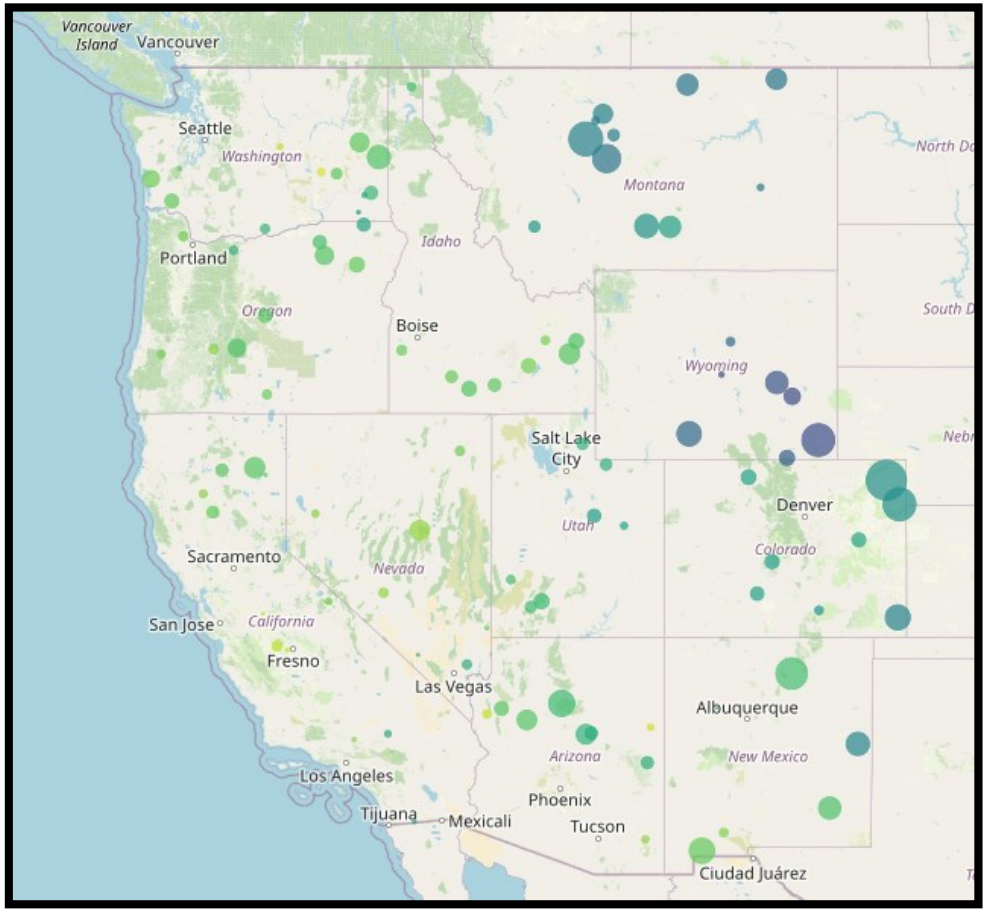
Policy “Constraints” respected in Resource Buildout

+ **The PLEXOS LT Model selects 20-year resources additions to create generation mix that complies with state policies and explicit utility goals**
  - Policies for Washington, Oregon, California, and Colorado are met with in-state generation or remotely procured resources that set aside transmission for delivery to their loads
  - The remaining needs from other states and utility plans can be selected by model from across WECC (must be delivered to a load rather than curtailed)



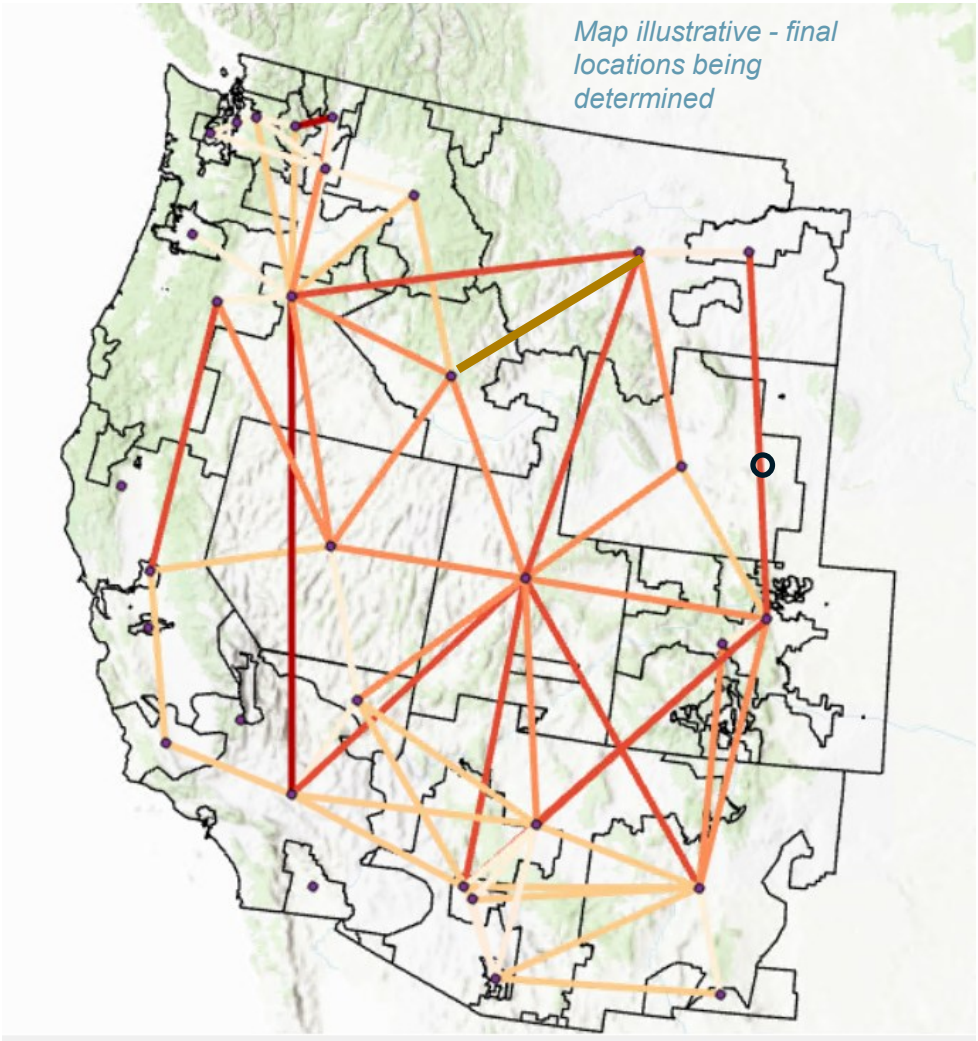
Wind & Solar Resource Candidates

- Energy Strategies & Montara Mountain Energy developed a set of candidate wind and solar resources for the 20-year capacity expansion model



Transmission Expansion Candidates in the 20-Year Model

- **Each transmission link between zones in the model can be expanded, but with a $/MW cost for transmission additions**
  - Cost is being developed as a function of expected distance to connect the zones, terrain, and state-specific cost factors
- **The goal of the transmission additions is to enable the model to see tradeoffs between generation locational choices & transmission costs**
  - e.g. is it cheaper to pick higher cost resources closer to load --- OR lower cost resources further from load (and incur additional transmission costs)
  - This model will enable exploration of these unique **transmission & generation cooptimization questions** – which historically had to be addressed one-by-one creating a chicken or the egg problem in planning



Scenario Development Status and Feedback

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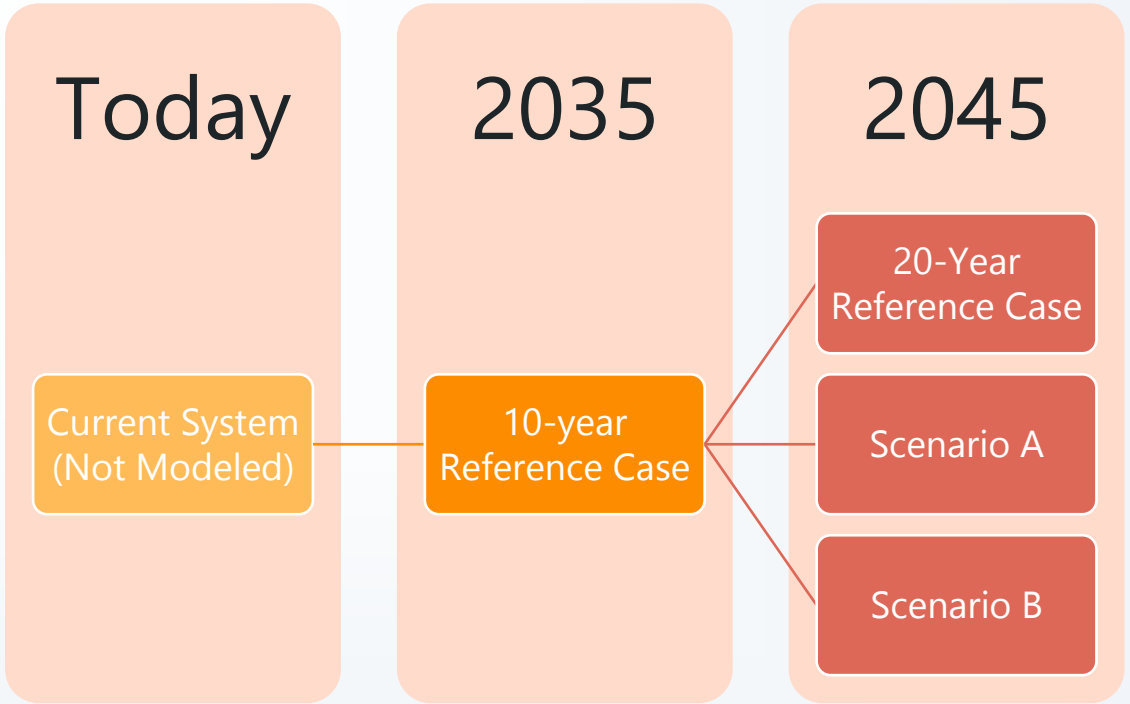
Focus of Scenario Planning Effort

- The scenario planning sub-team is facilitating the development of **two alternative scenarios** in the 20-year horizon
- Scenarios consider variations in technology advancement, load growth, policy changes, among other factors
- Scenario results will be used to identify persistent transmission needs across a range of future outcomes



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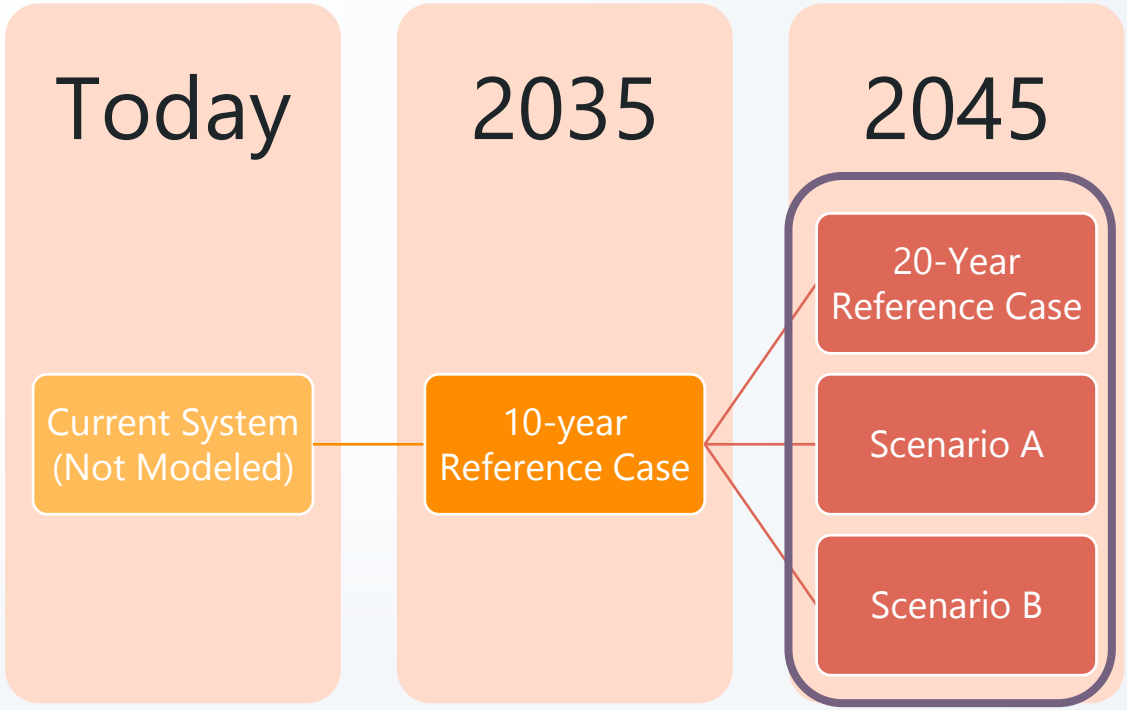
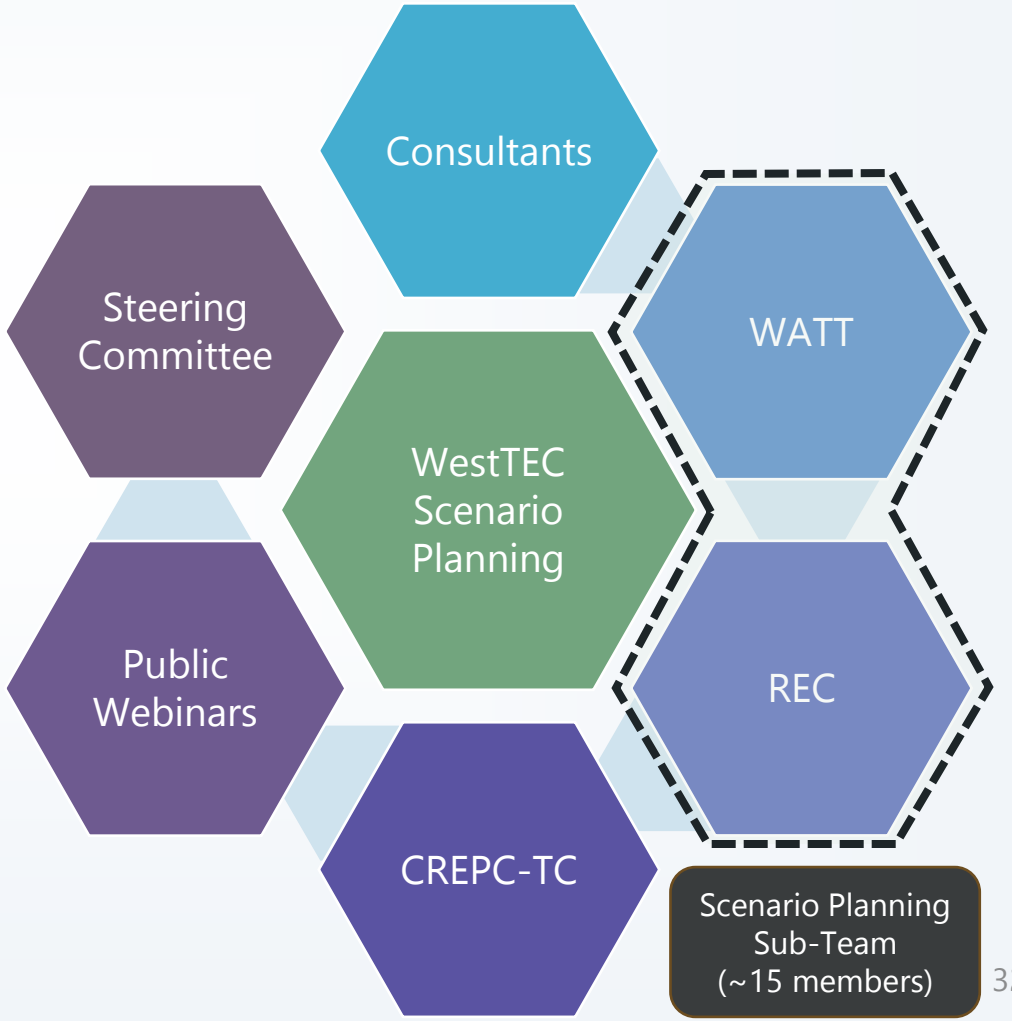


Scenario Framework

Summary of Scenario Effort

Milestone	Completion Date
Phase 1 (Drivers) Commenced	August 2024
Sub-Team's Initial List of Drivers	October 2024
Drivers Finalized & Approved	November 2024
Phase 2 (Scenarios) Commenced	December 2024
Sub-Team Scenario Submissions	January 2025
Scenario Feedback & Refinement	**February 2025**
Steering Approves Scenarios	March 2025
Scenario Capacity Exp. Complete	July 2025
Planning Scenarios Complete	July 2026



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Drivers

- Scenario sub-team proposed 5 drivers representing key uncertainties affecting transmission outcomes in a 20-year timeframe

- These drivers were used to develop scenario narratives

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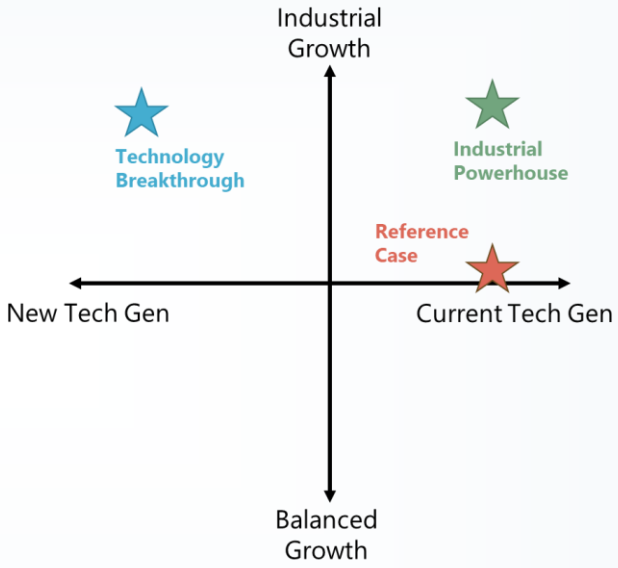
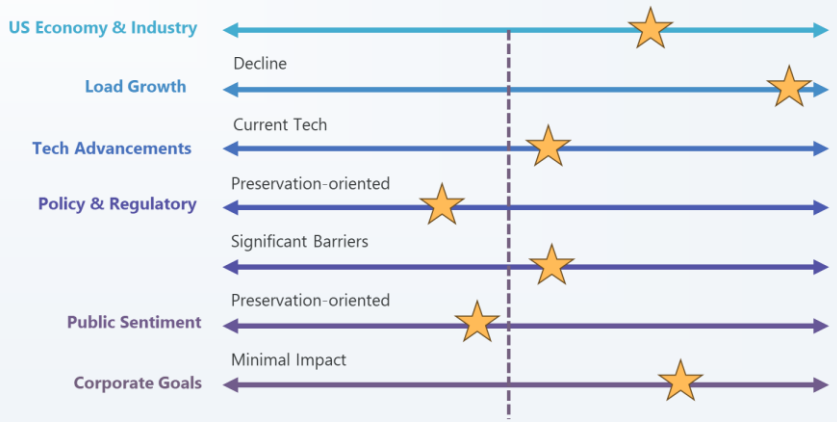
Scenario Templates & Brainstorming

- Scenario sub-team members were asked to submit scenario ideas via provided templates
  - Templates encouraged members to think through plausible scenario narratives
  - Sub-team members also encouraged to consider their scenarios as part of a **scenario framework**





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Submitted Sub-Team Scenarios

Framework	Scenario Name	Load Growth	Resource Technology Advancement	GHG Policies
1 (Ravi Aggarwal; Bonneville Power Administration WATT)	"Industrial Powerhouse"	High (Industrial)	Reference	Less
	"Technology Breakthrough"	High (Industrial)	Very High	Less
2 (Jeff Bower, Clean Energy Buyer's Association; REC)	"High Growth, Existing Tech"	High (Industrial)	Reference	Reference
	"High Growth, Breakthrough Tech"	High (Industrial)	High (Nuclear, OSW, Geothermal, LDS)	Reference
3 (Angus Duncan, National Resources Defense Council; REC)	"Politics Slows Everything Down"	Reference	Reference (Storage, Renewable Techs)	Slower
	"Tech Takes Off"	High (All Sources)	Very High (Nascent Techs)	Reference+
4 (Casey Baker, GridLab; REC)	"Go Your Own Way"	High (Electrification)	High (for Distributed Techs only)	Less
	"Energy Dominance"	High (Industrial)	High (for Nuclear & CCS only)	Less

WestTEC 20-Year Reference Case

- A baseline scenario reflecting a "reasonably anticipated" future with current trends, policies, and projections
- WECC load follows a growth rate reflecting projected levels of electrification & moderate amounts of industrial/data center growth
- Diverse set of resource options including long-duration storage and small modular reactors become available & more cost-effective over time
- RPS & carbon policies on the books today are largely achieved

20-Year Resource Options in WestTEC Study Plan

- Solar PV
- Land-based Wind
- Offshore Wind
- Geothermal
- Biomass
- Battery storage (a range of technologies)
- Pumped hydro storage
- Natural gas with or without CCS
- Nuclear Small Modular Reactors (SMRs)
- Hydrogen Fuel

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What do you like or dislike about the reference case as characterized?

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What might not be captured in the reference case that should be explored in a WestTEC scenario?

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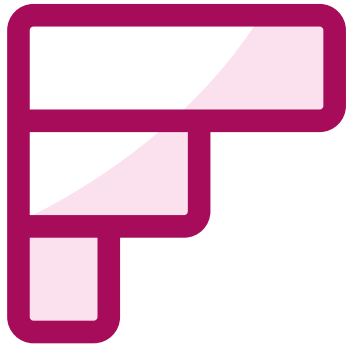

I'd like the two scenarios to explore different outcomes in...

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WestTEC 20-Year Reference Case

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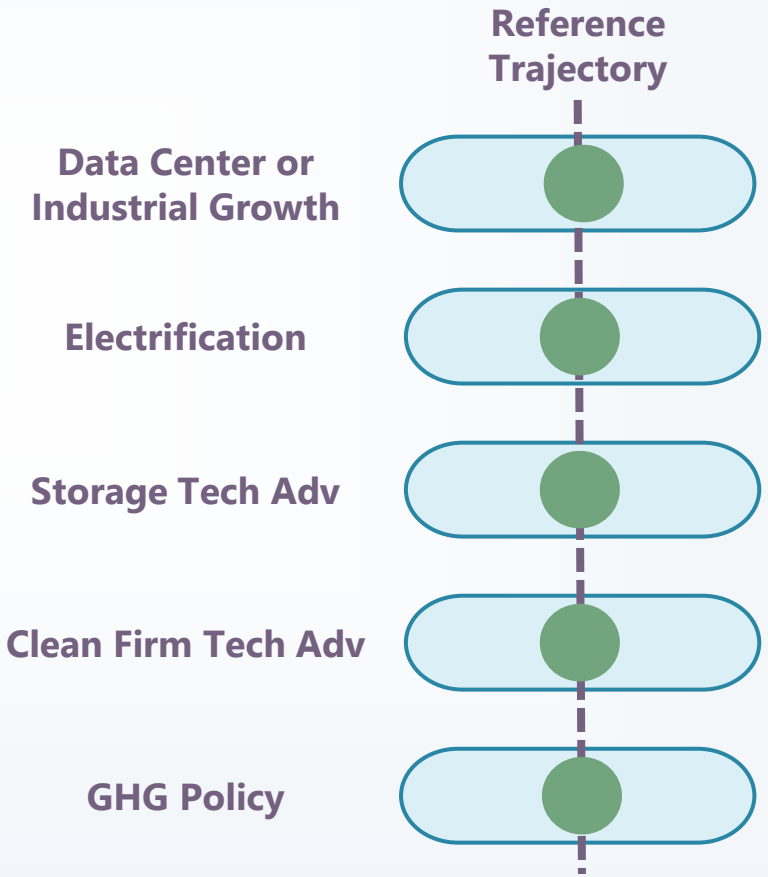
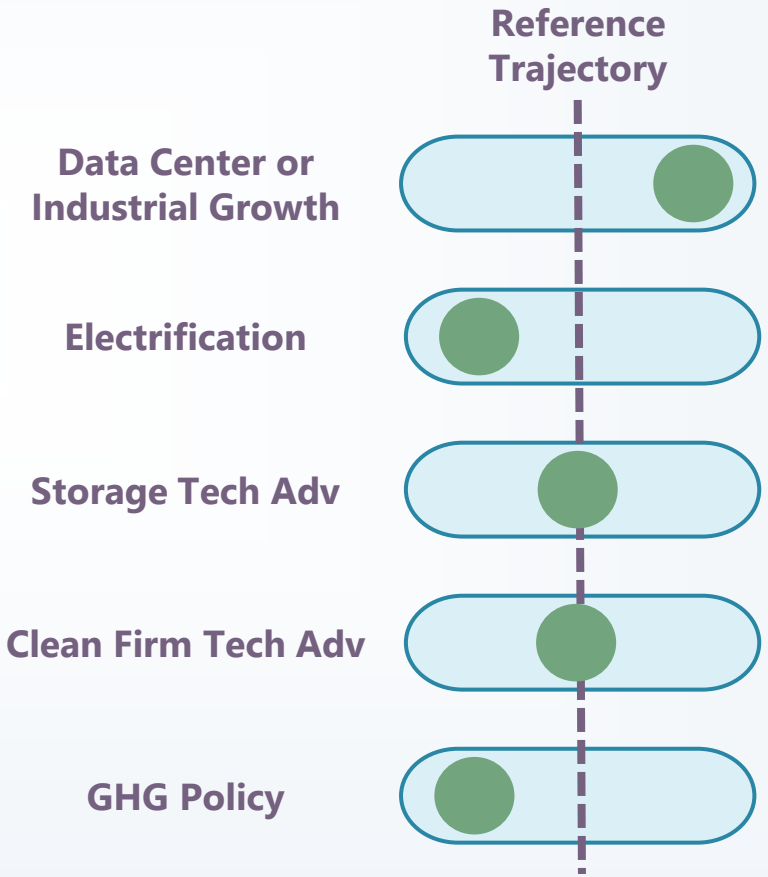


Scenario Option: Industrial Powerhouse

- Public policy prioritizes reliability and economically serving industrial and technology load growth for global competitiveness.
- **Rapid load growth from large industrial facilities** like data centers, manufacturing, and basic materials production. This would be modeled as concentrated point loads with flat profiles in areas with known data center, manufacturing, and material production potential.
- **Electrification load growth is more gradual.**
- **GHG emission reduction caps are less strict** with safety valves to prevent rate shock to encourage economic growth.



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What do you like or dislike about the Industrial Powerhouse scenario?

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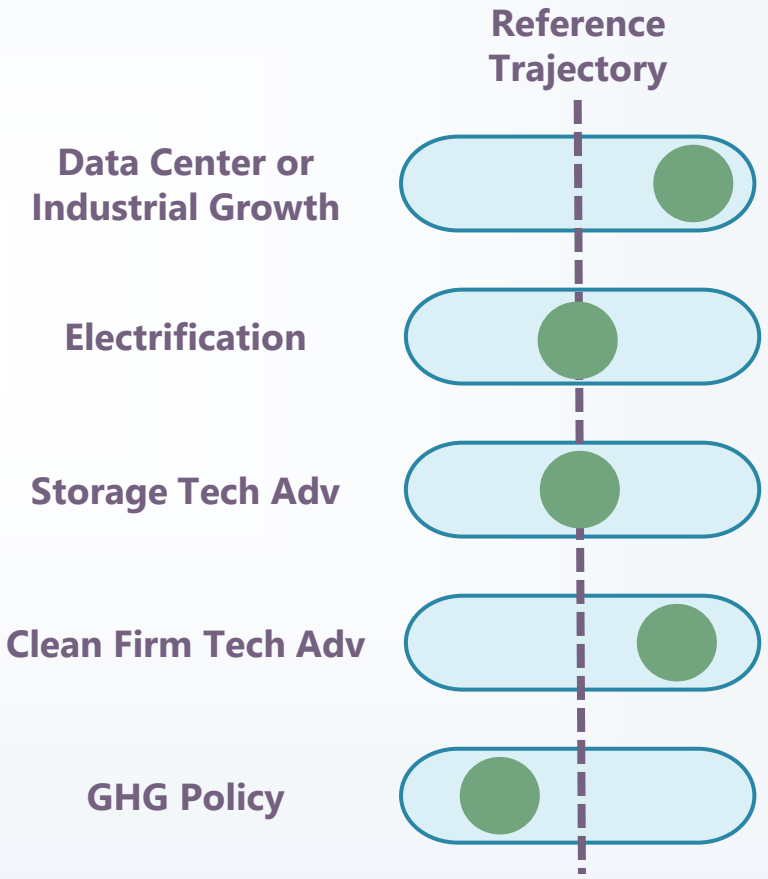
Scenario Option: Energy Dominance

- Energy access is recognized as a national security top priority (due to AI, manufacturing, attack vectors)
- Federal government takes a strong role in energy supply and transmission development, similar to the National Interstate and Defense Highways Act
- **Development of advanced nuclear and natural gas with CCS is prioritized**
- **Electric loads grow rapidly in response to access to low-cost (i.e. subsidized) energy**
- Mimics Power System buildout of the 1950s/60s



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What do you like or dislike about the Energy Dominance scenario?

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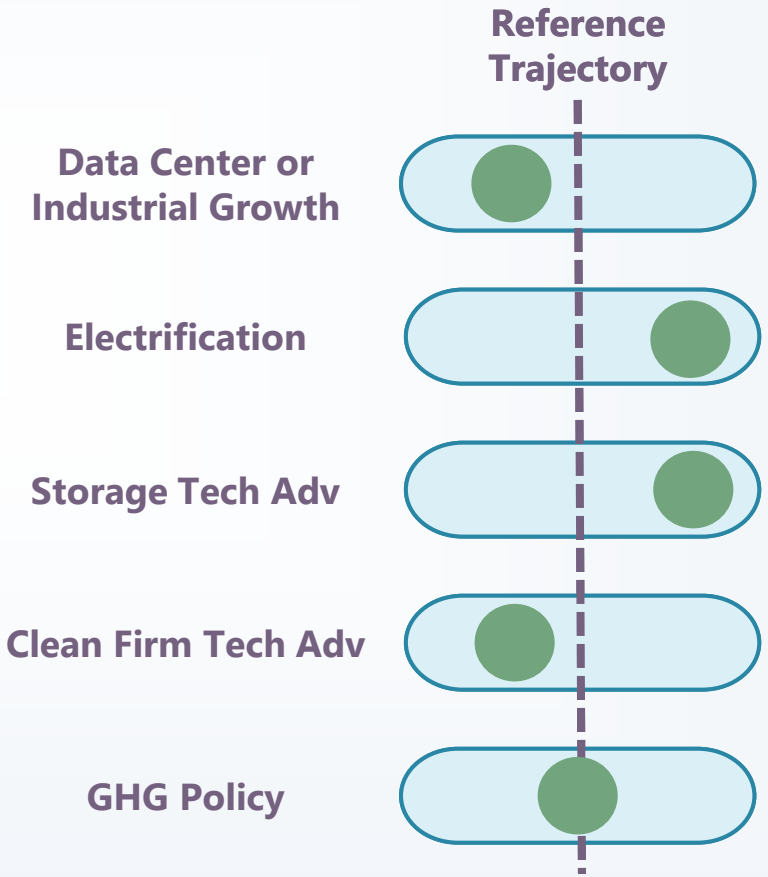
Scenario Option: Go Your Own Way

- Gas supply disruptions and supply chain shortages encourage state regulators to require "fuel independent" resources, **lean heavily into DERs, VPPs, and local storage**
- Continued cost declines in wind and solar drive high penetration levels
- **Advanced nuclear technology does not develop cost effectively,** encounters massive permitting barriers, few to no installations in the west
- Load grows with datacenter, manufacturing, heating and EVs, but **impact on the transmission system is lessened by DERs/VPPs/Local Storage**



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What do you like or dislike about the Go Your Own Way scenario?

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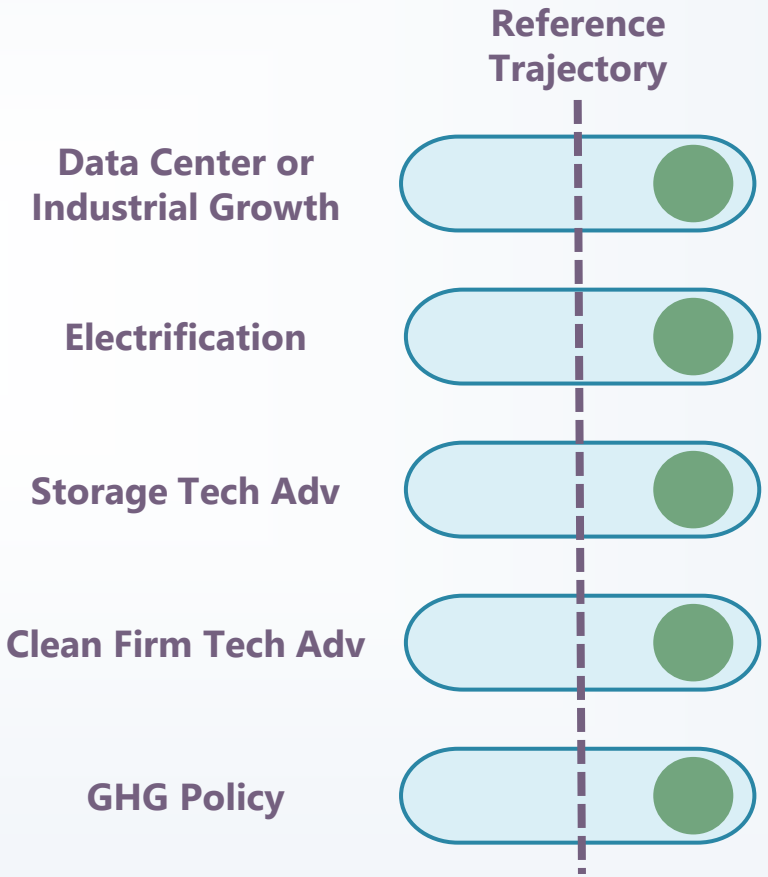
Scenario Option: Tech Takes Off

- **Demand grows faster than reference case**, reflecting strong economic growth (manufacturing, data centers, appliance/vehicle electrification etc.)
- **Clean energy demand accelerates** due to strengthening state/federal policies, corporate commitments
- Technology advancements and other reforms reduce barriers to emerging technologies including **offshore wind, geothermal, long-duration storage**
- Additional generation options could allow resources sited closer to load, reducing transmission need



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What do you like or dislike about the Tech Takes Off scenario?

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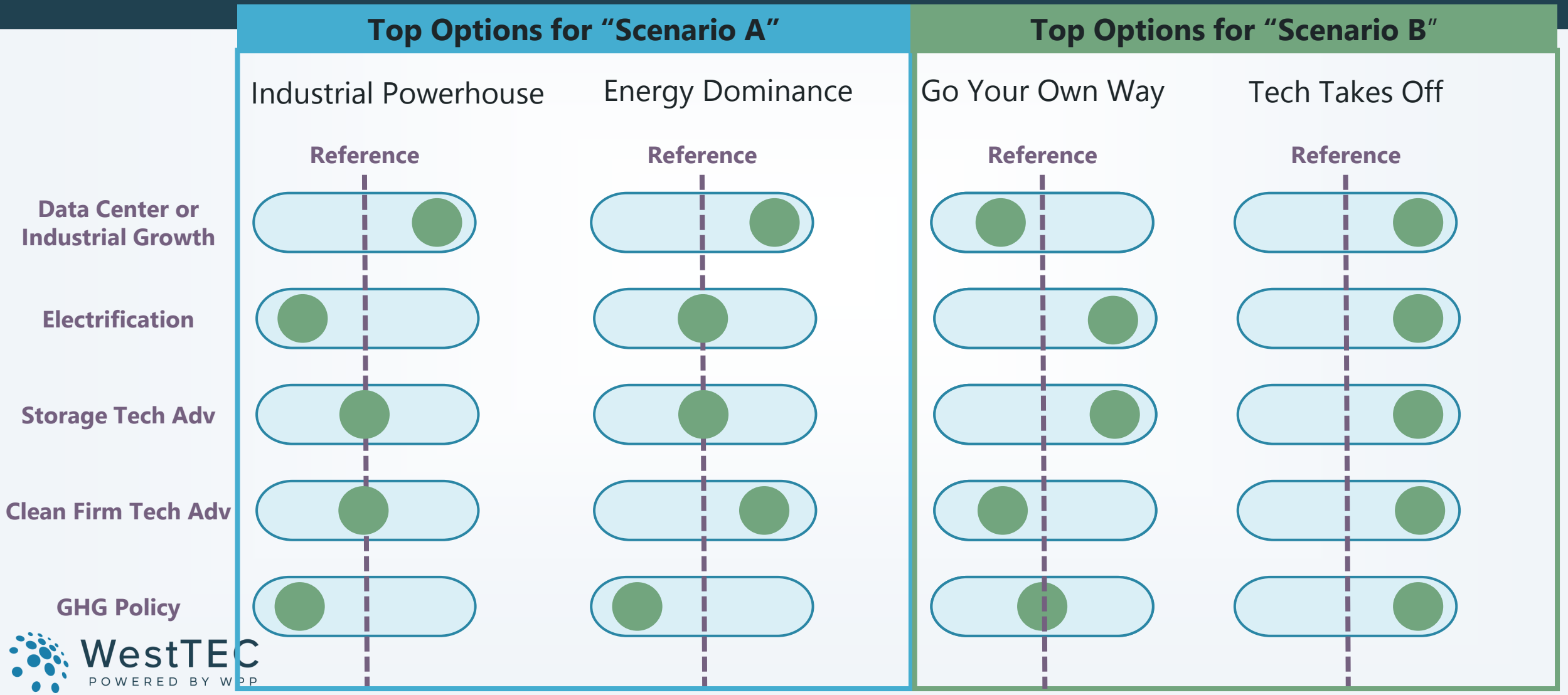
Top Scenario Frameworks



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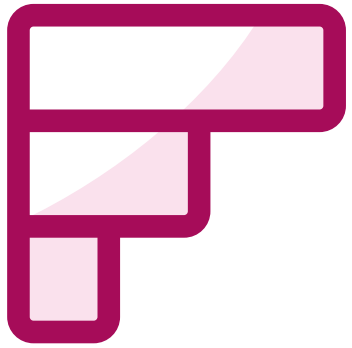

Which two scenarios, alongside the reference case, would you like to see in the WestTEC scenario framework?

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What might be missing from these scenario frameworks?

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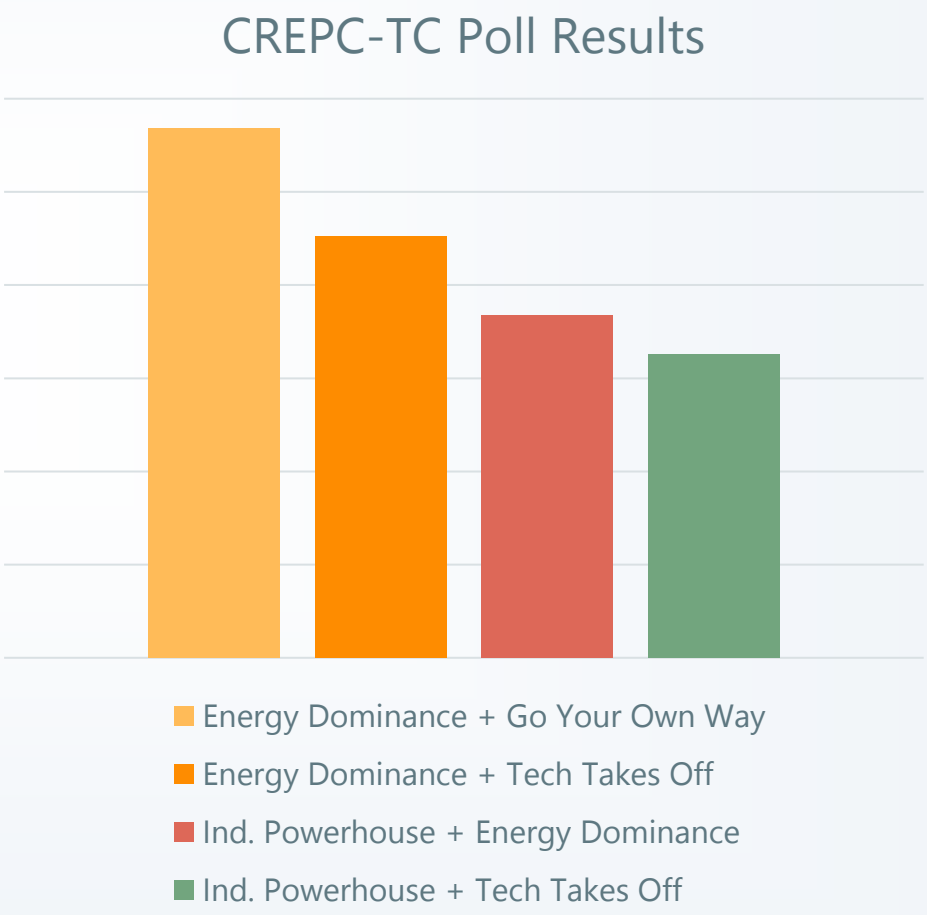
Feedback & Next Steps

- Sub-Team has solicited & received feedback:
  - REC & WATT Input Session (Feb 6th)
  - CREPC-TC Meeting (Feb 14th)
  - Public Webinar (Feb 28th)
- Sub-Team is reviewing feedback and refining scenarios
- Sub-Team plans to finalize a scenario framework by mid-March



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Action Items & Next Steps

Steering to approve Scenarios by the end of March

Initial 10-year horizon report to be completed by end of August

WestTEC
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Discussion/Q&A

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