Regional Engagement Committee Meeting

August 14th, 2025

Agenda

- Welcome and Agenda
- Tribal Engagement Updates
- Updates from Energy Strategies/WATT
- Next Steps
- Public comment

Tribal Engagement Updates

Tribal Engagement Events

- Affiliated Tribes of Northwest Indians (ATNI) Energy Sovereignty Summit on Sept. 3rd – 5th at Snoqualmie Resort Casino. During the summit, Donald Williams will be moderating a general plenary session titled: "**Partnership opportunities and Emerging Technologies**" on Sept. 3rd at 2:15 pm, then on Sept. 4th on the General plenary session at 11:15 am titled "Energy Sovereignty and the Evolving Power Grid" with Sarah Edmonds, WestTEC leadership/WPP CEO/President, Seth Nelson, TWTC, Anita Heradia, BPA Transmission Planning and asset management, and Donald Williams, FTL Consulting/WestTEC REC, will be speaking on this panel. Then, the same day at 3:30 pm, we were fortunate to develop a Transmission breakout session that could feature Keegan Moyer with Energy Strategies and the great work that he is doing in transmission planning, along with Sarah Edmonds and other speakers. I will have the privilege to moderate this breakout session.
- The Western Tribal Transmission Workgroup WTTW has been presenting informative web panels with various Subject Matter Experts (SME's) in their respective fields, such as WestTEC, TWTC, CAISO, OPSA, and Data center developers, to provide a vision for the need for Transmission buildout in the West and a role that Tribes could potentially play.
- WRA has a series of Tribal transmission and energy markets workshops in September and October, and WRA can provide more context on these engagements. FTL Consulting is honored to attend and looks forward to these workshops.
- FTL Consulting was invited to The Western Transmission Consortium's (TWTC) NW Pod meeting held at the Western Power Pool facility in Portland, Oregon, July 31st. It was great to be a part of this meeting.

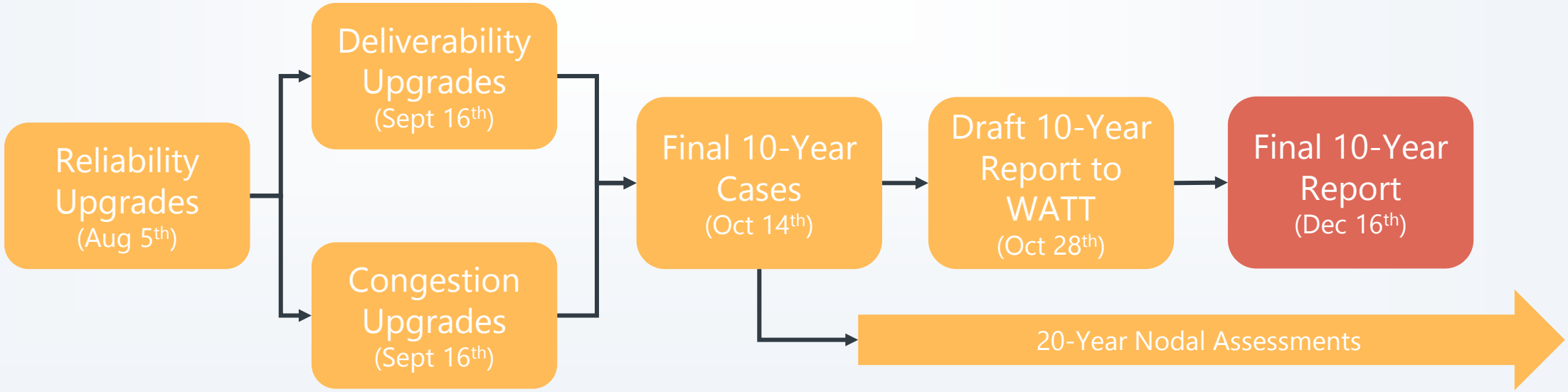
Energy Strategies/WATT Updates

Steady Progress in 2025

1. Despite schedule delays, the study is being executed as designed with **few deviations from the general technical approach** outlined in the Study Plan.
2. The **10-year assessment** is beginning to revealing modest interregional transmission deficiencies that, if addressed, will support reliability, efficient flows, and will allow utilities to integrate planned resources. However, the assessment is still underway.
3. Reference Case expansion plan is complete and early capacity expansion results from the **Core and Flux scenarios are promising** – they are producing divergent resource mixes that are consistent with expectations
4. Busbar mapping of Reference Case resource additions is the current focus of the **20-year assessment.** Forecasting the location of ~140 GW of resource additions is nearly complete and has received outstanding levels of participant engagement and input
5. We are addressing technical challenges as they arise, leveraging the expertise of the consulting team and local experience and knowledge of the participants

WestTEC 10-Year Study Timeline

- System Reliability Assessment solutions were proposed in **August 5th WATT Call**
- Deliverability Assessment & Congestion Assessment complete by **September 16th**
- Final 10-Year Reliability Cases & Production Cost Model complete by **October 14th**
- Draft 10-Year Report Provided to REC & WATT for review **October 28th - November 14th**
- Draft 10-Year Report Provided to Steering Committee **December 2nd**
- Final 10-Year Report Approved by Steering Committee **December 16th**



WestTEC 20-Year Study Timeline

10-Year Study

Reliability Upgrades (Aug 5th) → Congestion Upgrades (Sept 16th) → Final 10-Year Cases (Oct 14th) → Draft 10-Year Report to WATT (Oct 28th) → Final 10-Year Report (Dec 16th)

20-Year Reference

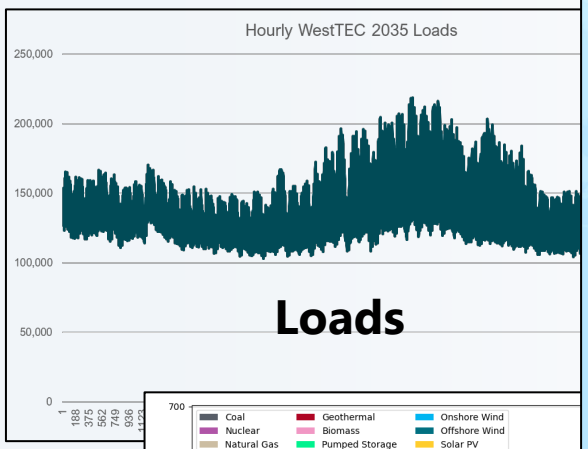
Capacity Expansion Modeling (June 3rd) → Busbar Mapping (Sept 2nd) → Hypothesis Map Development (Oct 14th) → Nodal Assessments (2026)

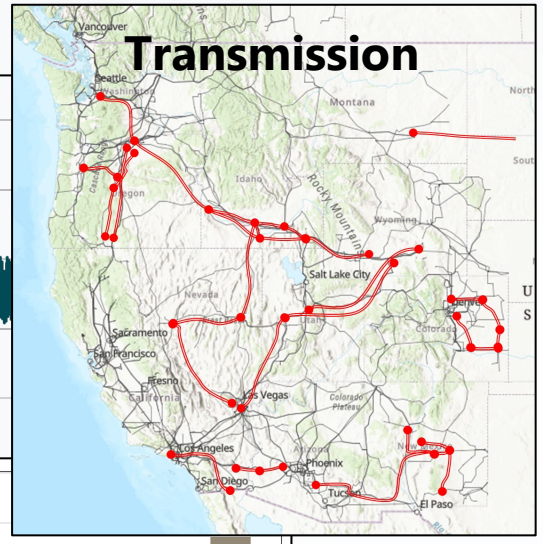
20-Year Scenarios

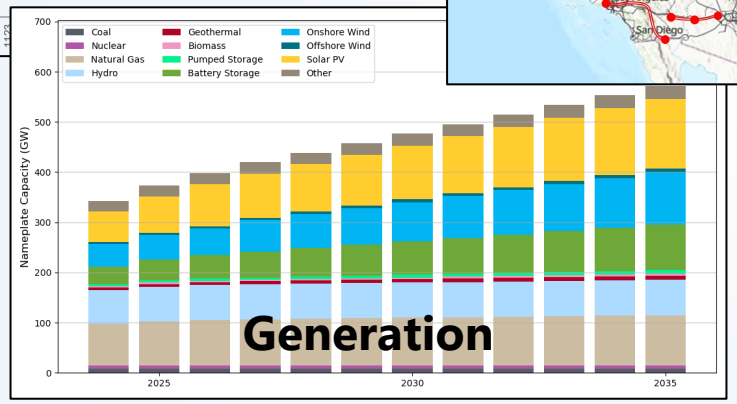
Capacity Expansion Modeling (Sept 16th) → Busbar Mapping (Dec 16th 2025) → Hypothesis Map Development (Jan 2026)

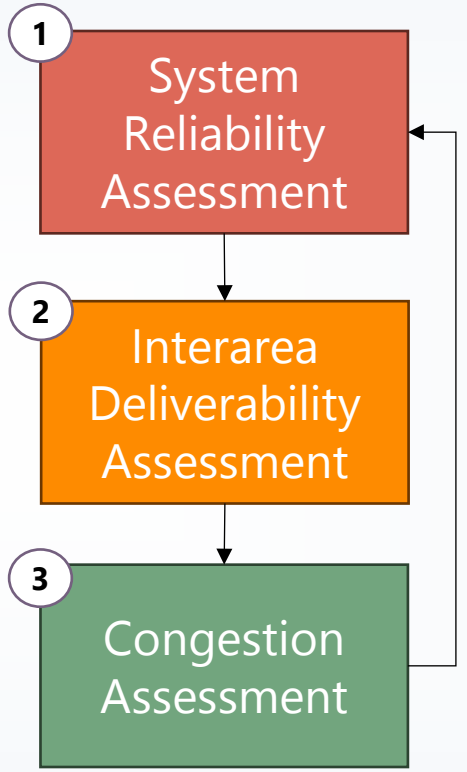
10-year Assessment

Stepping Back









Performed serially with bespoke methods on consistent database

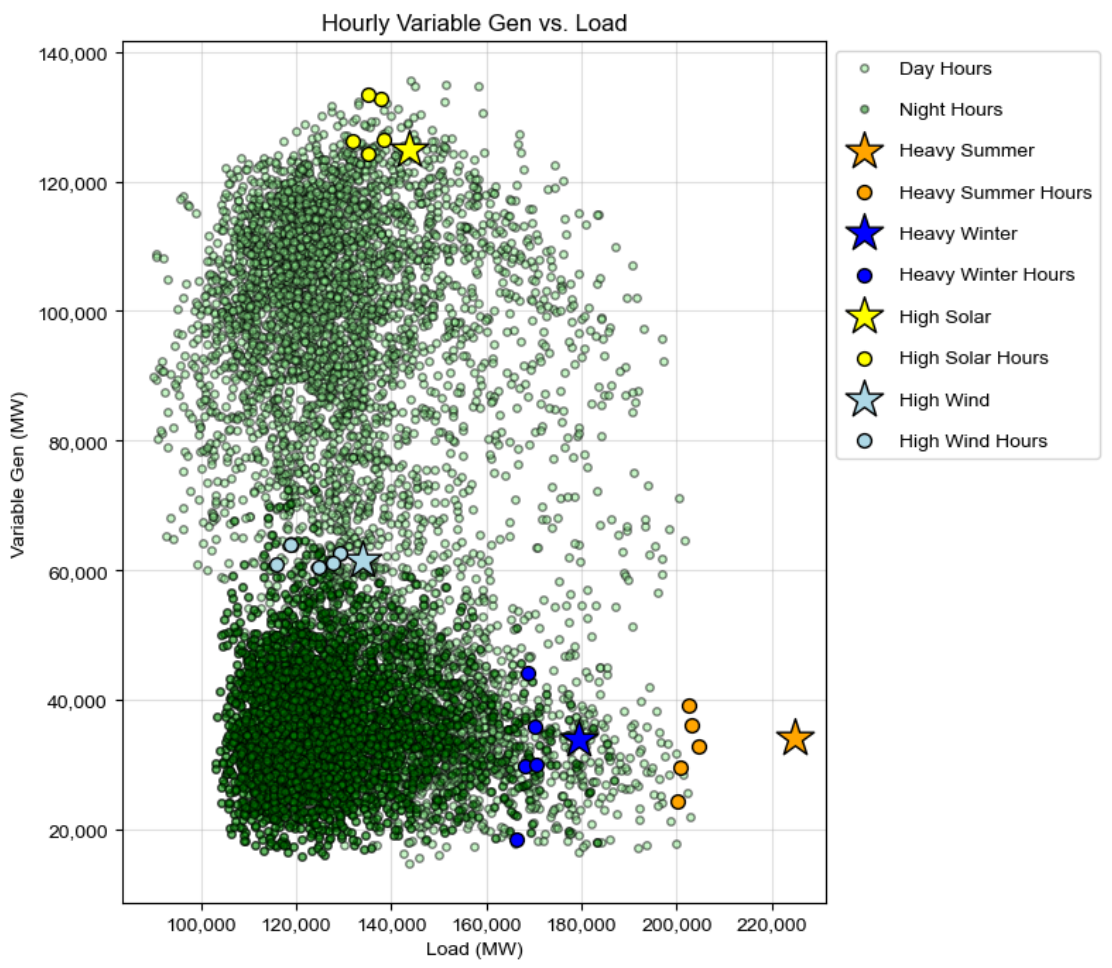
WestTEC 2035 transmission plan

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

10-year: System Reliability Assessment

- Developed four reliability models representing conditions that stress interregional transmission
  - Extensive work with members to refine models, dispatch levels, and contingency/monitoring of lines
- Early results indicate transmission needs at:
  - Four Corners and surrounding areas due to high southern to north flows
  - North of Pearl due to high Portland imports
  - Path 8 due to high Montana exports
  - DSW expansion including Mead – Marketplace and Peacock – Liberty and southern New Mexico upgrades
- Pending results from High Wind scenario could add to this list

2035 WestTEC Load vs. Variable Generation 2035



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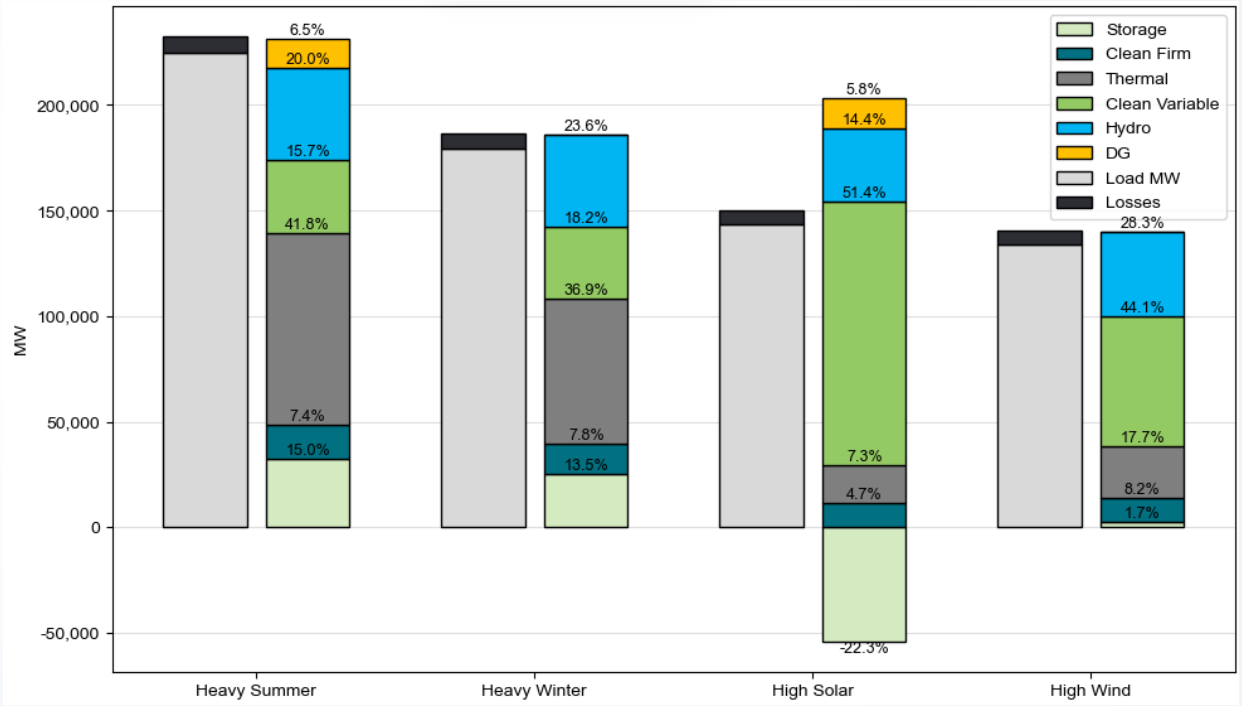
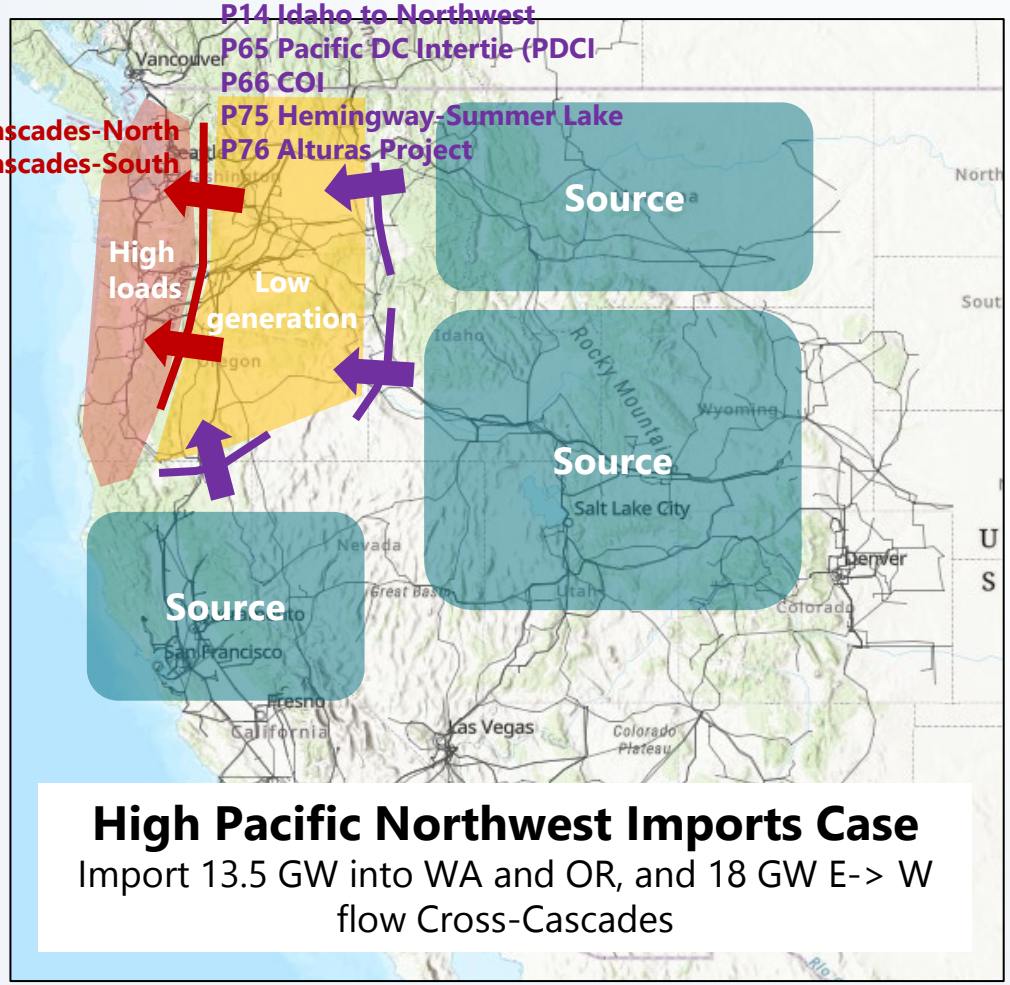
Load and Dispatch for 2035 SRA Cases



10-year: Interarea Deliverability Assessment

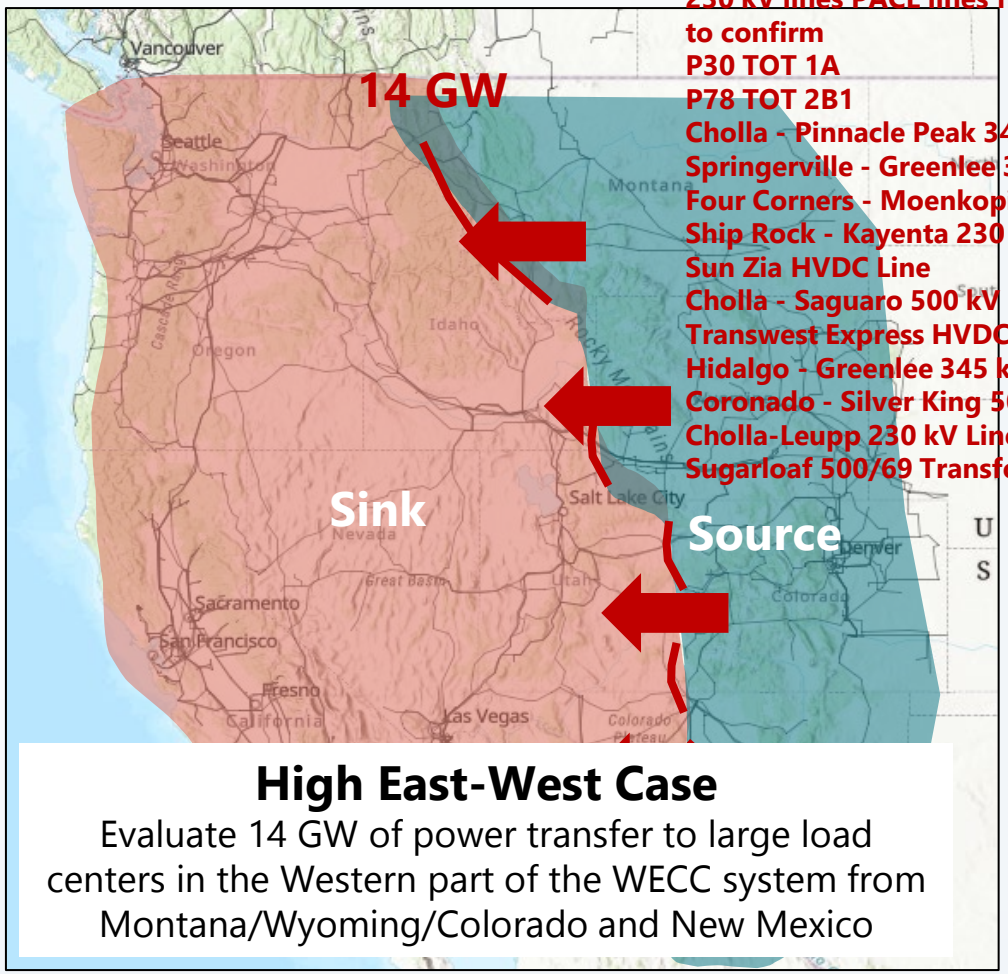
P08 Montana to Northwest
P14 Idaho to Northwest
P65 Pacific DC Intertie (PDCI
P66 COI
P75 Hemingway-Summer Lake
P76 Alturas Project

P04 West of Cascades-North
P05 West of Cascades-South



High Pacific Northwest Imports Case
Import 13.5 GW into WA and OR, and 18 GW E-> W flow Cross-Cascades

P08 Montana to Northwest
P18 Montana-Idaho
P19 Bridger West - Post Gateway West
Gateway South Transmission Project
230 kV lines PACE lines from WY to ID. PAC to confirm
P30 TOT 1A
P78 TOT 2B1
Cholla - Pinnacle Peak 345 kV #1 and #2 Line
Springerville - Greenlee 345 kV Line
Four Corners - Moenkopi 500 kV Line
Ship Rock - Kayenta 230 kV Line
Sun Zia HVDC Line
Cholla - Saguaro 500 kV Line
Transwest Express HVDC
Hidalgo - Greenlee 345 kV line
Coronado - Silver King 500 kV Line
Cholla-Leupp 230 kV Line
Sugarloaf 500/69 Transformer



High East-West Case
Evaluate 14 GW of power transfer to large load centers in the Western part of the WECC system from Montana/Wyoming/Colorado and New Mexico

10-year: Congestion Assessment

- Draft 2035 WestTEC production cost modeling in GridView format has been posted to WECC.org
- Once in-scope reliability and deliverability issues are addressed per the studies discussed, WestTEC will conduct a congestion assessment
- The purpose of the congestion assessment is to identify transmission constraints that cause congestion on the system that, if addressed, could help reduce systems costs, improve the operational efficiency of the grid, and enhance access to a diverse resource mix

10-year: Congestion Assessment

» While subject to change, draft congestion studies have identified material congestion on some major WECC interfaces:

Name	Congested Hours	Congestion Cost ($)
P08 Montana to Northwest	3,166	343,305,732
P46 West of Colorado River (WOR)	1,317	128,997,240
_Pth-BPA-North of Pearl	1,429	124,175,232
P15 Midway-LosBanos	1,559	117,704,784
P36 TOT 3	2,847	86,666,512
P65 Pacific DC Intertie (PDCI)	4,626	66,718,939
P83 Montana Alberta Tie Line	5,322	61,702,384
TRANSWEST EXPRESS AC LINE	2,721	40,546,667
P26 Northern-Southern California	1,324	37,368,902
P61 Lugo-Victorville 500 kV Line	2,337	36,599,544
P45 SDG&E-CFE	2,815	34,447,882
P66 COI	761	33,407,976
_WestTEC AB to BC_MATL Flowgate	2,041	30,011,618
P03 East Side NW-BC	2,896	21,373,041
SWIP-North (Midpoint-Robinson)	621	20,027,712
P77 Crystal-Allen	2,975	19,512,466
P18 Montana-Idaho	467	18,633,721
P48 Northern New Mexico (NM2)	1,361	17,575,299

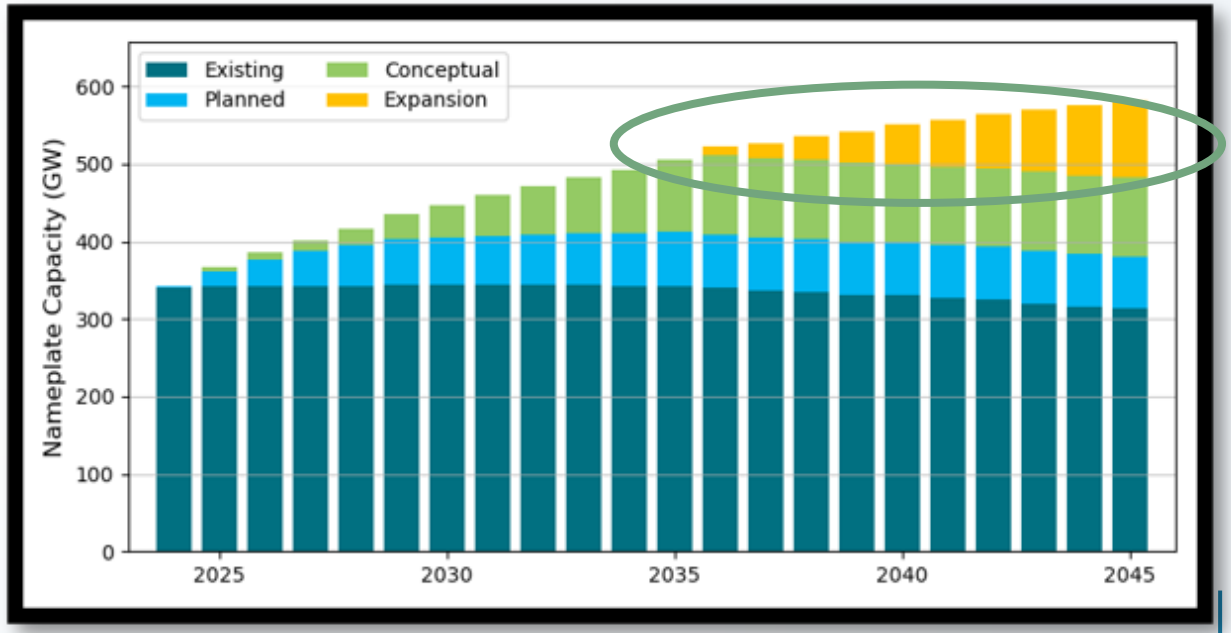
Congestion will shift and change as reliability and deliverability issues are addressed

20-year Busbar Mapping

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, engineering judgement, and most importantly WATT input
- The WestTEC study has already identified and busbar mapped a 10-year case the represents Western utility IRP plans through 2035

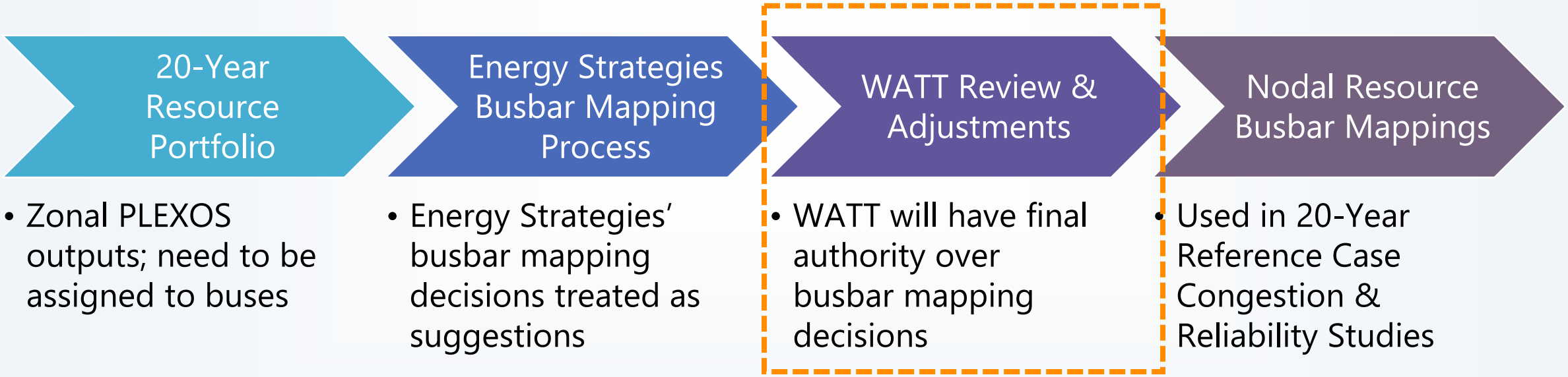
Busbar Mapping Incremental Additions 2036 - 2045



	Solar	Wind	Storage	Thermal	Total
California	36,136	6,833	12,371	2,183	**57,523**
Southwest	15,226	7,483	10,047	3,820	**36,576**
Rockies & Basin	11,888	21,250	324	8,128	**41,591**
Northwest	23,864	15,510	0	5,472	**44,846**

Approach to Busbar Mapping

Estimated Reference Case progress ~85%



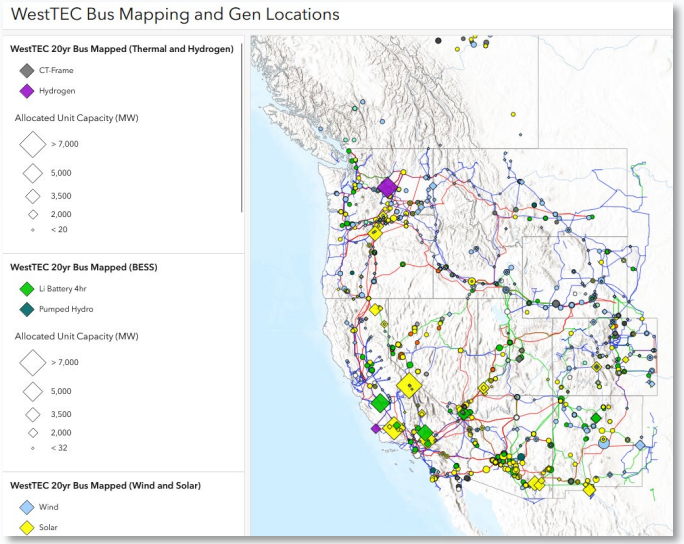
Busbar Mapping Flux and Core Scenarios beginning in coming months!

Update on Busbar Mapping Efforts

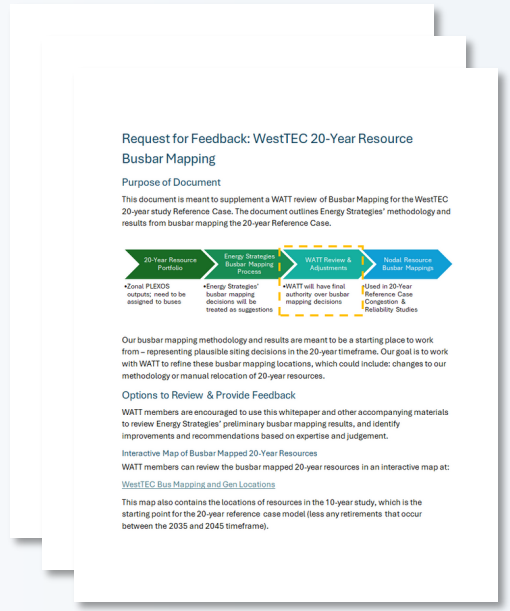
- Energy Strategies provided busbar mapping review materials to WATT on June 3rd
  - Review materials are hosted on the WestTEC sharepoint and are kept updated during the review process
- ES held working working sessions in June to orient WATT members

  Calls were broken out by region:
  - California & Southwest (CA, AZ, NM, NV)
  - Northwest (WA, OR, ID, MT)
  - Rockies & Basin (ID, UT, WY, CO)

Interactive Map



Methodology Whitepaper


Request for Feedback: WestTEC 20-Year Resource Busbar Mapping

Purpose of Document

This document is meant to supplement a WATT review of Busbar Mapping for the WestTEC 20-year study Reference Case. The document outlines Energy Strategies' methodology and results from busbar mapping the 20-year Reference Case.

20-Year Resource Portfolio → Energy Strategies' Busbar Mapping Process → WATT Review & Adjustments → Nodal Resource Busbar Mappings

•Zonal PLEXOS outputs; need to be assigned to buses

•Energy Strategies' busbar mapping decisions will be treated as suggestions

•WATT will have final authority over busbar mapping decisions

Used in 20-Year Reference Case Congestion & Reliability Studies

Our busbar mapping methodology and results are meant to be a starting place to work from – representing plausible siting decisions in the 20-year timeframe. Our goal is to work with WATT to refine these busbar mapping locations, which could include: changes to our methodology or manual relocation of 20-year resources.

Options to Review & Provide Feedback

WATT members are encouraged to use this whitepaper and other accompanying materials to review Energy Strategies' preliminary busbar mapping results, and identify improvements and recommendations based on expertise and judgement.

Interactive Map of Busbar Mapped 20-Year Resources

WATT members can review the busbar mapped 20-year resources in an interactive map at:

WestTEC Bus Mapping and Gen Locations

This map also contains the locations of resources in the 10-year study, which is the starting point for the 20-year reference case model (less any retirements that occur between the 2035 and 2045 timeframe).

Preliminary Busbar Mapping Table

Region	Bus Number	Bus Name	Bus kV	Wind	Solar	Thermal	Storage
AZPS	14012	DELANY	500	-	1,023	605	2,301
AZPS	14006	YAVAPAI	500	-	1,023	-	-
AZPS	14018	DUGAS	500	-	1,023	-	-
AZPS	14000	CHOLLA	500	455	-	-	-
AZPS	14002	MOENKOPI	500	455	-	-	-
AZPS	14101	FOURCORN	345	455	-	-	-
EPE	11061	DIABLO	345	-	452	-	-
EPE	11010	AMRAD	345	-	-	-	293
EPE	11093	LUNA	345	-	-	-	293
EPE	11317	EMPIRE	345	95	-	-	-

E3 Updates

WestTEC REC Meeting

20-Year Scenarios Capacity Expansion Analysis Update

August 14th, 2025

Arne Olson, Senior Partner
Jack Moore, Senior Director
Femi Sawyerr, Senior Managing Consultant

Energy+Environmental Economics

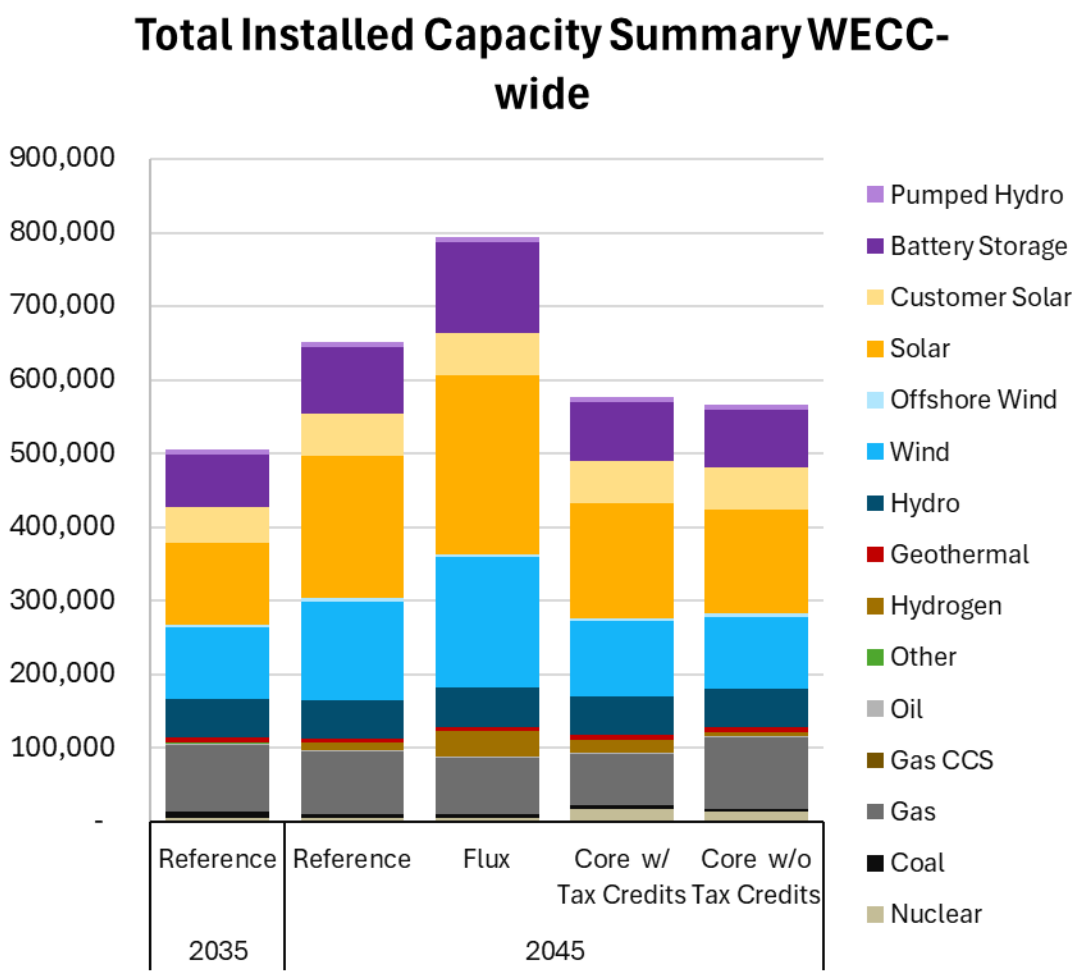
WestTEC 20-Year Scenarios

» Relative to the Reference scenario, the Flux and Core scenarios were crafted to reflect complementary alternative futures that will be used to (1) identify persistent transmission needs and (2) roadmaps for Western grid expansion

	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 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* *Breakthroughs in Advanced Geothermal, Nuclear SMRs, and CCS
GHG policies	Statutory	Statutory & voluntary	Statutory with 5-year compliance delay

Preliminary Results So Far

- Reference Scenario adds about 150 GW of new resources by 2045, incremental to the 500 GW by 2035. The Flux adds about 300 GW while the Core adds about 75 GW.
- As intended, the Flux and Core scenarios are showing a diverse range of resource selections relative to the Reference.
  - Flux selects significantly more renewables, storage and Hydrogen
  - Core scenarios select significantly more nuclear to replace the higher cost renewables
    - Hydrogen and gas are also selected depending on whether tax credits are embedded or not
- We will continue to iterate on both scenarios incorporating feedback received from the WATT and REC members



Survey Feedback on Scenarios

- **Consultants sent out 5-question survey to WATT distribution list to collect feedback on 20-year scenarios**
  - We will continue to leave the survey open through August 15th

Orig Core Case :
PTC/ITC applied for all applicable technologies

NREL "high cost" case for **solar, wind, storage, gas, PSH**

NREL "low cost" for **geothermal, nuclear, CCS**

NREL mid for **hydrogen**

Alternative Core Case :
No PTC/ITC

NREL "mid cost" case for **solar, wind, storage, gas, PSH**

NREL "low cost" for **geothermal, nuclear, CCS**

NREL mid for **hydrogen**

QR Code to Survey

Link to Survey:
https://forms.cloud.microsoft/r/p8XdLMJvGH

Feedback on Core Scenario

- All respondents supported proceeding with the “Alternative Core” over the “Original”
  - “Prefer the Alt Core over the Original”
  - “I think the core scenario is an essential scenario and should potentially be the "flagship" scenario for the study since it will likely demonstrate that even with a high penetration of "dispatchable" resources, transmission expansion will still be widely needed.”
  - “I would lean towards supporting the Alternative Core Case under the current federal/DOE trajectory. However, I suspect the states may include other incentives to support renewables within the next ten year – but 20-years out is difficult to gage.”
  - “E3 has implemented it as we discussed and offered an alternative. I tend to like the alternative because it reduces the wind and solar builds more and in today's landscape I think that is better.”

- **Consultant Recommendation:** Will model the Alternative Core (no tax credit) Case as the Core Case.

Feedback on Core Scenario

- Half of respondents requested that storage costs be reduced in the “core” scenario
  - “include lower storage costs than in reference scenario.”
  - “I think we should re-think how we characterize storage in this scenario. The goal of the scenario, as I understood it, was to identify the transmission system needed to support a largely "concentrated" fleet of advanced nuclear, CCS, and other technologies (hydrogen) and I would say storage (especially long duration storage) and advanced geothermal would fit into that paradigm better than in a highly distributed, high renewable case like the Flux scenario.”
  - “As above, the Core scenario uses storage costs that are too high, especially in contrast to the cost trends of early-stage technologies like SMR nuclear. Core scenario should reflect lower cost trajectories for storage”
  - “… the current Core scenario significantly overstates the cost spread between technologies in an implausible future where early-stage technologies such as SMR experience substantial costs declines, while storage technology costs rise relative to the Reference case. The Core scenario should reflect lower current industry storage cost estimates. Moreover, to the extent that storage can operate as a firm dispatchable resource, there is an argument for including more substantial storage cost declines as is the case in the Core Scenario for other firm dispatchable technologies.”
- **Consultant Recommendation:** Will model "low cost" trajectory for battery storage and PSH, like we're modeling for geothermal, nuclear, and CCS.

Feedback on Flux Scenario

- Also wide concerns about storage costs in the Flux scenario
  - “We believe it is important that storage costs decline significantly in the Flux Scenario. Current industry forecasts show a 40% reduction per decade in storage capital cost over the study period. Current Flux scenario storage cost assumptions are far above that level and should be reduced, both to reflect current cost trends and to be consistent with the overall focus of the Flux scenario on technology advancement.”
  - “Flux scenario should reflect significant declines in storage costs. The Current storage costs in Flux are far too high, should be lowered to reflect current trends and to be consistent with the overall intent of the Flux scenario.”
- One suggestion for ITC/PTC in the flux scenario
  - “… I think we should ignore any PTC/ITC impacts because the purpose of this scenario was to evaluate the transmission upgrades needed to support broad, distributed renewable deployment. This deployment implies a low price for solar and wind, whether through a revival of the PTC/ITC, increases in REC prices, or even continued technology price declines. I think the group is not really concerned on the "why" solar and wind prices are lower in this scenario, only that they are much lower than the reference case which accelerates their deployment.”
- **Consultant Recommendation**: Will model an updated "low cost" trajectory for battery storage resources using updated data.

E3 Proposal for Updating "Low Cost" Trajectory for Battery Storage

- In June, NREL released the Cost Projections for Utility-Scale Battery Storage: 2025 Update study.
- The study focuses on 4-hour duration utility-scale battery storage costs, making significant updates to cost assumptions and trajectories relative to the 2023 report and the 2024 NREL ATB.
- By 2045, the updated mid trajectory is significantly lower than the current E3 mid trajectory (closer to the E3 low trajectory); and the low trajectory is about 30% lower than the E3 low trajectory

- The low trajectory shows about 65% reduction by 2045, relative to 2025 values, representing technology advancements and learning curves
- E3 recommends using this updated "low cost" trajectory to be in alignment with feedback from the WATT while also preserving the same level of publicly vetted data source as the other resource costs

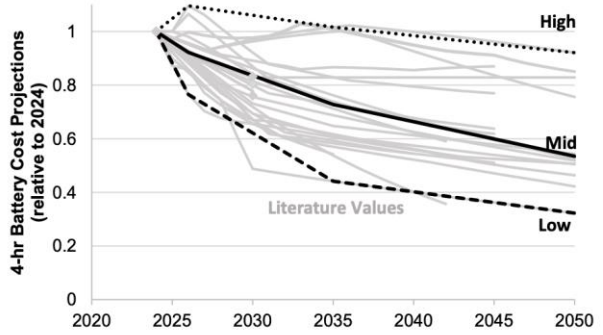


Figure 3. Battery cost projections for 4-hour lithium-ion systems, with values relative to 2024. *The high, mid, and low cost projections developed in this work are shown as bold lines. Published projections are shown as gray lines. Figure values are included in the Appendix.*

Table 2. Values from Figure 3 and Figure 4, which show the normalized and absolute storage costs over time. *Storage costs are overnight capital costs for a complete 4-hour battery system.*

	Normalized Cost Reduction			4-hour Storage Costs (2024$/kWh)		
Year	Low	Mid	High	Low	Mid	High
2024	1.00	1.00	1.00	334	334	334
2025	0.88	0.96	1.05	295	321	350
2026	0.77	0.92	1.10	255	308	366
2027	0.73	0.90	1.09	243	301	363
2028	0.69	0.88	1.08	231	293	360
2029	0.66	0.86	1.07	219	286	357
2030	0.62	0.84	1.06	207	279	354
2031	0.59	0.81	1.05	195	272	351
2032	0.55	0.79	1.04	183	265	348
2033	0.51	0.77	1.03	171	257	345
2034	0.48	0.75	1.03	159	250	342
2035	0.44	0.73	1.02	147	243	339
2036	0.43	0.71	1.01	145	239	337
2037	0.43	0.70	1.00	142	234	335
2038	0.42	0.69	1.00	139	230	333
2039	0.41	0.68	0.99	137	226	331
2040	0.40	0.66	0.98	134	221	329
2041	0.39	0.65	0.98	132	217	326
2042	0.39	0.64	0.97	129	213	324
2043	0.38	0.62	0.97	126	209	322
2044	0.37	0.61	0.96	124	204	320
2045	0.36	0.60	0.95	121	200	318

Updated Scenario Definition

- After adjustments to incorporate the WATT feedback, the proposed definition for the adopted Core Case is as shown below

Alternative Core Case:
No PTC/ITC

NREL "mid cost" case for **solar, wind, Hydrogen, gas**

NREL "low cost" for **geothermal, nuclear, CCS, battery storage, PSH**

- Both the Flux Case and Core Case will use the same updated "low cost" trajectory as a base, with the Flux incorporating tax credits and the Core excluding tax credits.

WestTEC Q3 2025 Schedule

	Jun 30th-Jul 4th	Jul 7th-11th	Jul 14th-18th	Jul 21st-25th	Jul 28th-Aug 1nd	Aug 4th-8th	Aug 11th-15th	Aug 18th-22nd	Aug 25th-29th	Sep 1st-5th	Sep 8th-12th	Sep 15th-19th	Sep 22nd-26th
REC		Jul 10th					Aug 14				Sep 11th		
WATT		Jul 8th		Jul 22nd		Aug 5th		Aug 19th		Sep 2nd		Sep 16th	
Steering	Jul 1st		Jul 15th		Jul 29th		Aug 12th		Aug 26th		Sep 9th		

Sep 23: All-committee in-person meeting

Oct 10 : Public Webinar

Next Steps

- Next in-person all-committee meeting is September 23rd, RSVP will be sent out next week.
- Next Public Webinar is October 10th.
- Any feedback or questions, please email GDS:
  - gillian.biedler@gdsassociates.com
  - kyra.green@gdsassociates.com

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Public Comment