

Western Transmission Expansion Coalition "WestTEC"

October 10th, 2025

Agenda Overview

Time (PT)	Item	Speaker(s)
8:00-8:10	WestTEC Overview and Announcements	Sarah Edmonds, WPP
8:10-8:30	Study Execution Update	Keegan Moyer, Energy Strategies
8:30-8:45	Updates from Committees, States and Tribes	Robin Arnold, States Kelsey Martinez and John Martinsen, Steering Keegan Moyer, WATT Vijay Satyal, REC Donald Williams, Tribes
8:45-9:20	10-Year Horizon: Preliminary Transmission Results	Kavita Sheno, Energy Strategies
9:20-9:55	20-Year Horizon: Scenarios and Resource Forecast	Femi Sawyerr and Jack Moore, E3 John Muhs, Energy Strategies
9:55-10:00	Action Items and Next Steps	Sarah Edmonds, WPP

The Presentation Team

- **Western Power Pool:** Sarah Edmonds
- **Consultants:**
 - **Energy Strategies:** Keegan Moyer, Kavita Shenoï and John Muhs
 - **E3:** Jack Moore and Femi Sawyerr
 - **GDS Associates:** Gillian Biedler, Kyra Green, Annie Capper, Mike Castelhanò
- **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

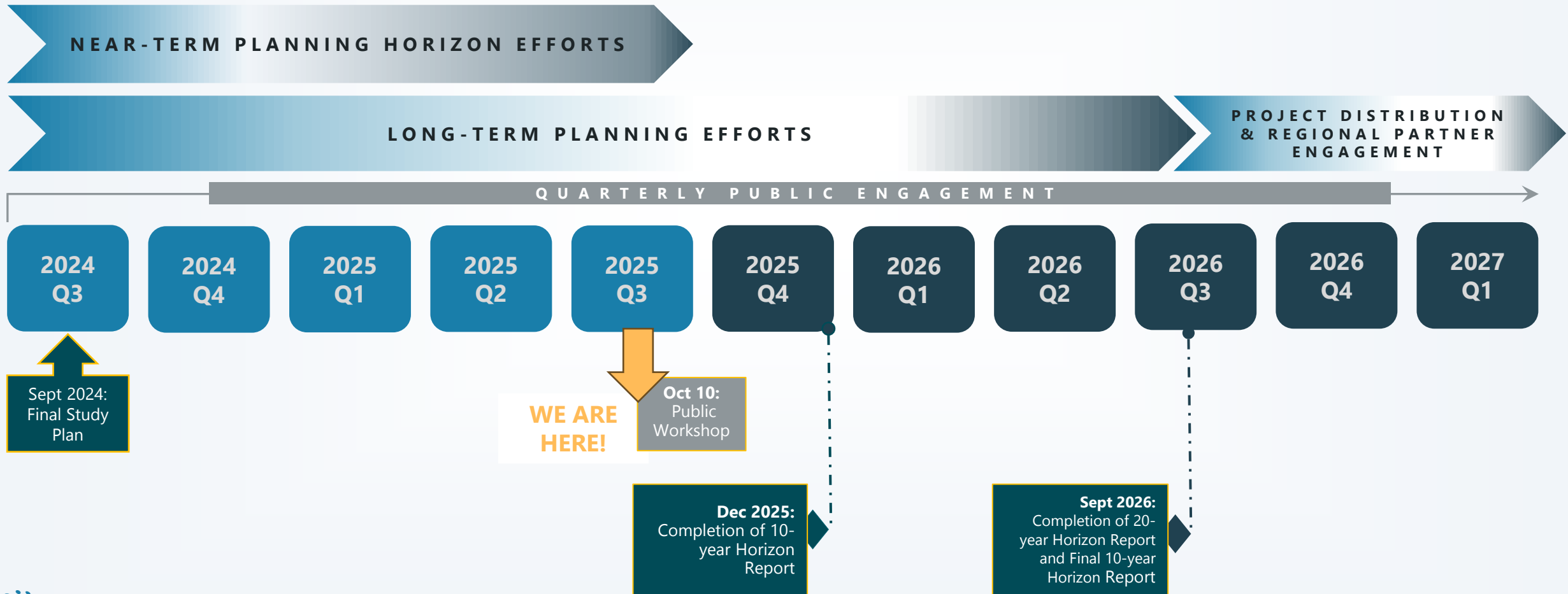
WestTEC Overview

Western Transmission Expansion Coalition – “WestTEC”

- » *West-wide 10 and 20-year transmission study*
- » *Industry-led with unprecedented regional partner inclusion*
- » *Goal is to produce an actionable transmission study*



WestTEC Project Timeline

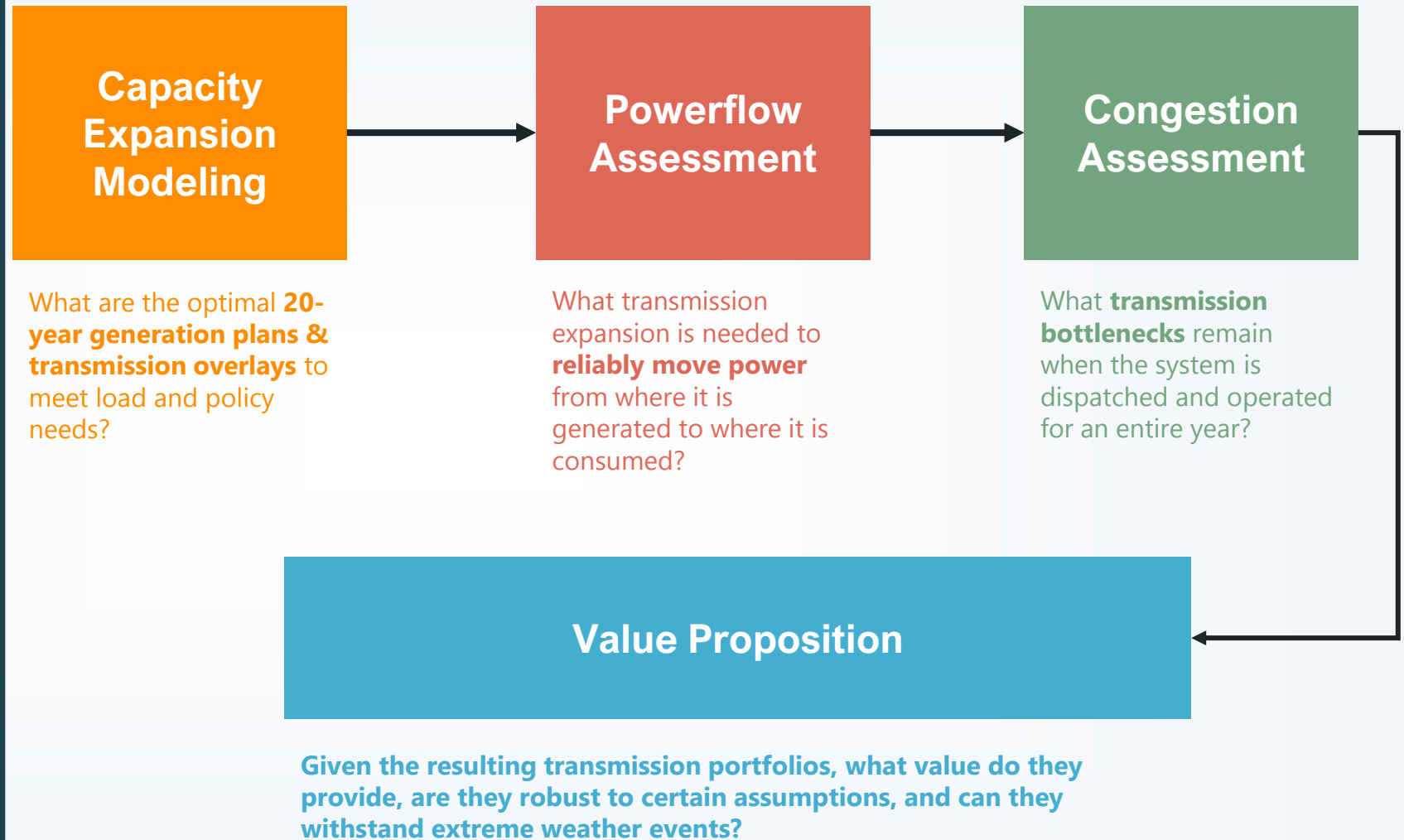


WestTEC Regional Partners – Over 70+

Western Interstate Energy Board GridWorks Western Electricity Coordinating Council Connected Grid Initiative Wyoming Office of Consumer Advocate Public Advocates Office at the California Public Utilities Commission Bonneville Power Administration Grid United Clean Energy Buyers Association Amazon Energy PacifiCorp Puget Sound Energy Portland General Electric Renewable Northwest Snohomish PUD Tucson EPC Grant County PUD <i>Western Power Pool</i> <i>GDS Consulting</i>	Washington Department of Commerce InterWest Invenergy Idaho Power Company NorthWestern NV Energy Salt River Project Arizona Public Service Public Service Company of New Mexico Western Area Power Administration WestConnect NRDC Northwest & Intermountain Power Producers Coalition Public Power Council Colorado River Energy Distributors Association LS Power Tacoma Power	Northwest Requirements Utilities PNGC Western Resource Advocates Clean Energy Transition Institute NW Energy Coalition From the Light Consulting Navajo Transitional Energy Company Warm Springs Power & Water Enterprises Avangrid Renewables EDF Renewables Aypa Power Grid Strategies PG&E Southern California Edison Seattle City Light Black Hills Energy LADWP GridLab	California ISO Southwest Power Pool Avista Xcel Energy Powerex BC Hydro GridLiance Pacific Northwest Utilities Conference Committee Pattern Energy Cascade Renewable Transmission Chelan County PUD Pacific Northwest National Laboratory Northwest Power and Conservation Council Whatcom County PUD Savion <i>E3</i> <i>Energy Strategies</i>
---	--	---	---

Study Execution Update

20-year Horizon Modeling Platform



Study Execution Update

Where we are at now...

- » **10-year horizon (Reference Case):**
Transmission need and solutioning analysis is nearly finalized
- » **20-year horizon:** Reference Case capacity expansion plan and busbar mapping are complete
- » **Scenarios:** Final capacity expansion model runs are complete for both scenarios



What to expect next...

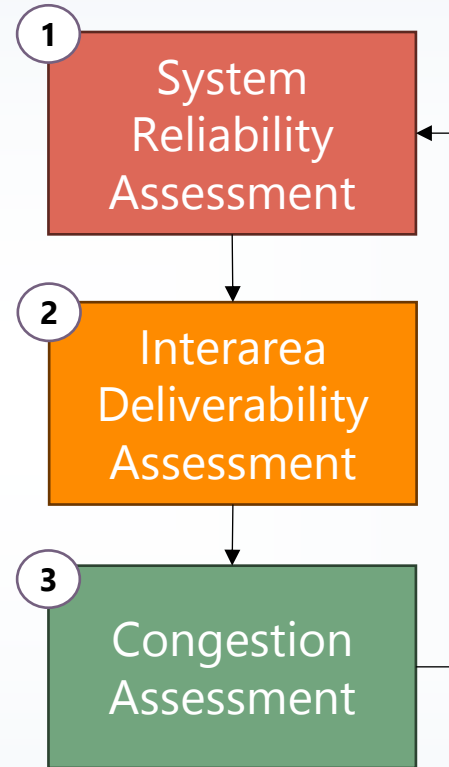
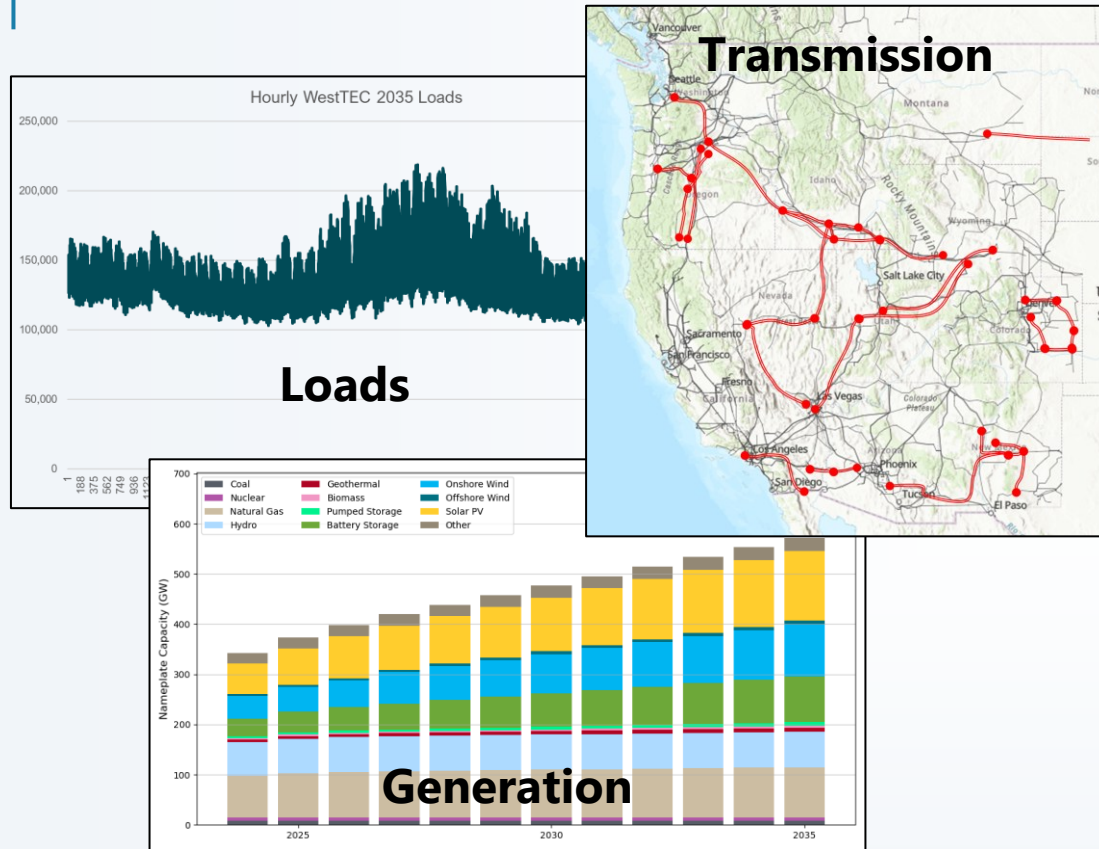
- » Team is transitioning to documenting analysis and findings
 - » Report will be issued by end of December
- » Model building activity will commence in Q4 as soon as 10-year technical work is complete
- » Efforts focused on busbar mapping of Flux and Core resource expansion plans
 - » Preparing for transmission analysis in 2026

States, Committees, and Tribal Update

10-Year Horizon: Preliminary Transmission Results

WestTEC 10-year Horizon Study

Regionally consistent forecasts of....



**WestTEC 2035
transmission
needs &
results**

*Initial plan subject to
revision based on 20-year
results in 2026*



*WestTEC 2035 Reference Case modeling
platform posted to WECC.org in powerflow and
PCM formats*

10-year Horizon: Study Purpose and Transmission Drivers

» Why are we doing this?

- » Need for a credible, holistic, and integrated evaluation of Western transmission needs
- » Focus on identifying critical interregional transmission gaps and actionable projects
- » Prepare starting point for 20-year horizon with tailored models and methods

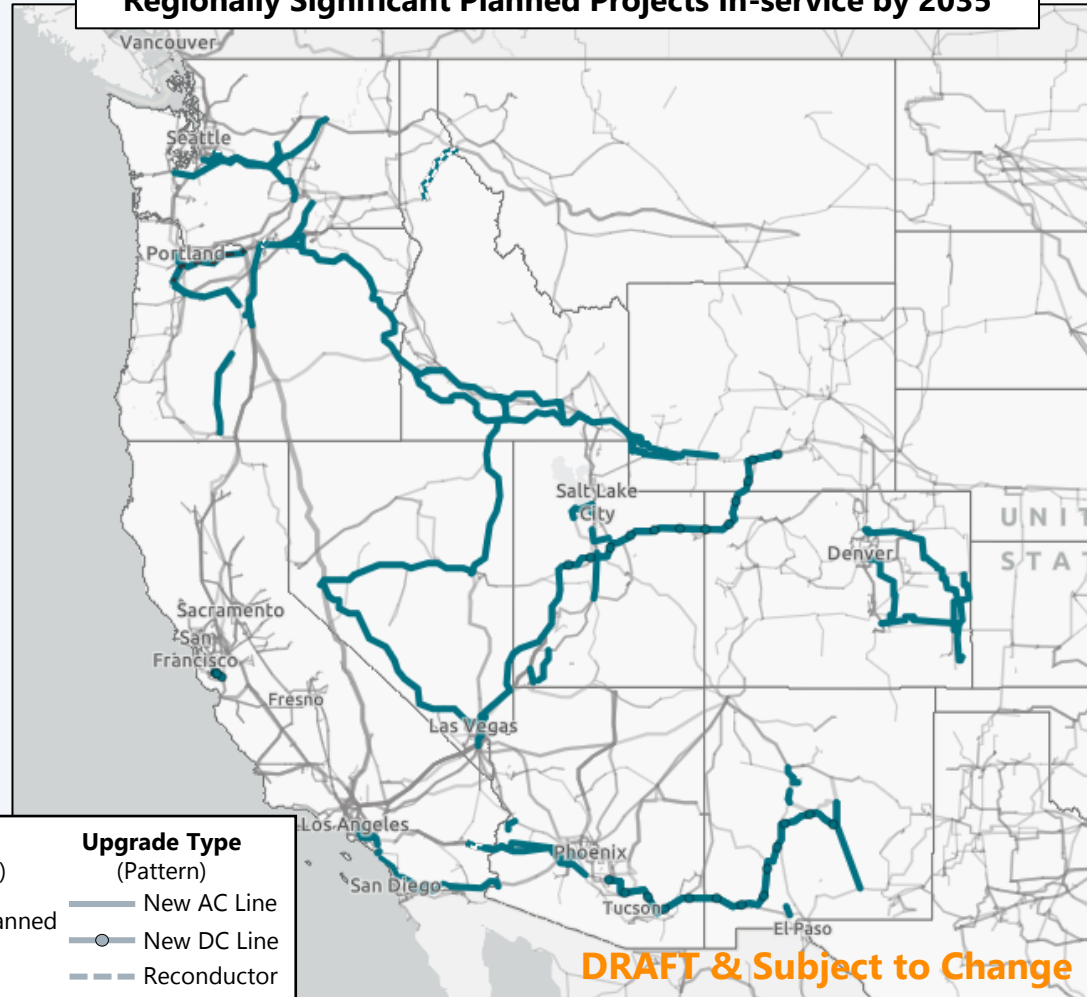
» Drivers of transmission challenges we see over the approaching 10-years:

- » Load growth adds 50 GW of demand (2.4% vs. 1.1% historical CAGR)
- » 146 GW of new resources need to be integrated and delivered to loads (2x the historical rate)
- » High volumes of interregional transfers during key moments



Planned Project Overview: These projects are foundational to the 2035 WestTEC Reference Case

Regionally Significant Planned Projects In-service by 2035



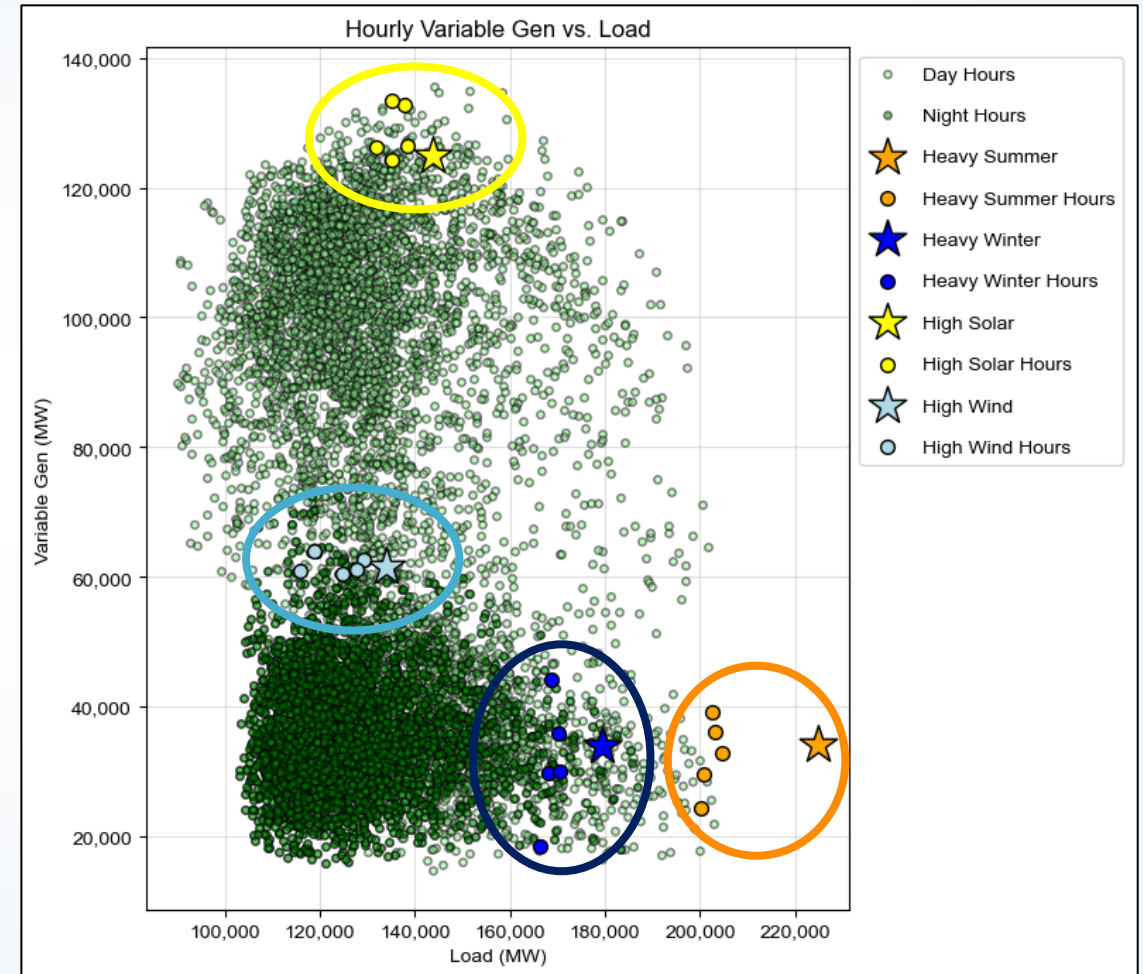
- » Reference Case includes projects in local and regional transmission plans anticipated by providers to be in-service by 2035 or earlier
- » Also includes several merchant business model projects that are under construction or achieved approval in regional planning processes:
 - » SunZia, TransWest Express, SWIP North
- » **Total assumed investment of regionally significant projects in Reference Case is \$40B**
- » Projects not included in the Reference Case are used in solutioning exercise, based on the needs identified

» If these projects are not constructed, 10-year needs identified will be broader and more severe

10-year Horizon: System Reliability Assessment Summary

- » Developed **four reliability models** representing stressed yet credible conditions that challenge the Western transmission system
 - » Coincident Heavy Summer Peak
 - » Coincident Heavy Winter Peak
 - » High Solar conditions
 - » High Wind conditions
- » Extensive work with members to:
 - » Vet conditions being studied
 - » Develop a 1-in-10 load forecast
 - » Update transmission topology to capture utility transmission plans
 - » Adjust hydro generation dispatch to match seasonal operations
 - » Revise study contingencies to align with those used by utilities for transmission planning
 - » Update location of conceptual generation added to match utility IRPs

2035 WestTEC Load vs. Variable Generation 2035

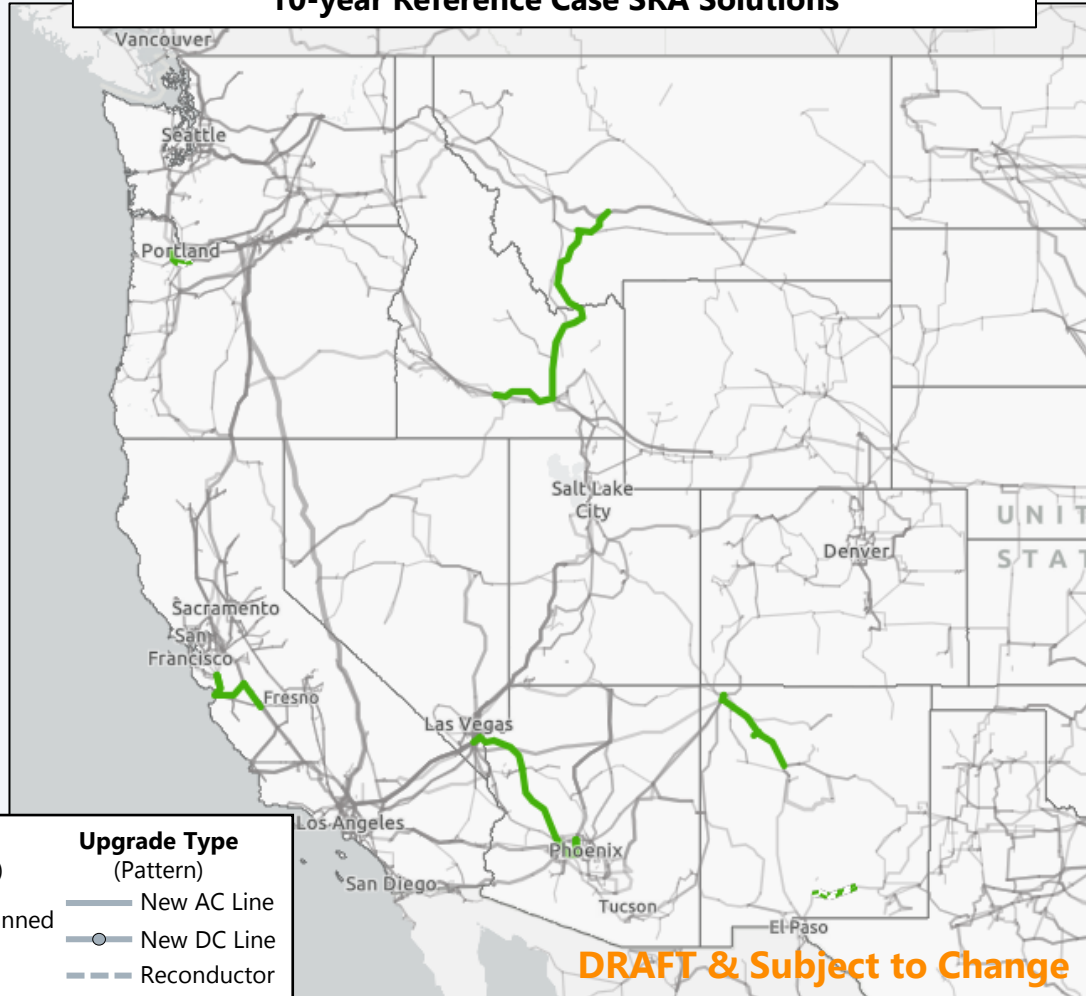


Production cost modeling results were used to derive load and dispatch conditions that are likely to stress high-voltage grid. These data points already reflect curtailments, so economic tradeoffs are partially accounted for.



10-year Horizon SRA Transmission Needs: These projects were added to address system reliability concerns

10-year Reference Case SRA Solutions



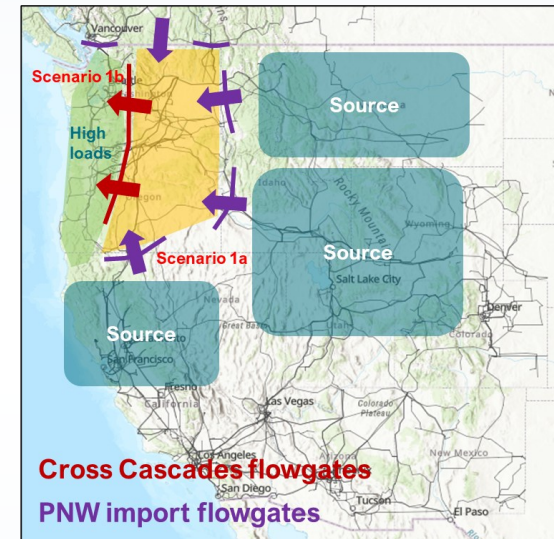
- » A relatively small set of incremental upgrades on top of what is already planned is needed to assure basic system reliability under the conditions studied
 - » In most cases, these are known system constraints and WestTEC's results further validate the need for expansion
- » Some of the drivers for these upgrades are:
 - » Significant **exports out of New Mexico** cause overloads on the ties to Arizona and Colorado requiring network upgrades
 - » **High exports out of Montana** require an alternate to Path 8 between Montana and the Pacific Northwest
 - » There is a **need to better integrate the Liberty – Peacock 345 kV** line with the EHV transmission system in AZ
 - » **Significant flows from Southern CA into PG&E** to serve load occur during peak load and high solar generation conditions
 - » **High imports into load centers in the Pacific Northwest**

10-year Horizon: Interarea Deliverability Assessment Summary

- » Adapted SRA models to determine if interregional capacity is sufficient to support delivery of resources when areas require significant imports or exports during stressed conditions
- » Study is critical to ensuring that the power system can maintain resource adequacy and operational reliability under **evolving but credible** regional generation and load patterns that are *not* captured in the SRA conditions.
- » IDA scenarios selected based on results from:
 - » SRA studies
 - » Identification of areas with high curtailment or zones being reliant on imports/exports
 - » Observed high interregional transfers, identification of zones being reliant on import capability.
- » This analysis led WestTEC to explore two conditions that have target transfers established by observations from the dispatch study.

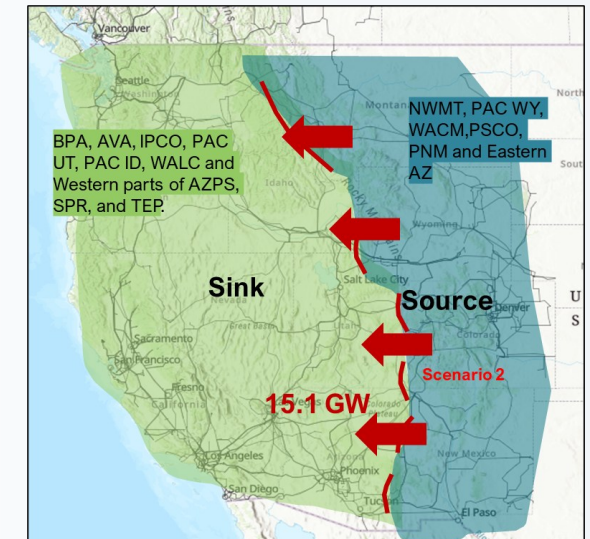
IDA Transfer Scenarios

Northwest Import



- Target transfers of 14.1 GW and 17.3 GW of PNW imports and across Cascades (respectively)
- Occurs during winter peak load conditions

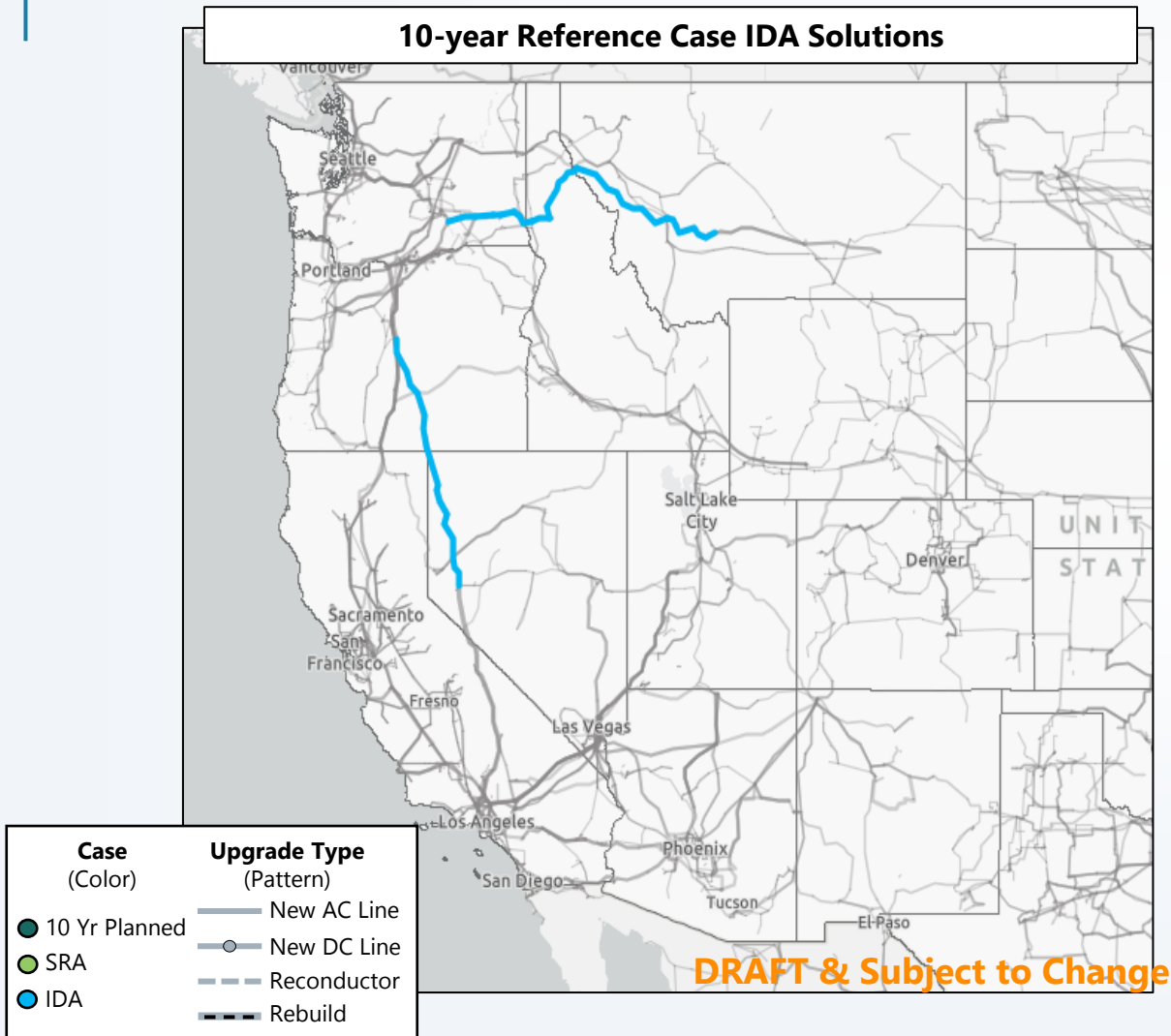
East to West



- Target transfers of 15.1 GW
- Occurs when there is high renewable generation conditions



10-year Horizon IDA Transmission Needs: These projects were added to ensure reliable transfers across the region



- » The West is beginning to rely on the transmission system to move vast amount of energy long distances to maintain reliability / resource adequacy
 - » LOLP modeling used to identify increasing long and severe outages have shown that these resource deficiencies can happen any time
 - » Such studies generally don't take into account detailed forecasts of transmission availability, driving the need for backbone upgrades to support these interregional transfers
- » Preliminary analysis has identified the following upgrades to increase imports into the PNW:
 - » Townsend – Hatwai 500 kV line
 - » A new Midpoint – Grizzly 500 kV line
 - » Reconductor existing Hemingway – Burns – Summer Lake line and add a new circuit.
 - » BPA's Evolving Grid Project 2.0: Bonanza – NOB – Walker 500 kV line.

10-year Horizon Initial Transmission Plan: Working draft of transmission expansion subject to refinement

10-year Reference Case: Current Solutions and Planned Projects [DRAFT]

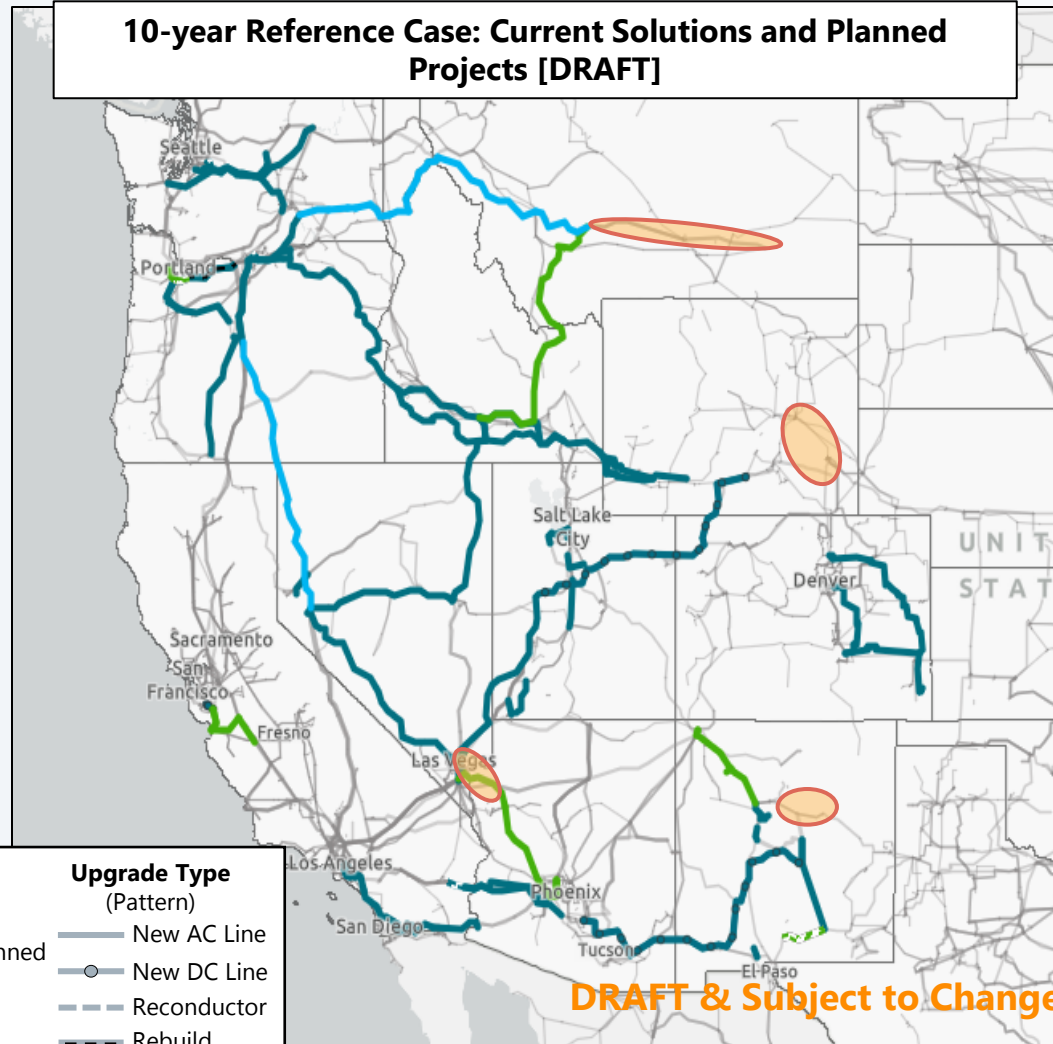


Developing themes of WestTEC 10-year Horizon Report:

- » Transmission needs are being driven by load growth and the need to integrate and deliver generation resources
- » Region must construct **planned projects** on schedule or reliability issues will be exacerbated
- » Additional **reliability upgrades** are required to assure system reliability under a range of probable operating conditions
- » Projects **enhancing interregional connectivity** allow for the system to realize diversity benefits the future grid will rely on for system adequacy
- » Economic upgrades offer congestion relief projects **TBD**

10-year Horizon Initial Transmission Plan: Working draft of transmission expansion subject to refinement

10-year Reference Case: Current Solutions and Planned Projects [DRAFT]



Exploration of potential **congestion relief projects** based on most recent PCM metrics is ongoing, addressing potential constraints including:

- » Dave Johnston - Laramie River (Wyoming)
- » Clines Corner – Guadalupe (New Mexico)
- » Colstrip system (Montana)
- » Las Vegas area
- » Several series capacitor upgrades and rating adjustments

Framing this Work: 10-year Horizon Report

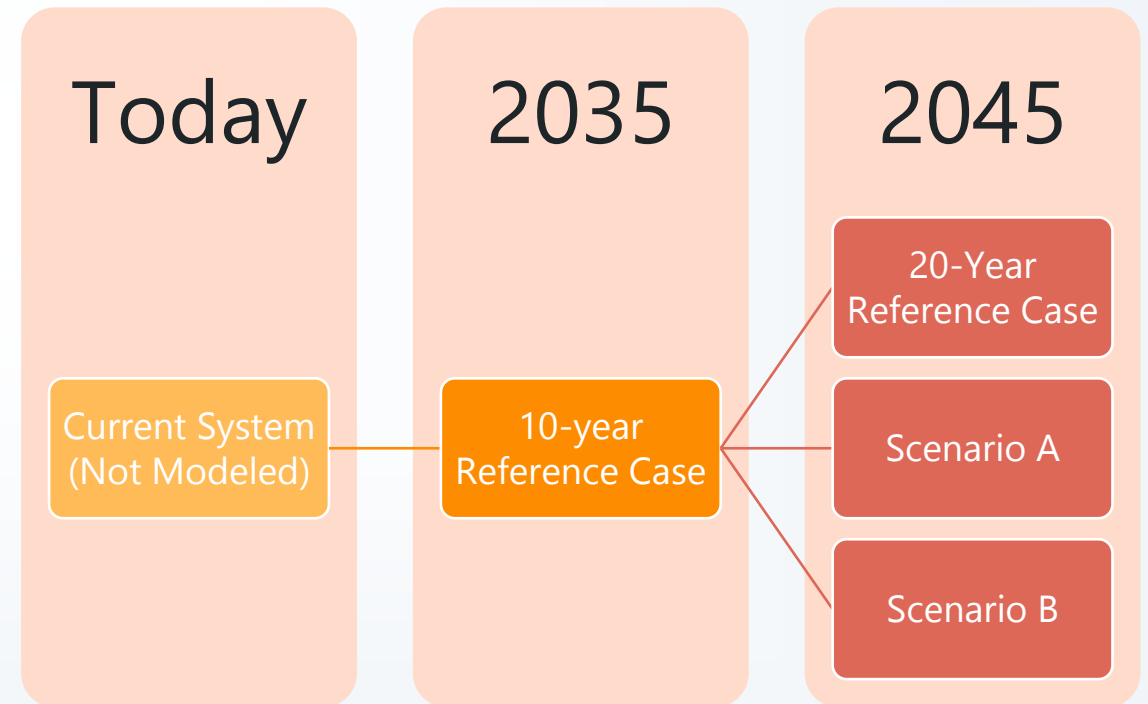
- » The *10-year Horizon* report will be issued by the end of the year and will feature:
 - » Descriptions of transmission needs, drivers, and solutions
 - » Identifications of risk and challenges to building the needed transmission
 - » Recommendations to support implementation
- » Other issues the report will address include:
 - » Affordability
 - » Discussion of what the transmission buildout will enable
 - » Recognition for the potential for revaluation of solutions



20-Year Horizon: Scenarios and Resource Forecast

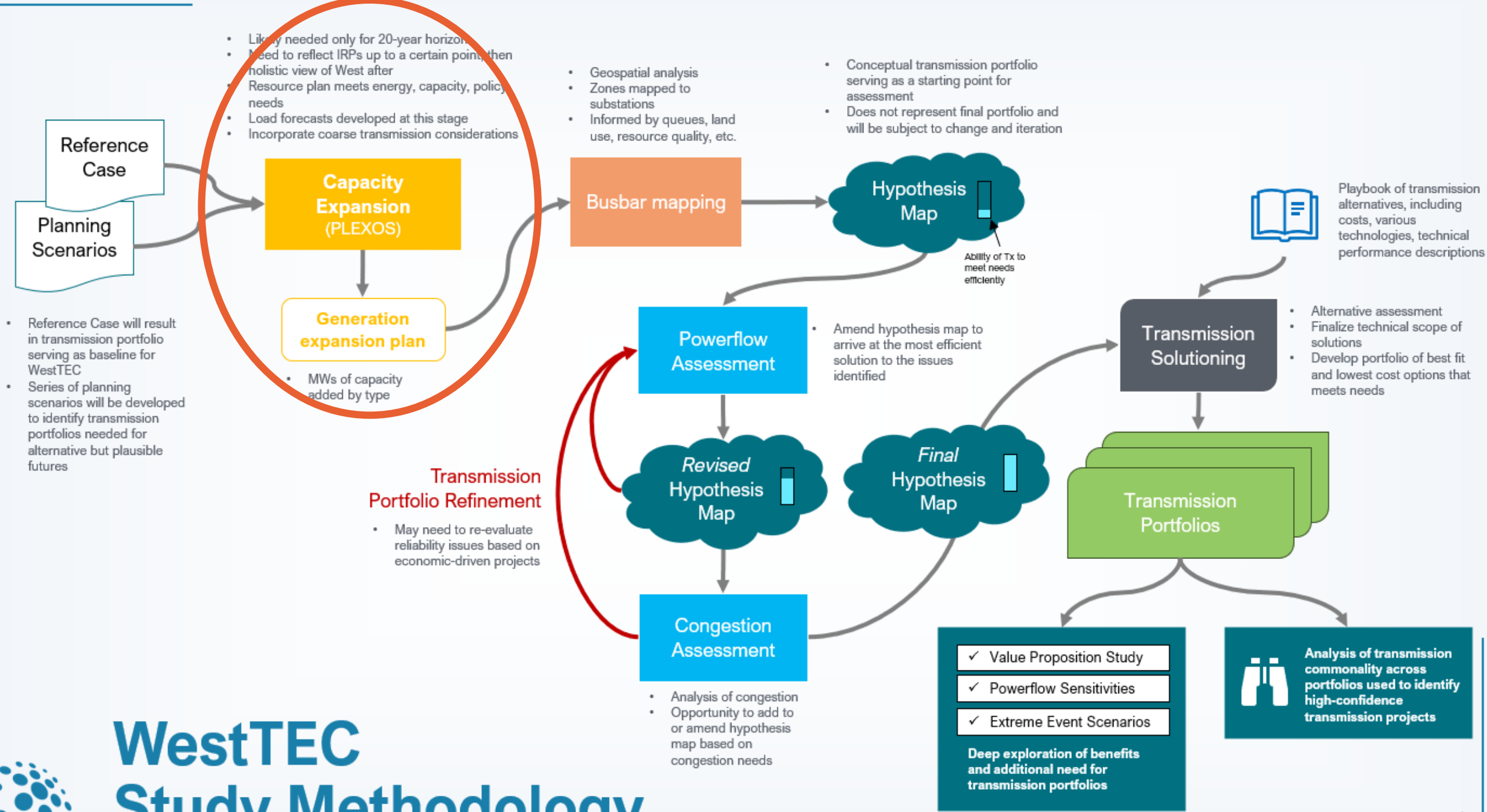
Focus of Scenario Planning Effort

- » The scenario planning sub-team has developed **two alternative scenarios** in the 20-year horizon
- » Scenarios consider variations in load growth, technology advancement, and policy
- » Scenarios reflect a comprehensive understanding of regional priorities and potential future developments
- » Scenario results will be used to identify persistent transmission needs across a range of future outcomes





WestTEC Study Methodology



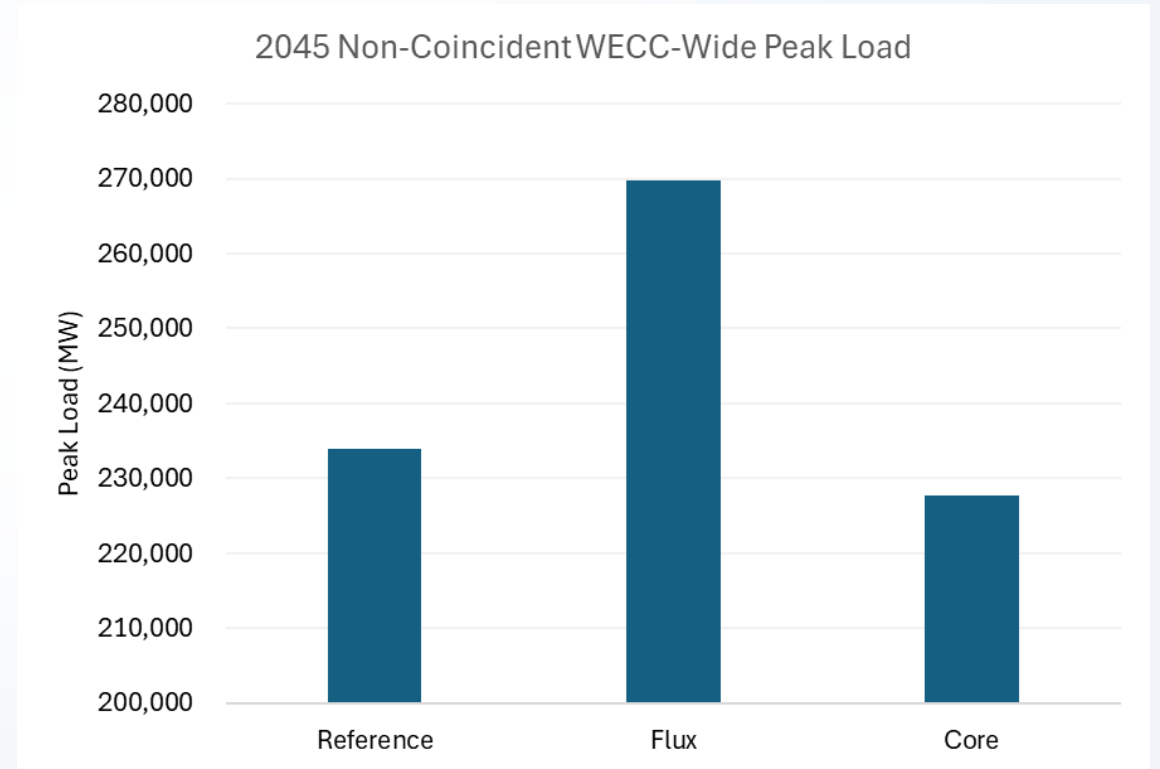
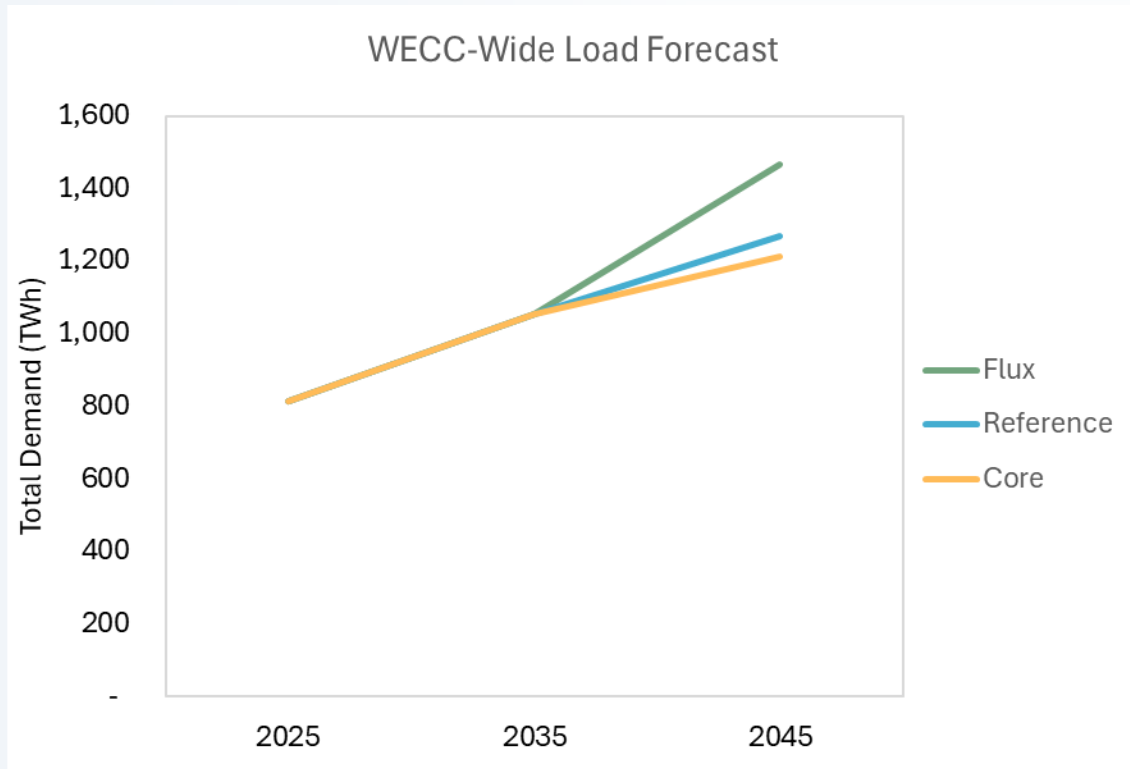
Overview of Capacity Expansion Analysis

- » E3 is leading the capacity expansion analysis, utilizing the PLEXOS LT model to co-optimize intrazonal generation and storage resource portfolios, and inter-zonal transmission resources over the entire Western Interconnection.
- » The optimization will create portfolios that will incorporate the following in each of the modeled zones:
 - » Meet hourly load and reserve requirements
 - » Respect policy and voluntary goals
 - » Respect resource availability limits
 - » Result in the lowest Western-system-wide capital, dispatch, and penalty costs (if applicable)
- » The goal of the capacity expansion analysis is to create 20-year resource portfolios for each zone, which:
 - » incorporate generation, load, and transmission information from the 10-year study as base inputs
 - » utilize new load forecasts data that are being developed using a bottom-up approach
 - » utilize the latest generation, storage, and transmission resource costs and performance assumptions
 - » utilize scenario analysis to consider multiple potential future realities

WestTEC 20-Year Scenarios

	Reference	Flux	Core
Narrative	A baseline scenario reflecting reasonably anticipated trends in load growth, technology, and policy	A high-growth scenario reflecting rapid changes in power demand and technology innovation	A moderate-growth scenario with select firm technology breakthroughs
Load Growth (2025-2045)	2.2% per year (56% increase)	3% per year (80% increase)	2% per year (48% increase)
Technology Costs	Moderate innovation trajectory	Advanced innovation trajectory	Conservative innovation trajectory* (No Tax Credits) *Breakthroughs in Storage, Advanced Geothermal, Nuclear SMRs, and CCS
GHG Policies	Statutory	Statutory & voluntary	Statutory with 5-year compliance delay

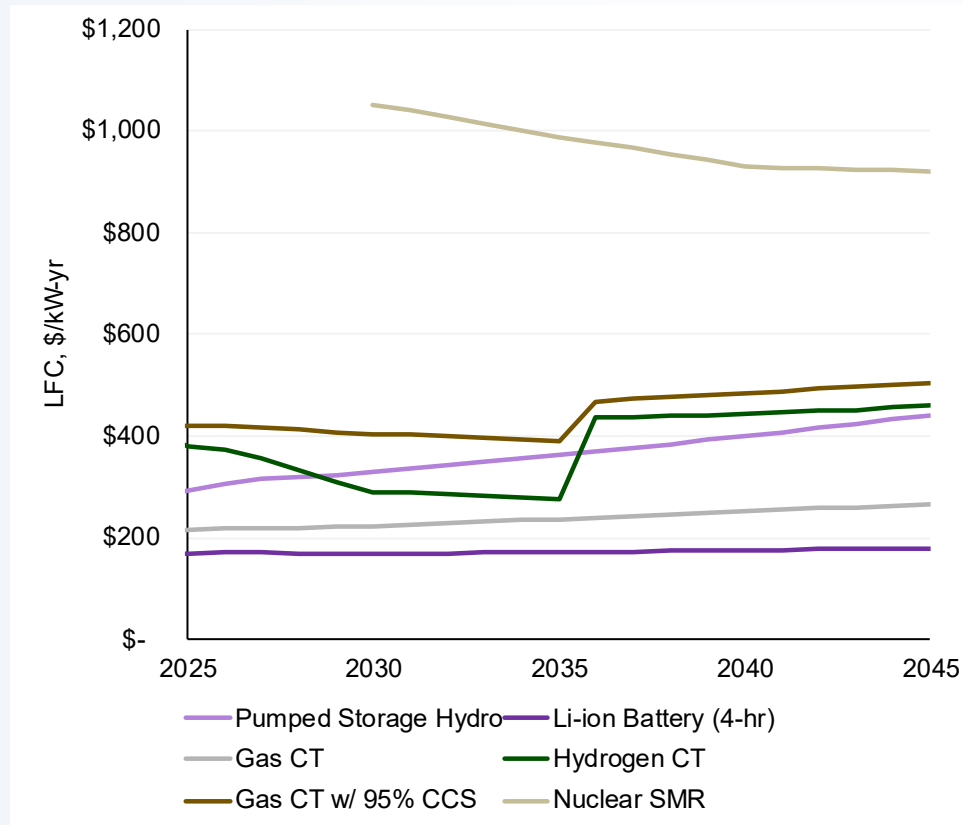
Annual Demand and Peak Load Summary



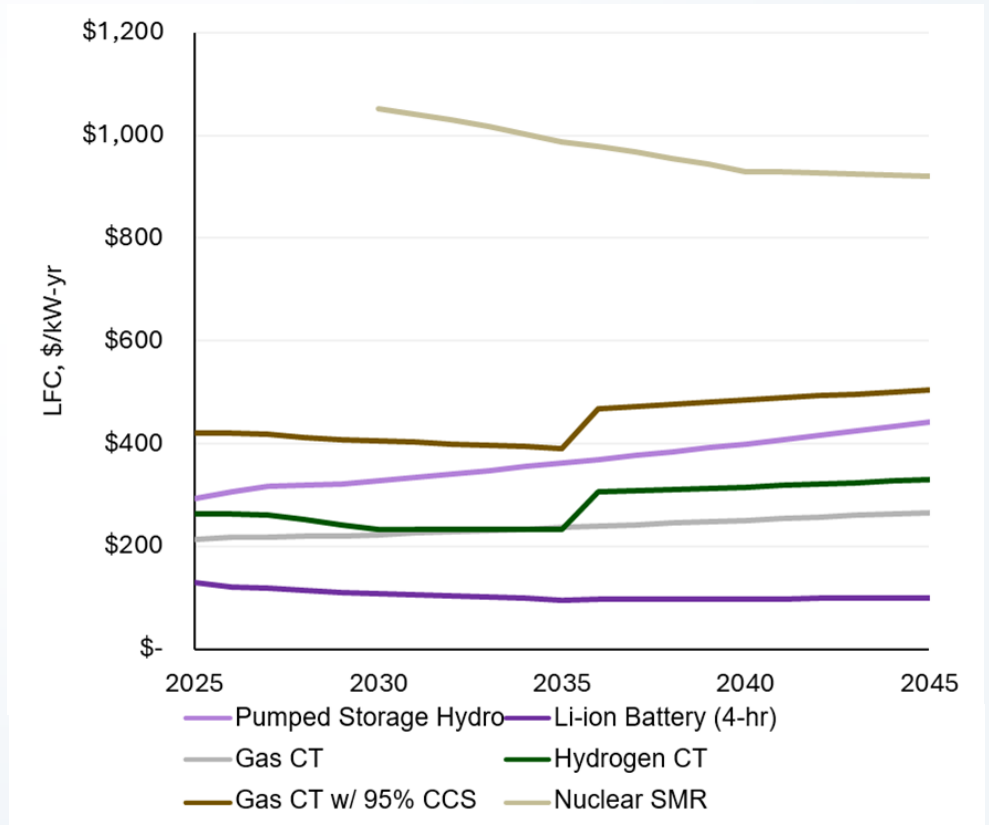
Nominal-Levelized Resource Costs (Average Across Regions)

Levelized Fixed Costs of Firm Capacity Resources, Reference vs. **Flux**

LFC, Reference Scenario



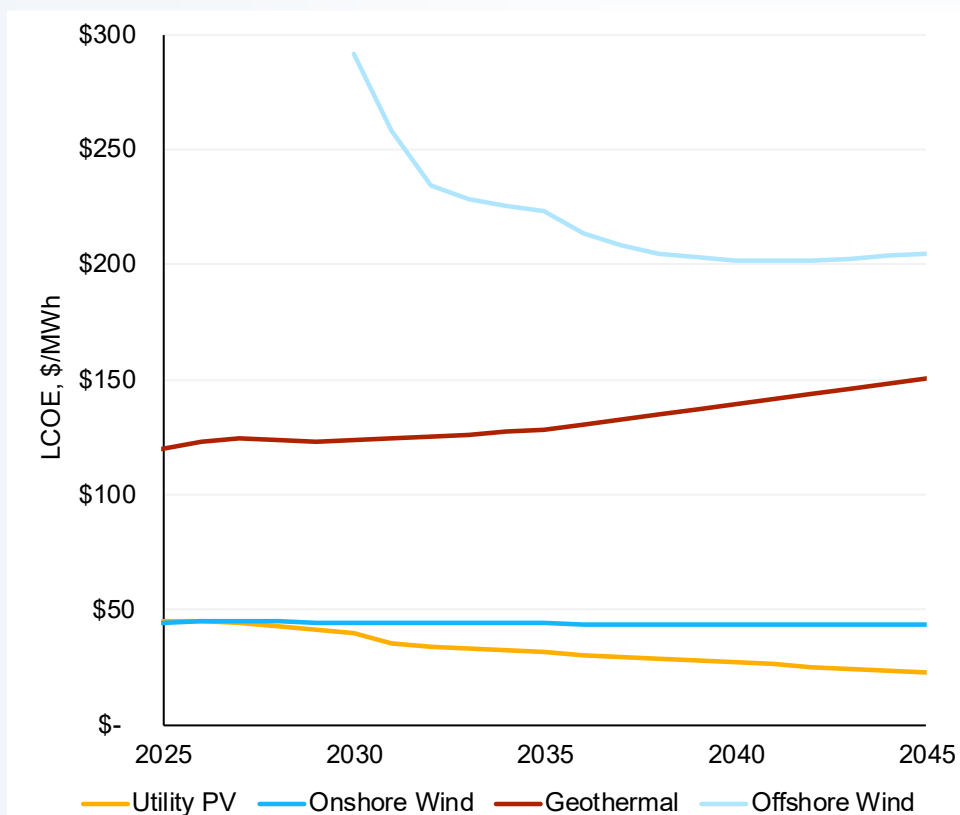
LFC, Flux Scenario



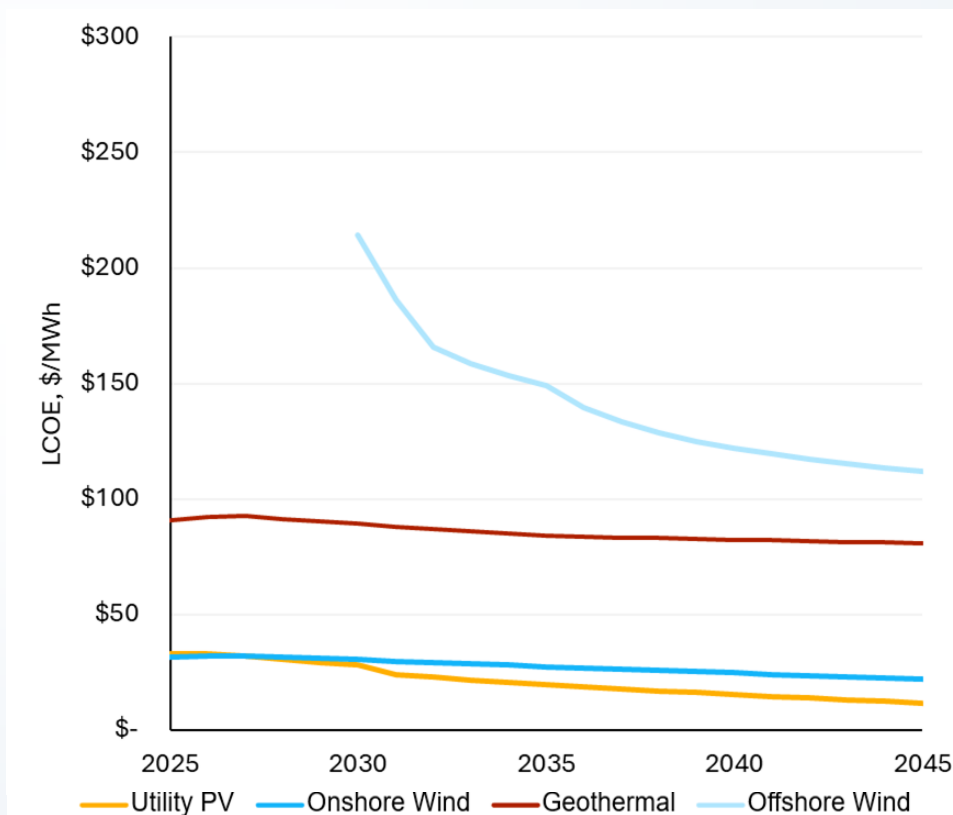
Nominal-Levelized Resource Costs (Average Across Regions)

Levelized Cost of Electricity of Variable Renewable Resources, Reference vs. **Flux**

LCOE, Reference Scenario



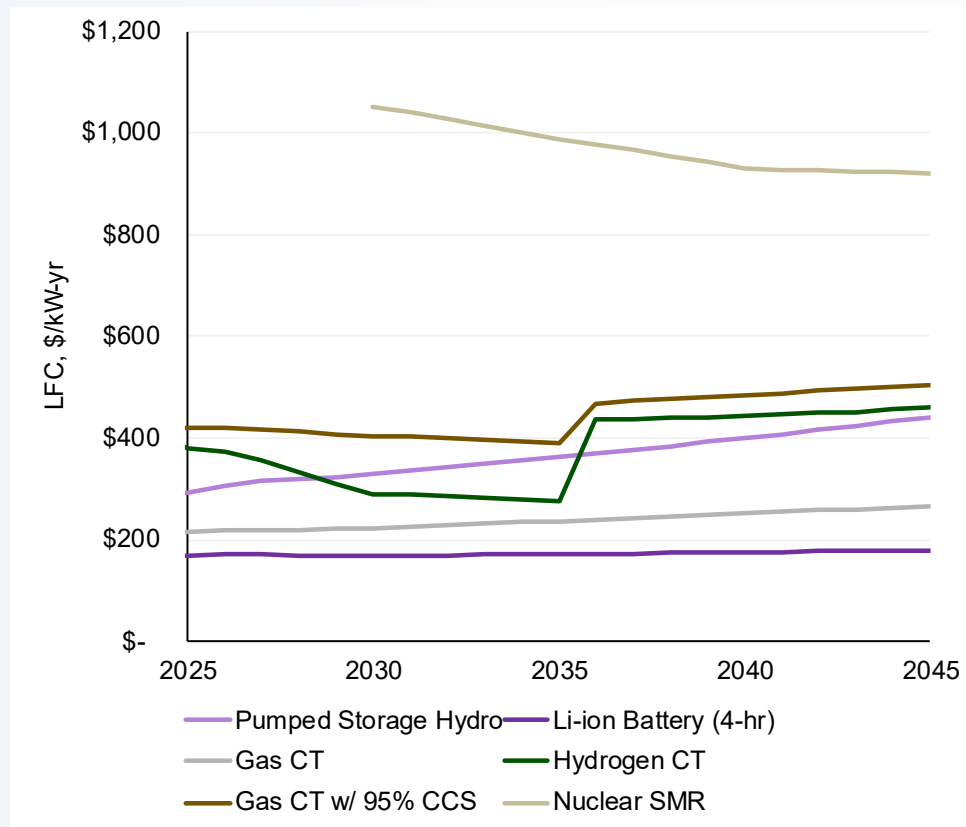
LCOE, Flux Scenario



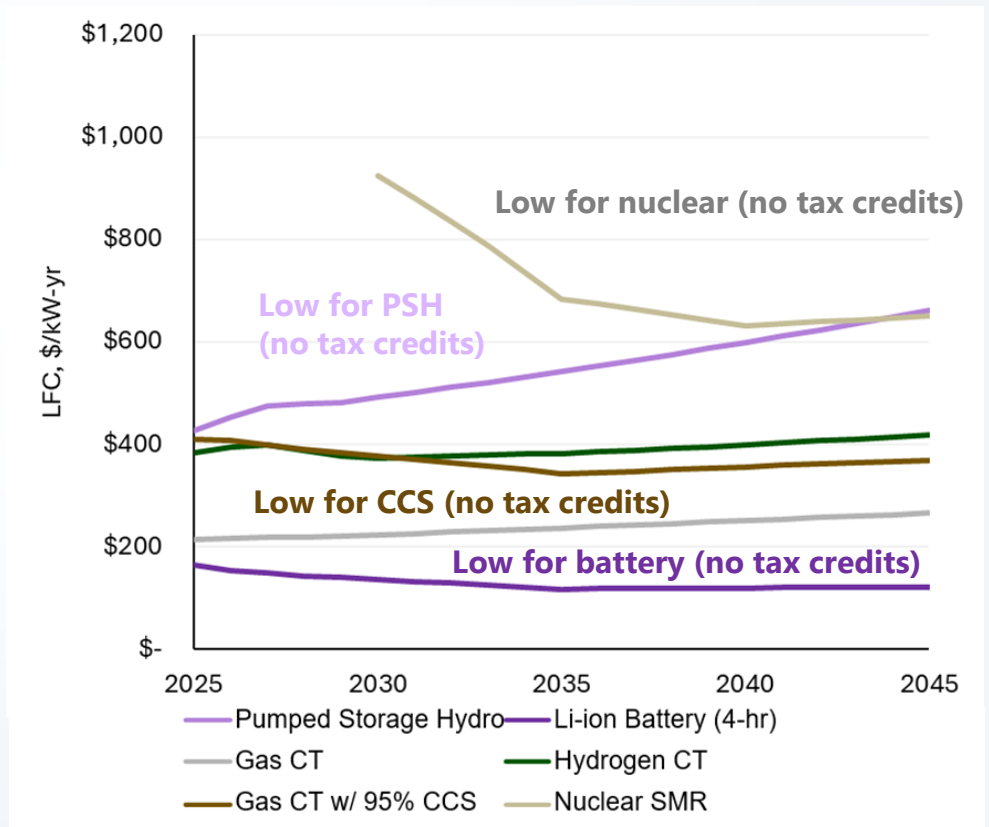
Nominal-Levelized Resource Costs (Average Across Regions)

Levelized Fixed Costs of Firm Capacity Resources, Reference vs. **Core**

LFC, Reference Scenario



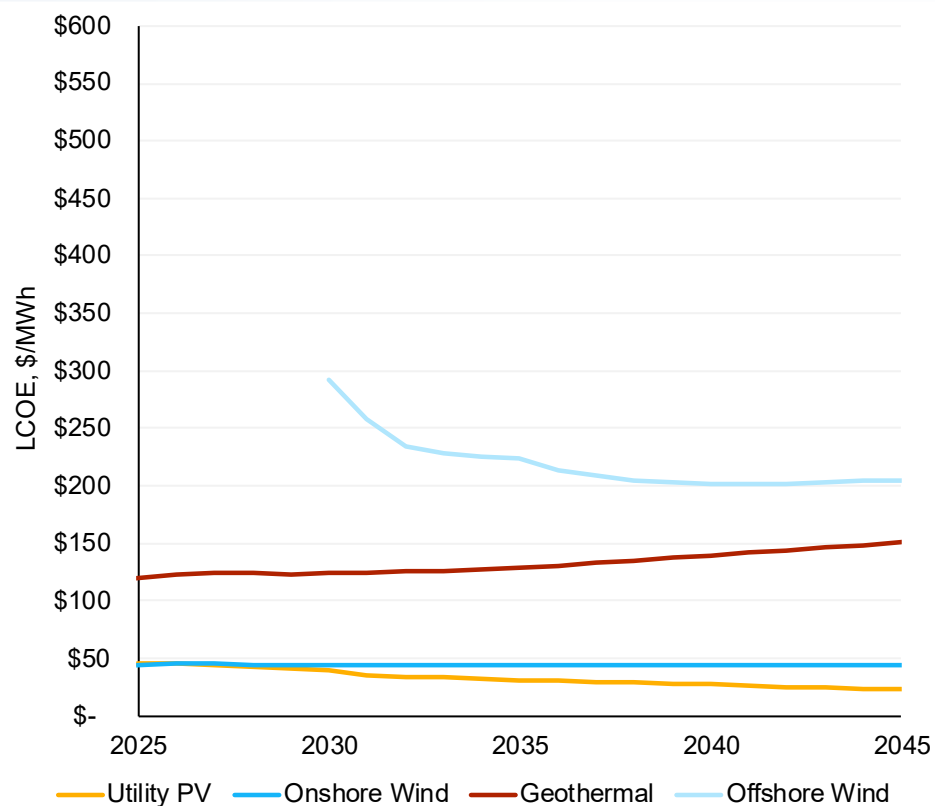
LFC, Core Scenario



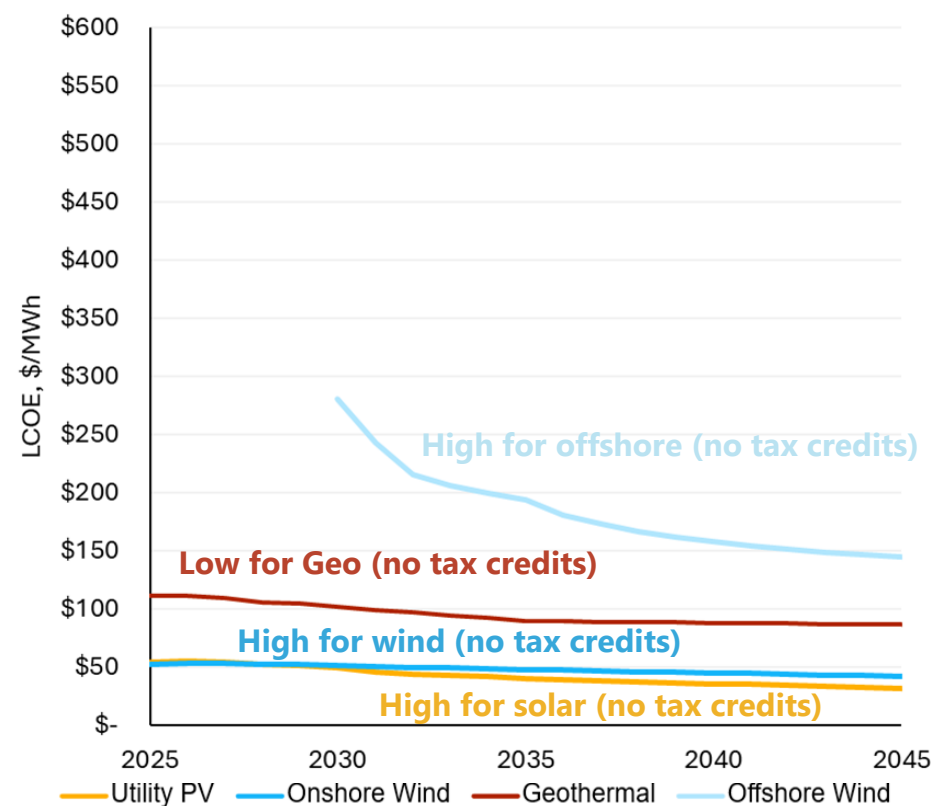
Nominal-Levelized Resource Costs (Average Across Regions)

Levelized Cost of Electricity of Variable Renewable Resources, Reference vs. **Core**

LCOE, Reference Scenario

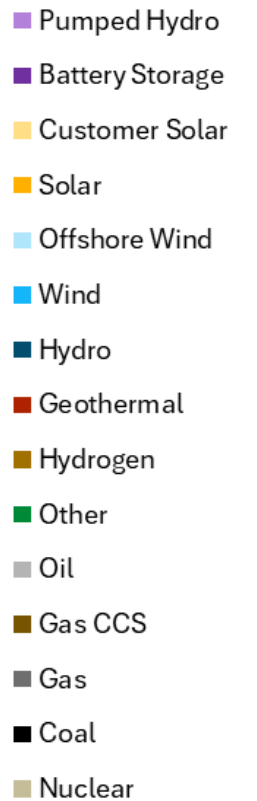
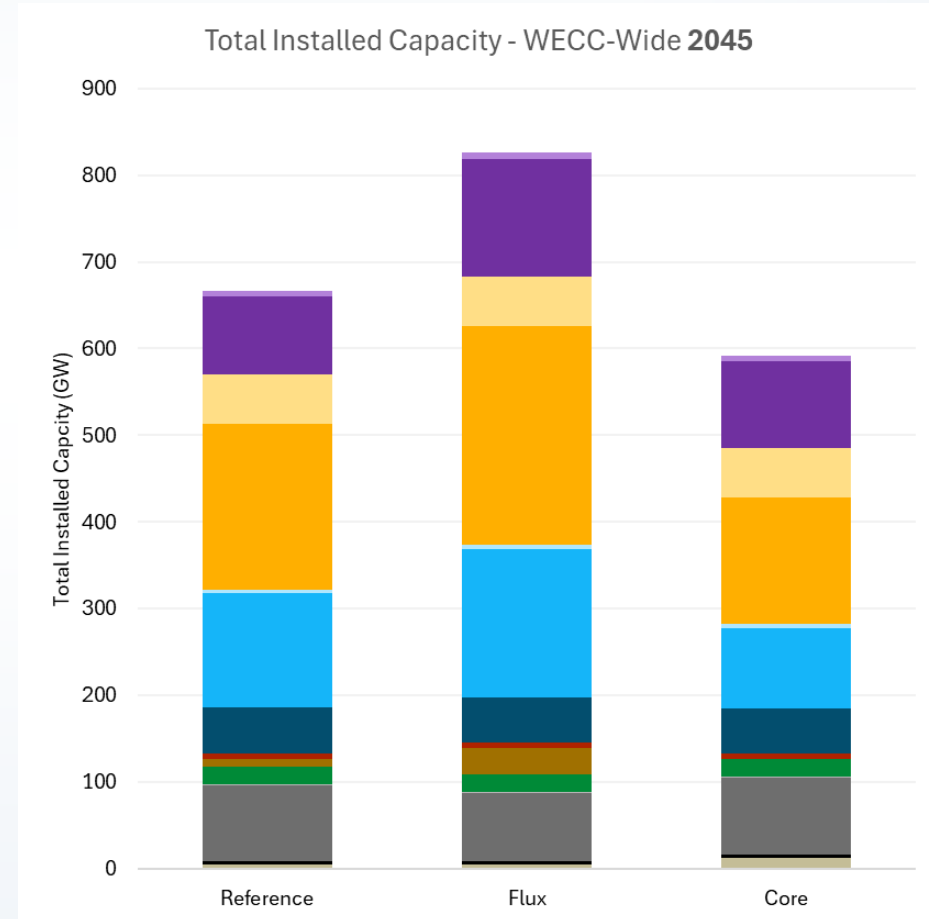
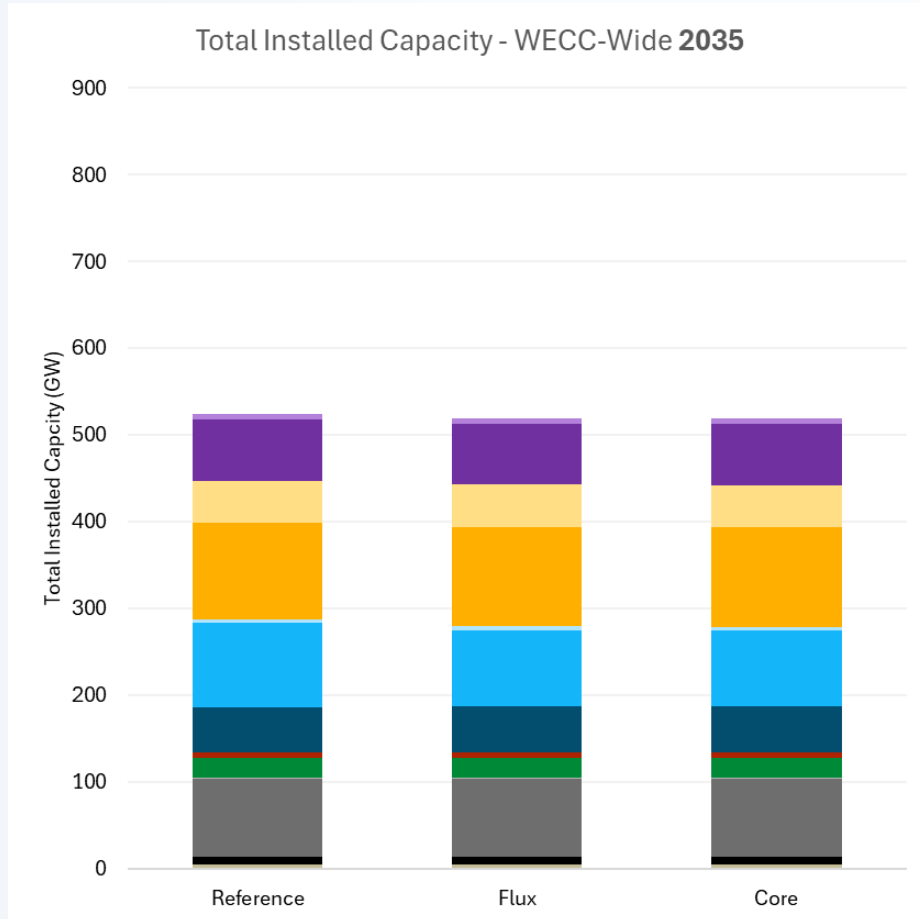


LCOE, Core Scenario



Total Installed Capacity Summary – All Scenarios

[Resources](#)

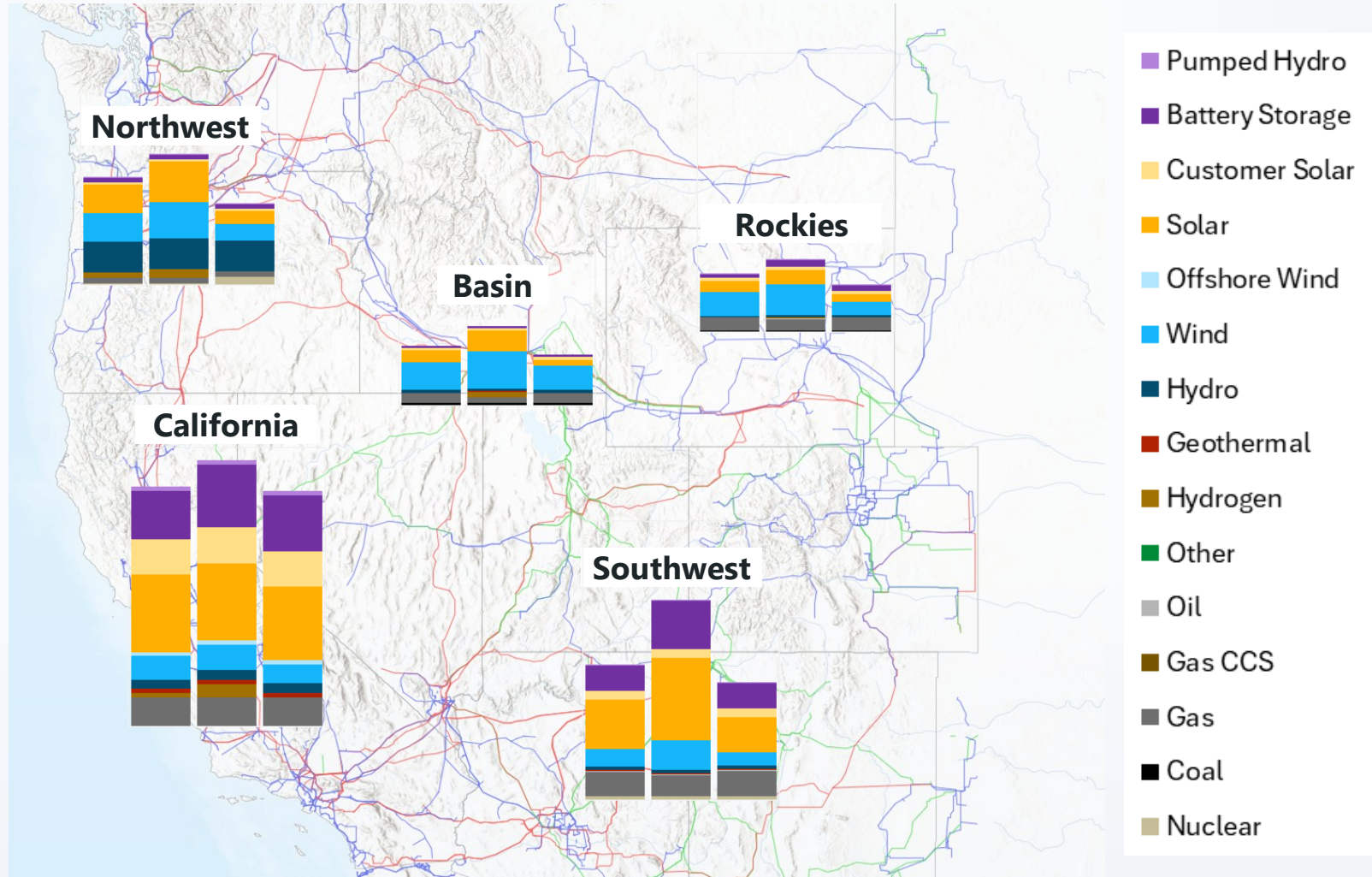


Total Installed Capacity by 2045 – All Scenarios

Resources

Capacity (MW)

300,000
250,000
200,000
150,000
100,000
50,000
-



Key Takeaways from Additional Scenarios Capacity Expansion Results

- » These scenarios will likely provide a robust look at potential drivers for transmission over the next 20 years
 - » In the **Flux Case**, high load growth and low technology costs for wind and solar translate to significant additional generation build out in zones more distant from load
 - » In the **Core Case**, more conservative, low growth and higher technology cost for a variable generation reduces remote wind and solar build out, displacing it with more centralized battery, nuclear, and gas generation, likely leading to a smaller but still sizable set of inter-regional transmission needs

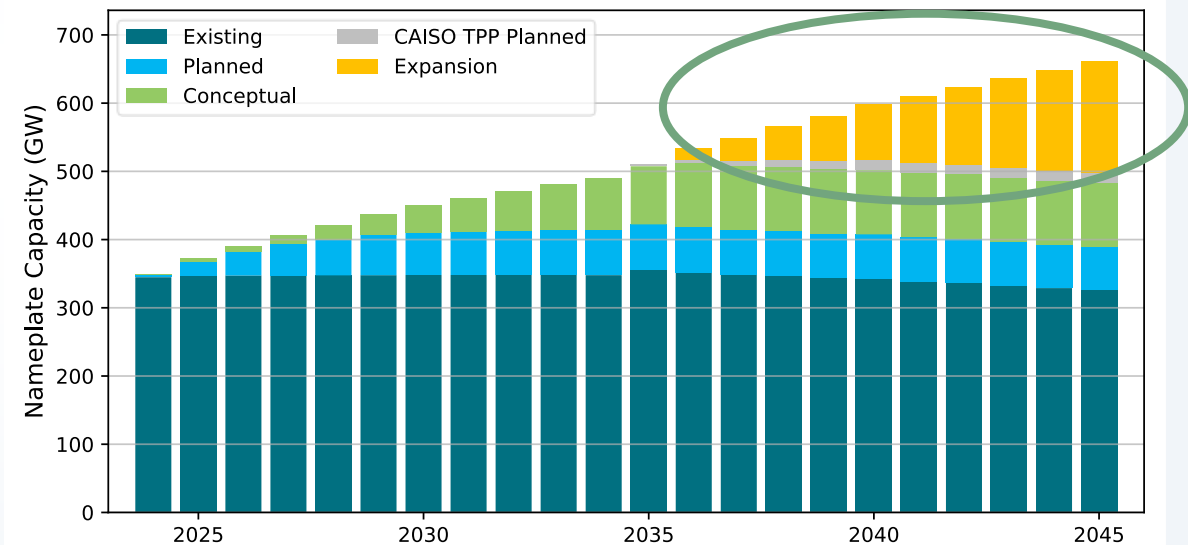
20-year Horizon: Busbar Mapping Results for Reference Case

John Muhs, Energy Strategies

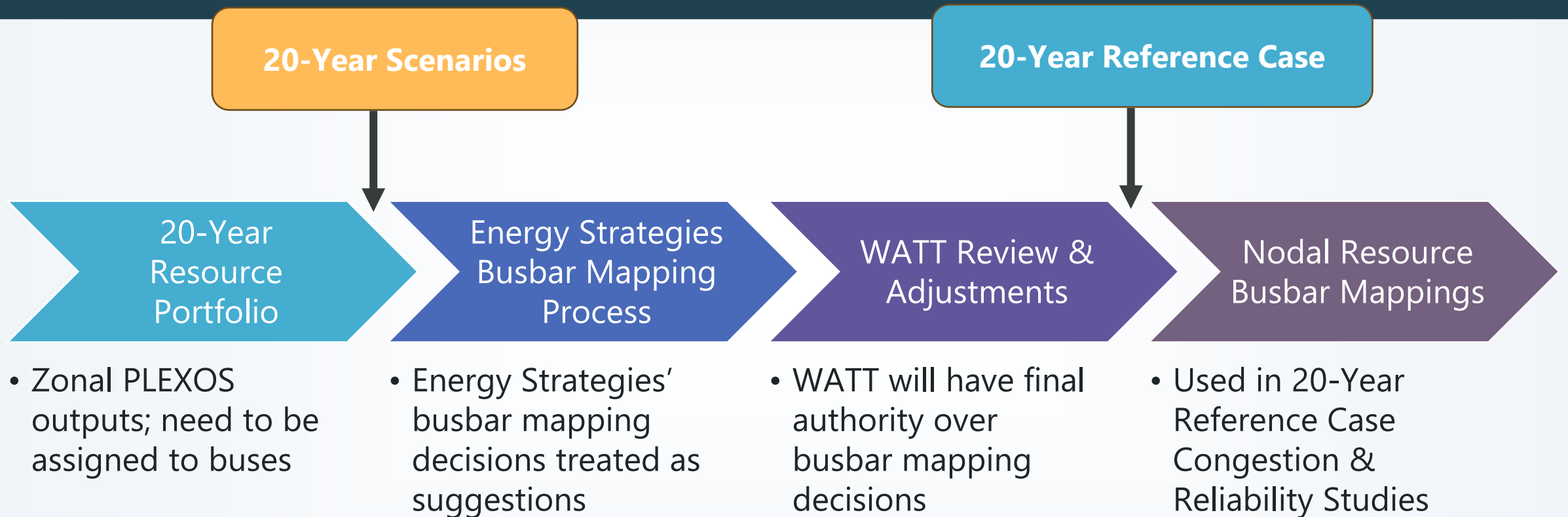
Approach to Busbar Mapping

- » Busbar mapping process identifies reasonable points of interconnection for 2036 – 2045 incremental resource additions identified from capacity expansion modeling
 - » High-level resource trajectories are mapped to buses based on commercial interest, resource quality, WATT input
- » The WestTEC study has already identified and busbar mapped a 10-year case the represents Western utility IRP plans through 2035

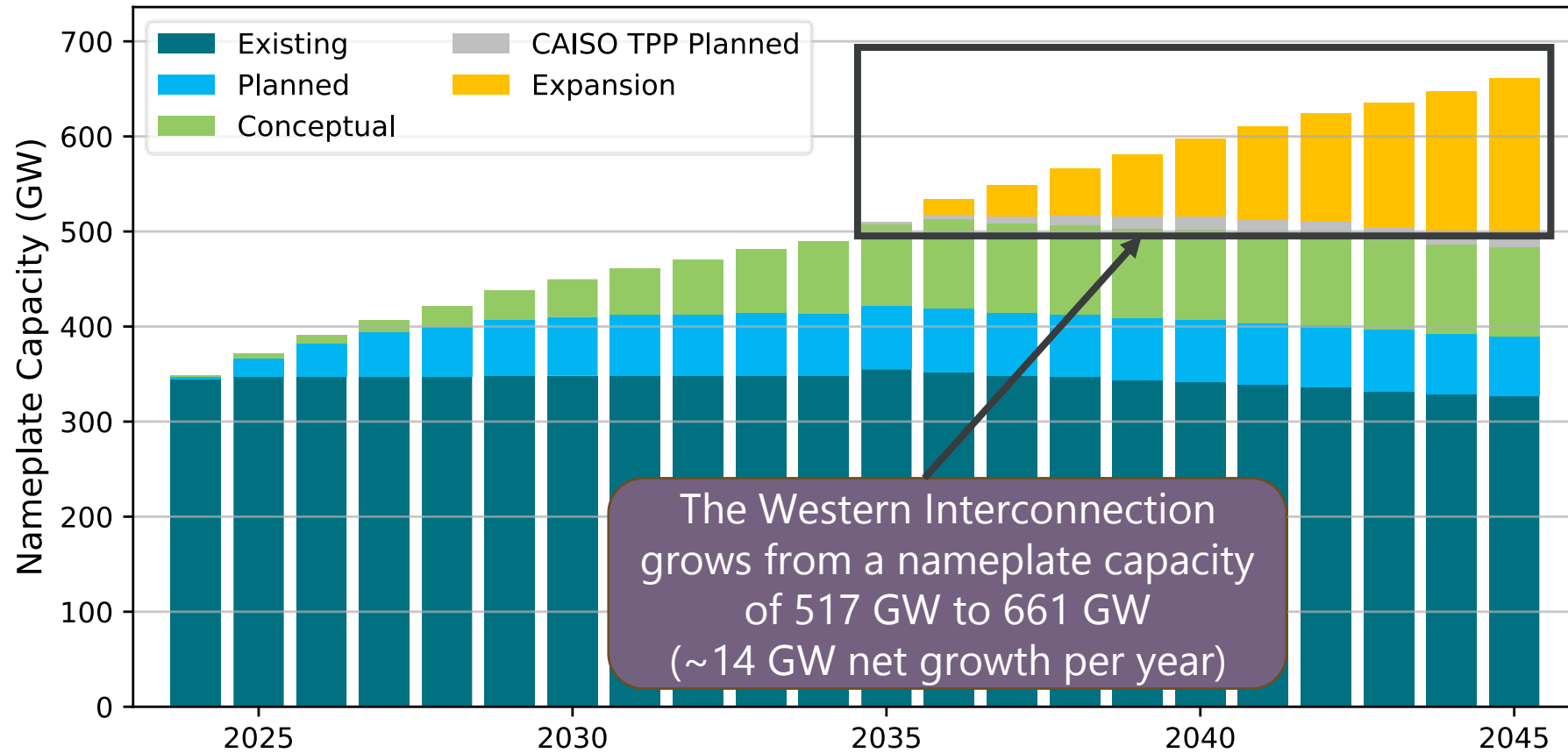
Busbar Mapping Incremental Additions 2036 - 2045



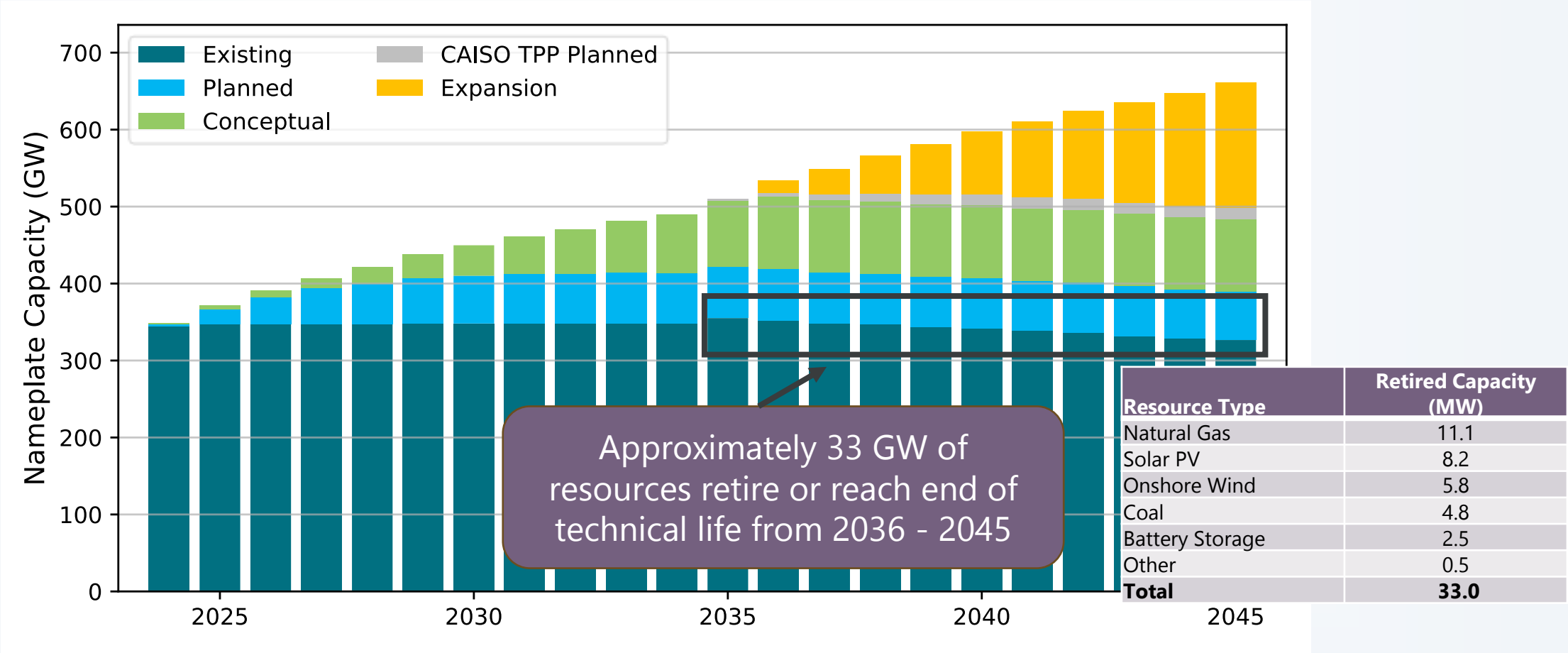
Approach to Busbar Mapping



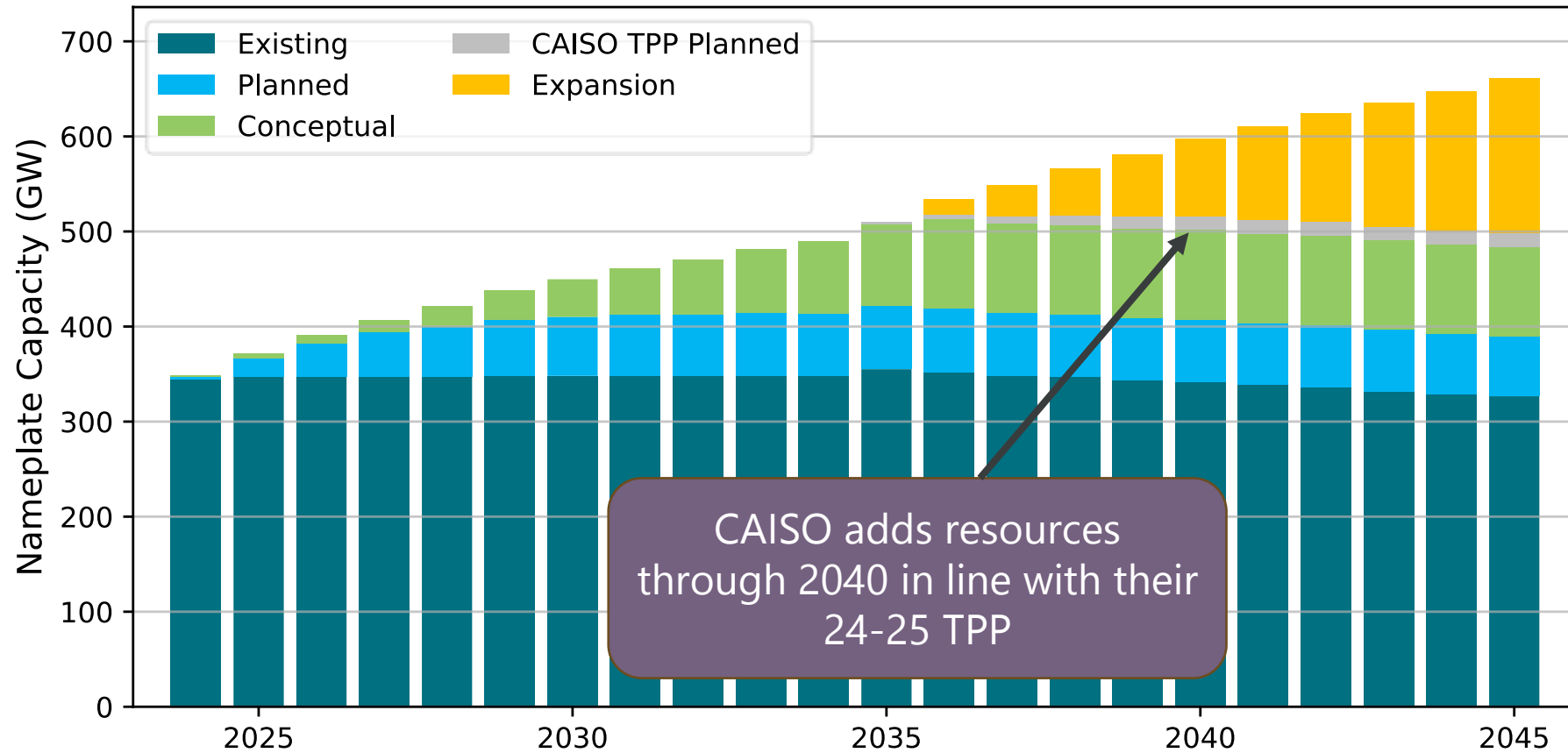
From 2035 to 2045, the WestTEC Reference Case assumes...



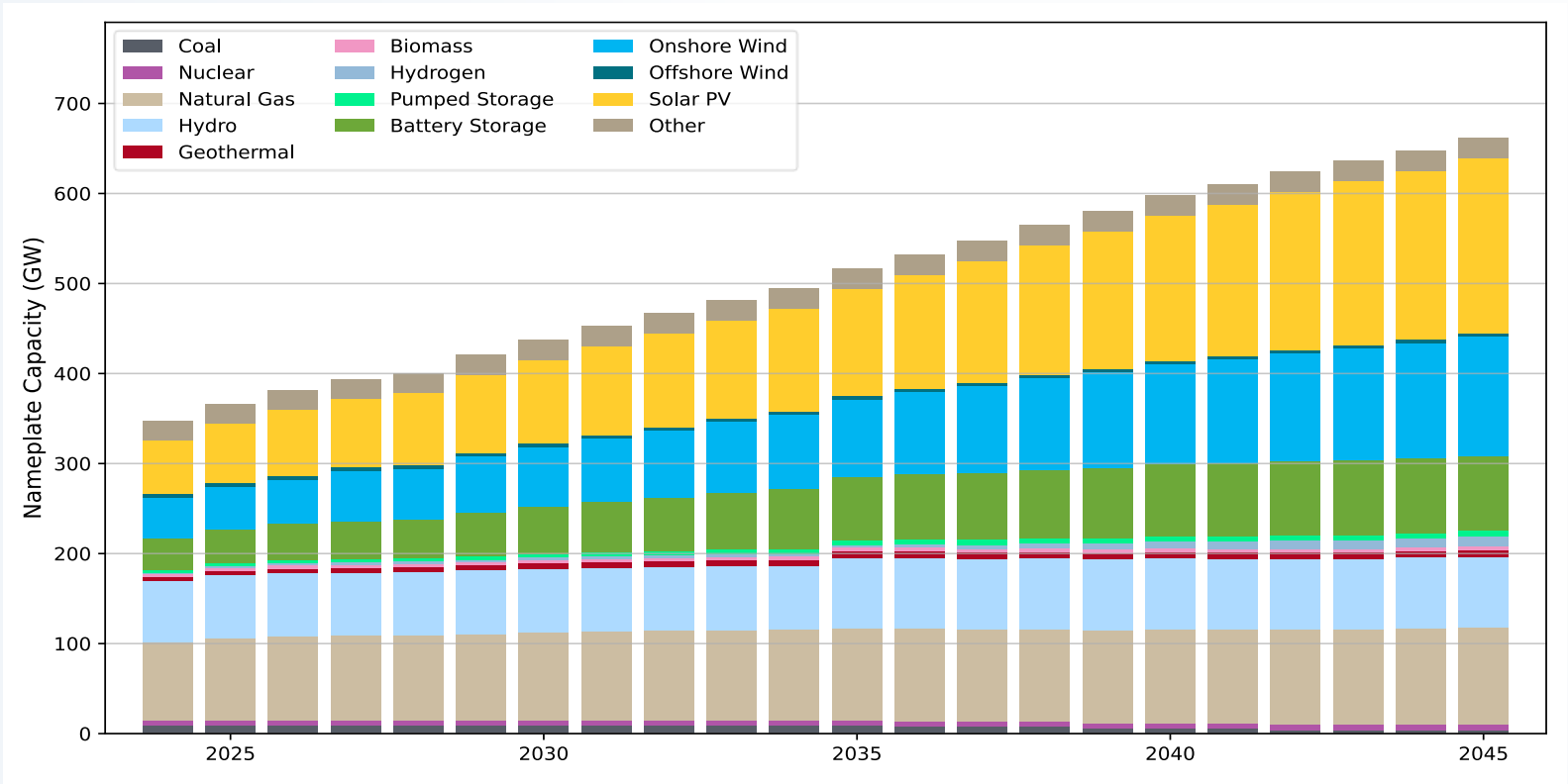
From 2035 to 2045, the WestTEC Reference Case assumes...



From 2035 to 2045, the WestTEC Reference Case assumes...

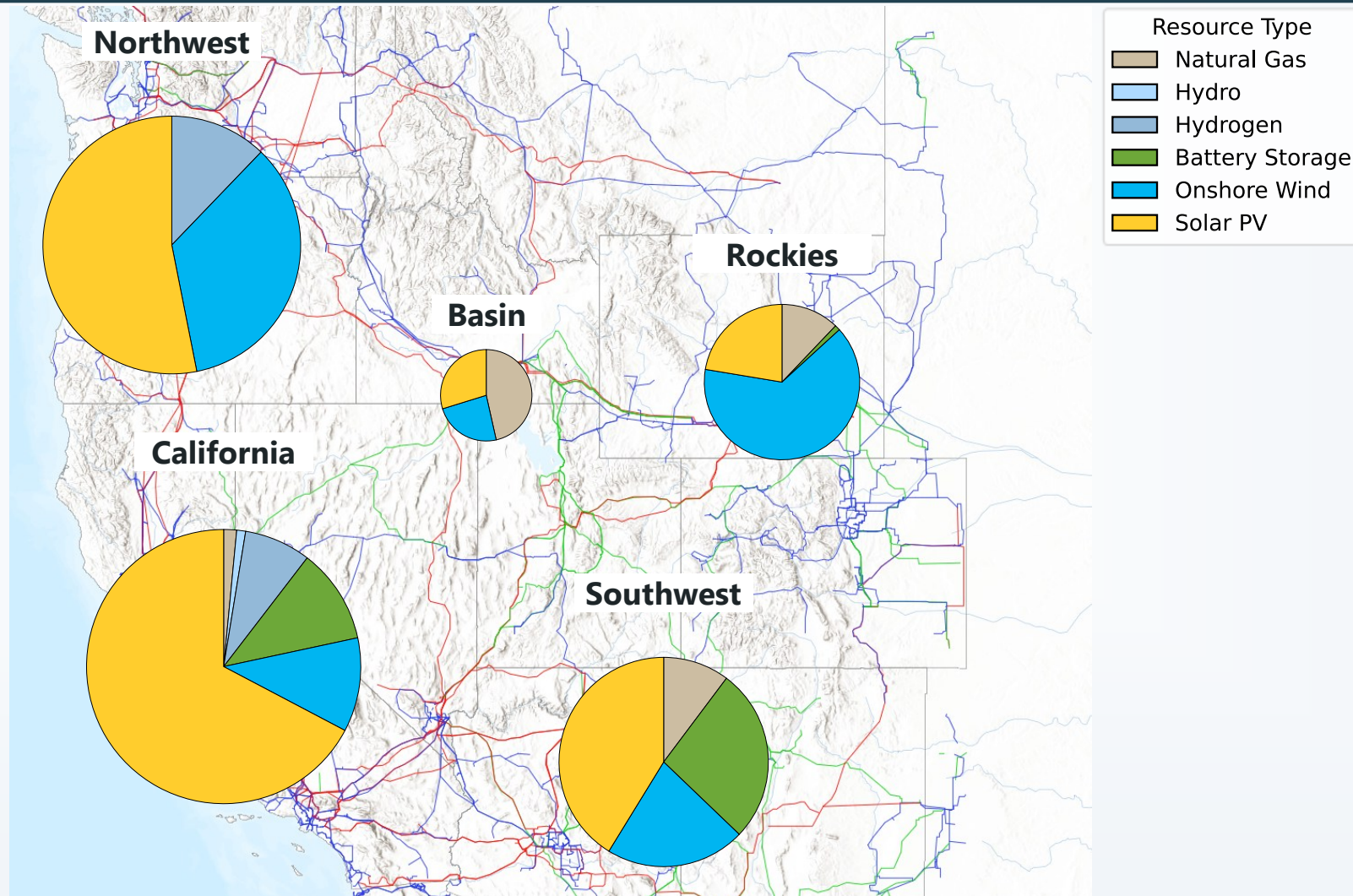


WestTEC Reference Case

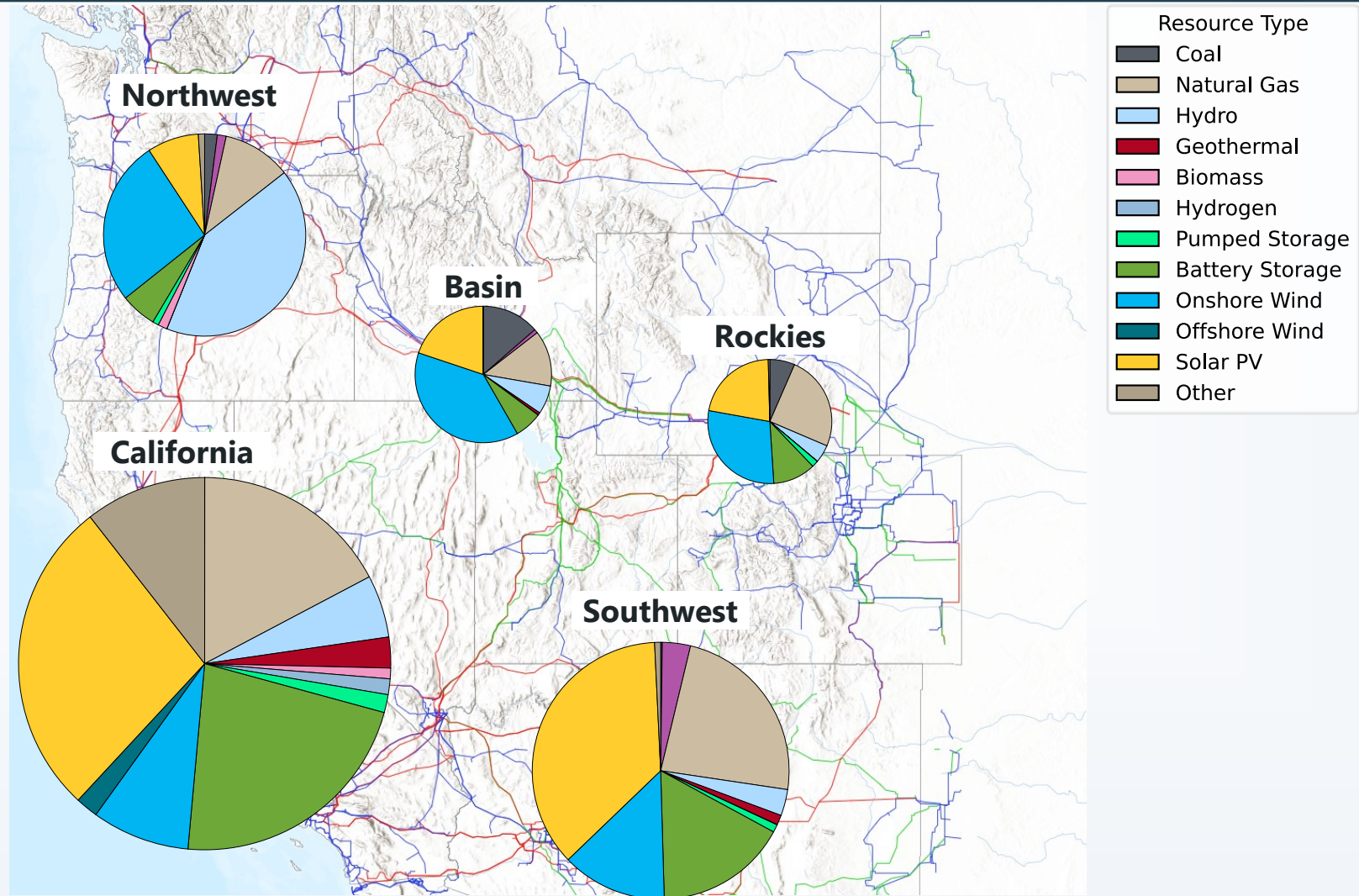


Resource Type	2025	2035	2045
Solar PV	67	119	194
Onshore Wind	47	86	132
Natural Gas	92	102	108
Battery Storage	37	70	84
Hydro	70	79	79
Other	22	23	23
Hydrogen	2	3	12
Geothermal	5	7	7
Nuclear	5	6	6
Pumped Storage	4	6	6
Coal	9	9	4
Biomass	3	4	4
Offshore Wind	4	4	4
Total	367	517	661

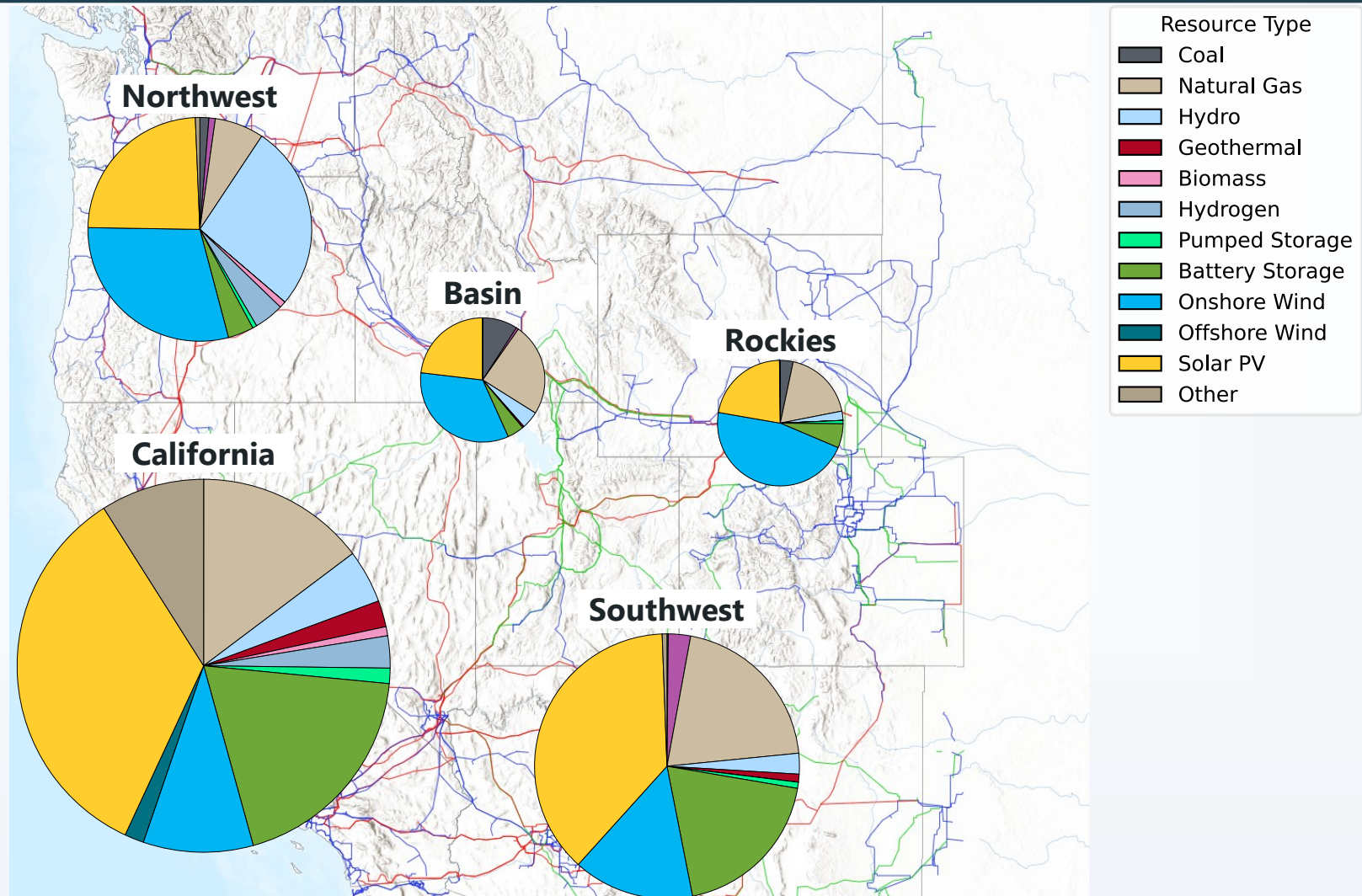
Incremental Resource Additions 2036 - 2045 (20-year Reference Case)



2035 Resource Mix by Planning Region



2045 Resource Mix by Planning Region



Resources for Further Review Include

WestTEC Bus Mapping and Gen Locations

WestTEC 20yr Bus Mapped (Thermal and Hydrogen)

- CT-Frame
- Hydrogen

Allocated Unit Capacity (MW)

- > 7,000
- 5,000
- 3,500
- 2,000
- < 20

WestTEC 20yr Bus Mapped (BESS)

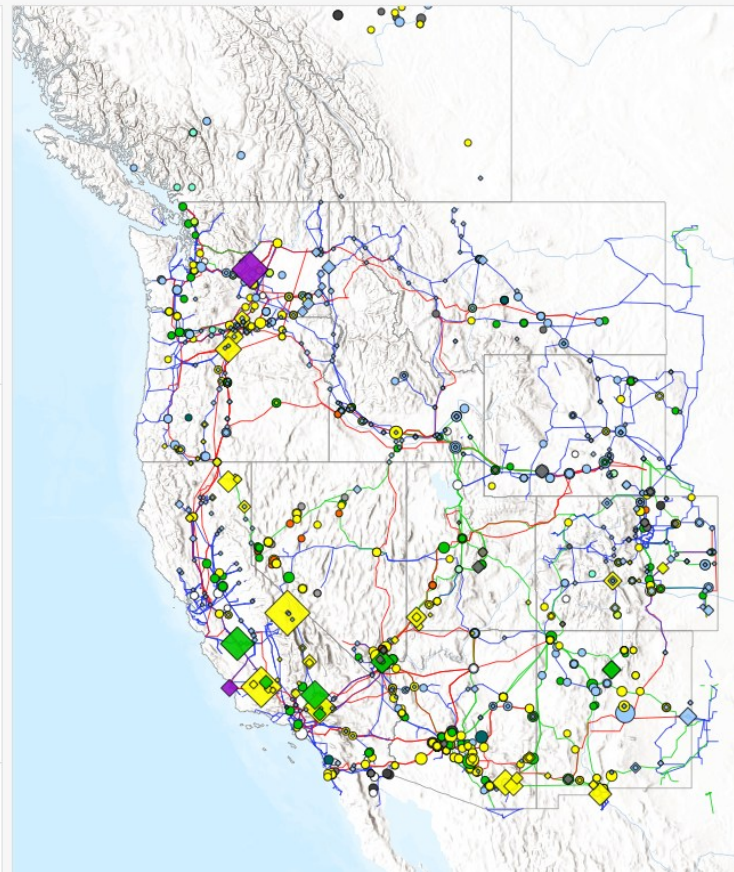
- Li Battery 4hr
- Pumped Hydro

Allocated Unit Capacity (MW)

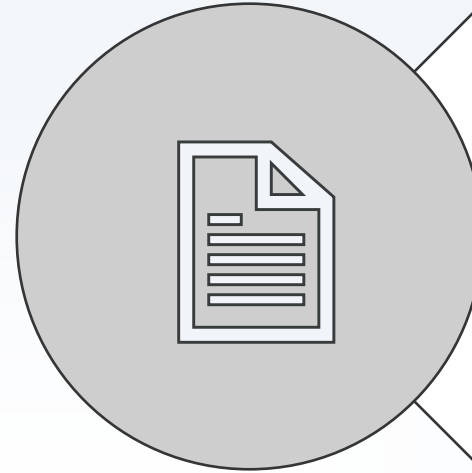
- > 7,000
- 5,000
- 3,500
- 2,000
- < 32

WestTEC 20yr Bus Mapped (Wind and Solar)

- Wind
- Solar



Action Items & Next Steps



Complete 10-Year Report



20-Year Horizon model building activity will commence in Q4 as soon as 10-year technical work is complete

Discussion/Q&A

Admin-WTEC@westernpowerpool.org

Wrap-Up

- » This webinar has been recorded and will be posted along with this presentation to the WestTEC website in the coming days at [WPP](#)
- » Look for the next Public Webinar to be scheduled in Q1 2026
- » Thank you for your support and participation!