HB212 Advanced Transmission Technologies

Utah Public Service Commission Technical Briefing

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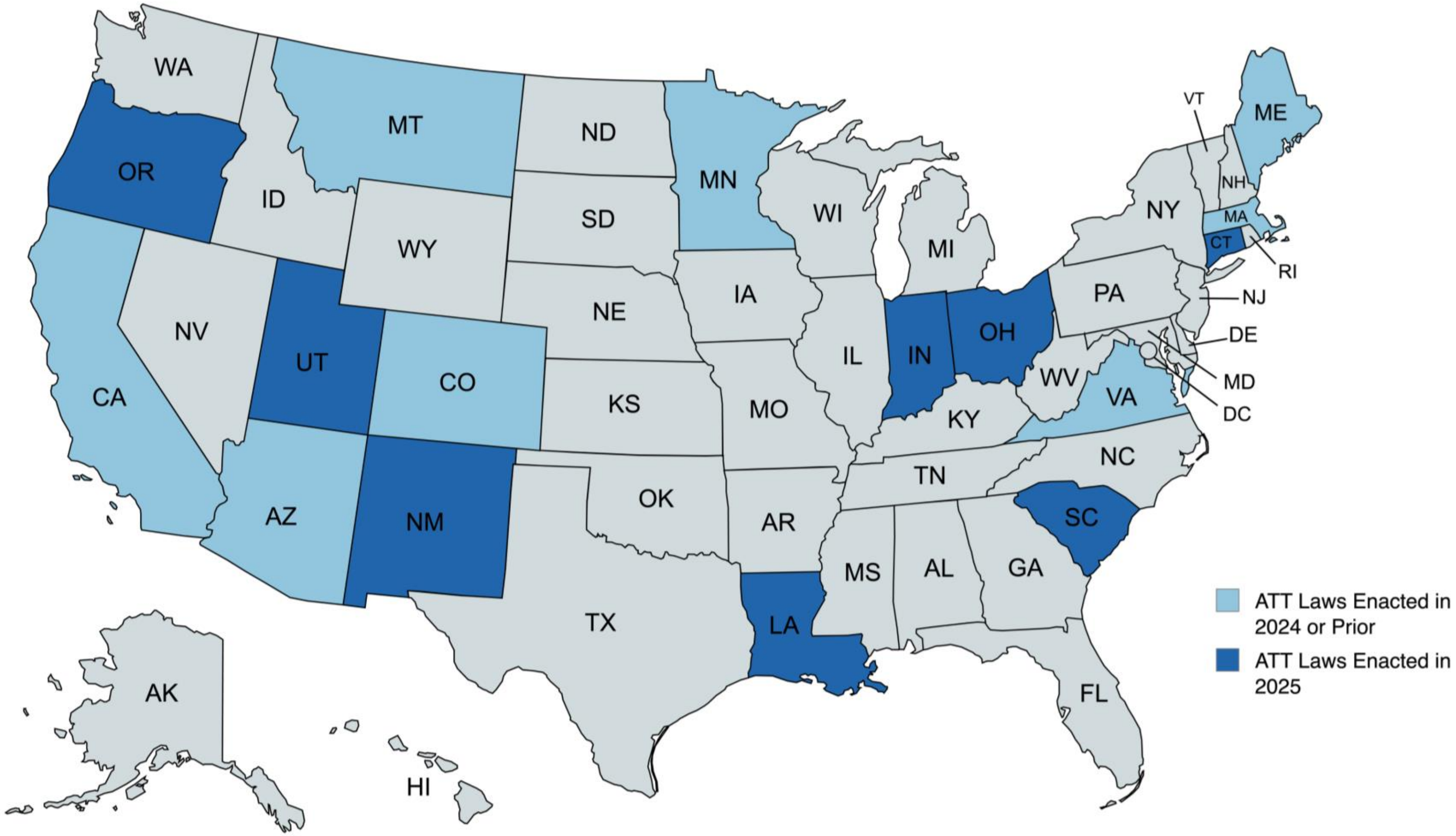
July 15, 2025

Pew

Gov. Cox HB212 Bill Signing

National Look at ATT Legislation



HB 212 Bill – ATT Definitions

54-17-1101. Advanced transmission technologies.

(1) As used in this section:

(a) "Advanced transmission technology" means a technology that increases the capacity, efficiency, or reliability of electric transmission infrastructure.

(b) "Advanced transmission technology" includes:

(i) technology that dynamically adjusts the rated capacity of transmission lines based on real-time conditions;

(ii) advanced power flow controls used to actively control the flow of electricity across transmission lines to optimize usage and relieve congestion;

(iii) software and hardware used to identify optimal transmission grid configurations and enable routing power flows around congestion points;

(iv) advanced transmission line conductors that increase the power transfer capacity of transmission lines; and

(v) energy storage technologies that facilitate energy storage during times of excess generation and discharge of stored energy during times of high demand to support transmission system operation.

HB 212 Bill – Planning Analysis

(2) In an integrated resource plan filing, a general rate case, or other proceeding in which a large-scale electric utility proposes additions or expansions to the transmission system, the utility shall:

(a) analyze:

(i) the cost effectiveness and timetable for deployment of advanced transmission technologies as an alternative strategy to meet electric system needs; and

(ii) whether the technologies would:

(A) increase transmission capacity;

(B) increase transmission efficiency;

(C) reduce transmission system congestion;

(D) reduce curtailment of energy generation resources;

(E) increase reliability;

(F) reduce the risk of igniting wildfire;

(G) increase resiliency; and

(H) increase capacity to connect new energy resources; and

(b) include the analysis described in Subsection (2)(a) in the filing to the commission.

HB 212 – IRP Summary and Cost Recovery

(3) (a) The commission shall encourage the utility to include deployment of advanced transmission technologies in an integrated resource plan.

(b) A large-scale electric utility shall include a summary of its existing and planned advanced transmission technologies in each integrated resource plan filed with the commission.

(4) If the commission determines, based on the analysis provided by the utility under Subsection (2)(a), that the deployment of advanced transmission technologies is cost effective, the commission shall approve the utility's recovery of the prudently incurred costs of the advanced transmission technologies.

Today's Agenda

- **Julia Selker** - Director of Policy and Strategy, Grid Strategies
- **Rikin Shah** - Director of Area Planning and Development, PacifiCorp
- **Max Backlund** – Utah Regulatory Affairs Manager, PacifiCorp
- **Jay Caspary** – Former Southwest Power Pool (SPP) Director - Research, Development & Tariff Services
- **Casey Baker** – Senior Program Manager, GridLab
- 30-minute Discussion

Advanced Transmission Technologies (ATTs)

Julia Selker, Executive Director, WATT Coalition

Zach Zimmerman, AMP Coalition

Why learn about ATTs today?

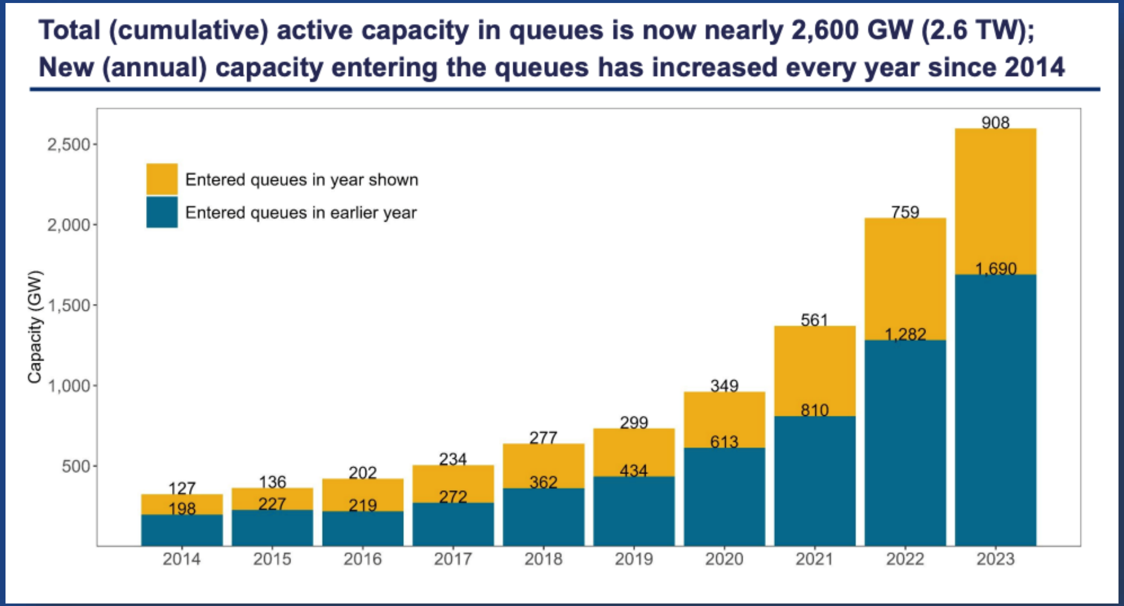
Grid Strategies

Today's grid is *inefficient*

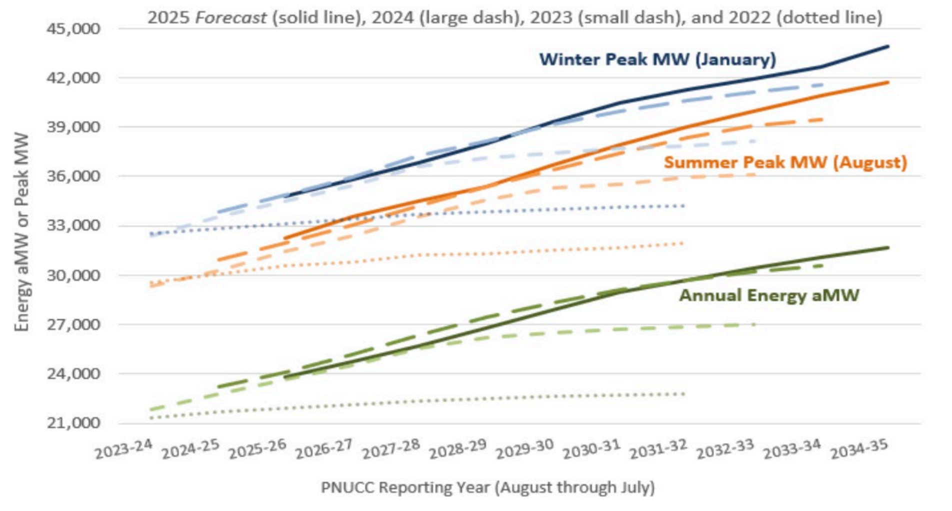
because it is *underutilized*.

Urgent need for transmission capacity

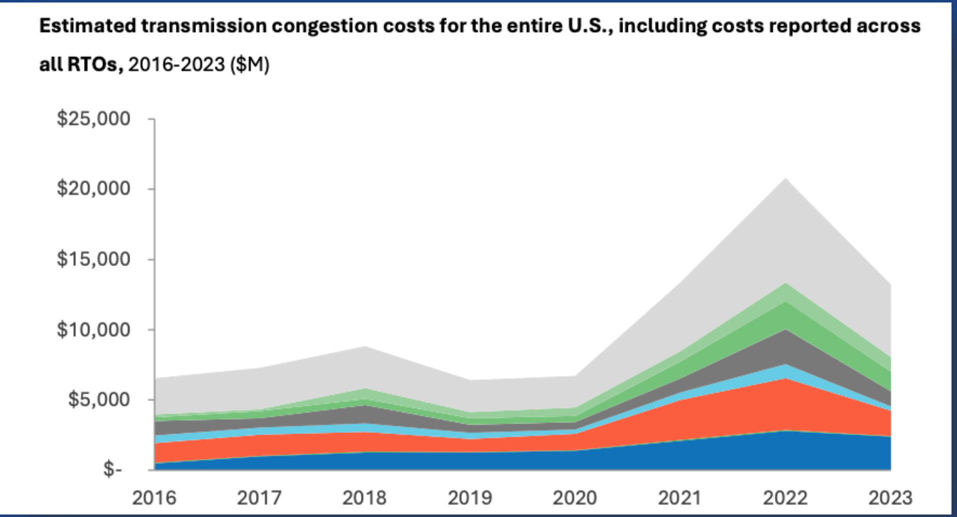
Interconnection



Load growth



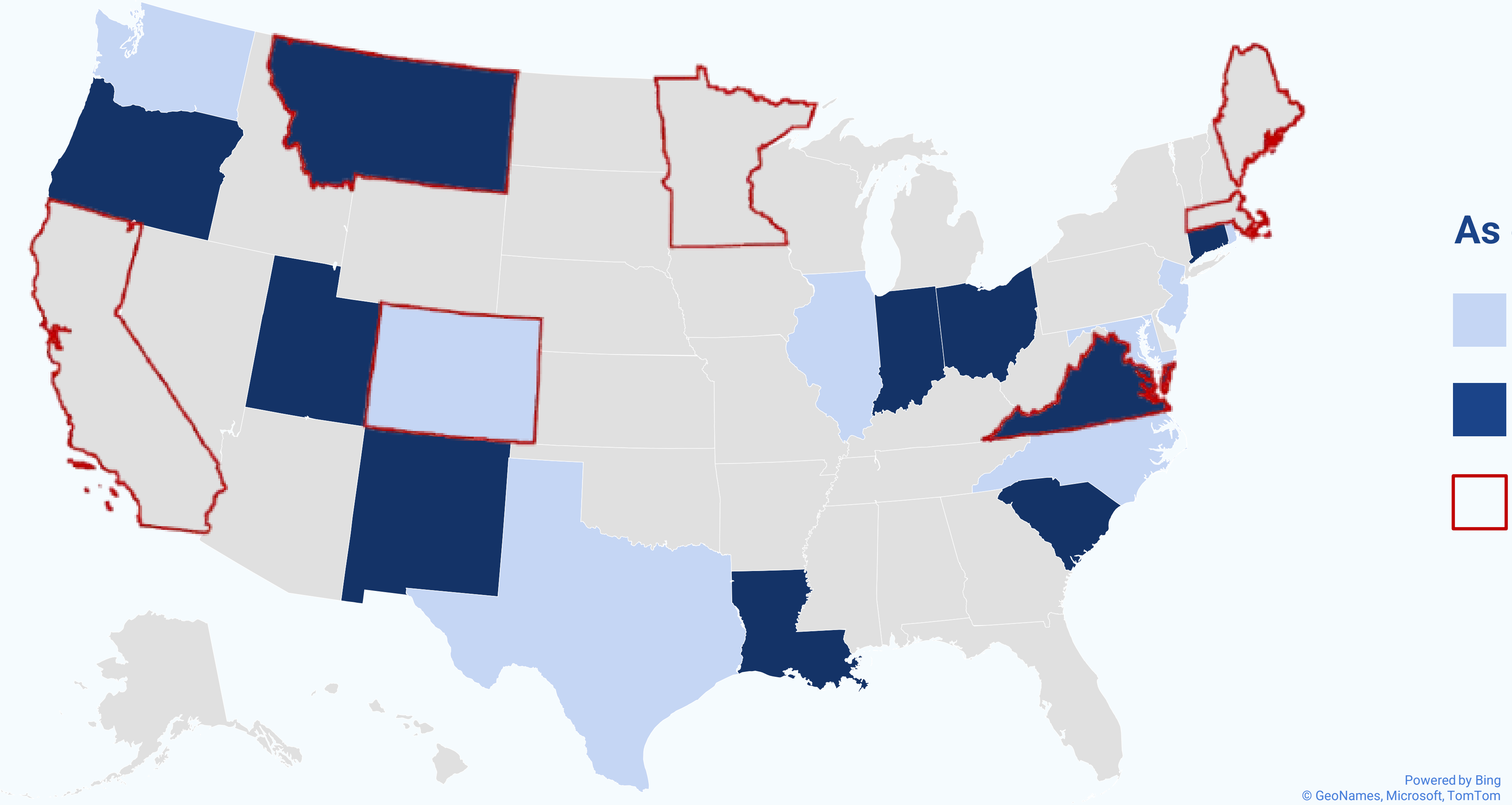
Congestion



Federal policies: Advanced Transmission Technologies

Organization	Federal action	ATTs impact	Date
FERC	Order No. 881	**Line ratings**: Mandates that RTOs accept dynamic line ratings, and utilities use Ambient Adjusted Ratings. RTOs have asked for extensions to July 2025 deadline.	Dec 2021
	Order No. 2023	**Generator interconnection**: Requires the consideration of APFC and HPCs in generator interconnection processes; TTO and DLR as optional. All RTOs submitted compliance filings in May 2024; FERC has not ruled on any compliance filings yet.	Jul 2023
	Order No. 1920	**Transmission planning**: Requires APFC, DLR, HPCs and transmission switching to be studied in regional plans and deployed if it would make transmission assets more cost effective; also includes a “right-sizing” requirement.	May 2024
	DLR ANOPR	**DLR Ruling**: Proposes requirements that transmission owners must deploy dynamic line ratings on highly constrained lines.	Jun 2024

13 states have passed legislation since 2023, and at least 18 states explored ATTs legislation in 2025



As of June 2025:

- Legislation introduced
- Legislation passed & signed
- Previous ATTs legislation passed & signed in 2024 and prior

Grid Enhancing Technologies (GETs)

Grid Strategies

ADVANCED POWER FLOW CONTROL

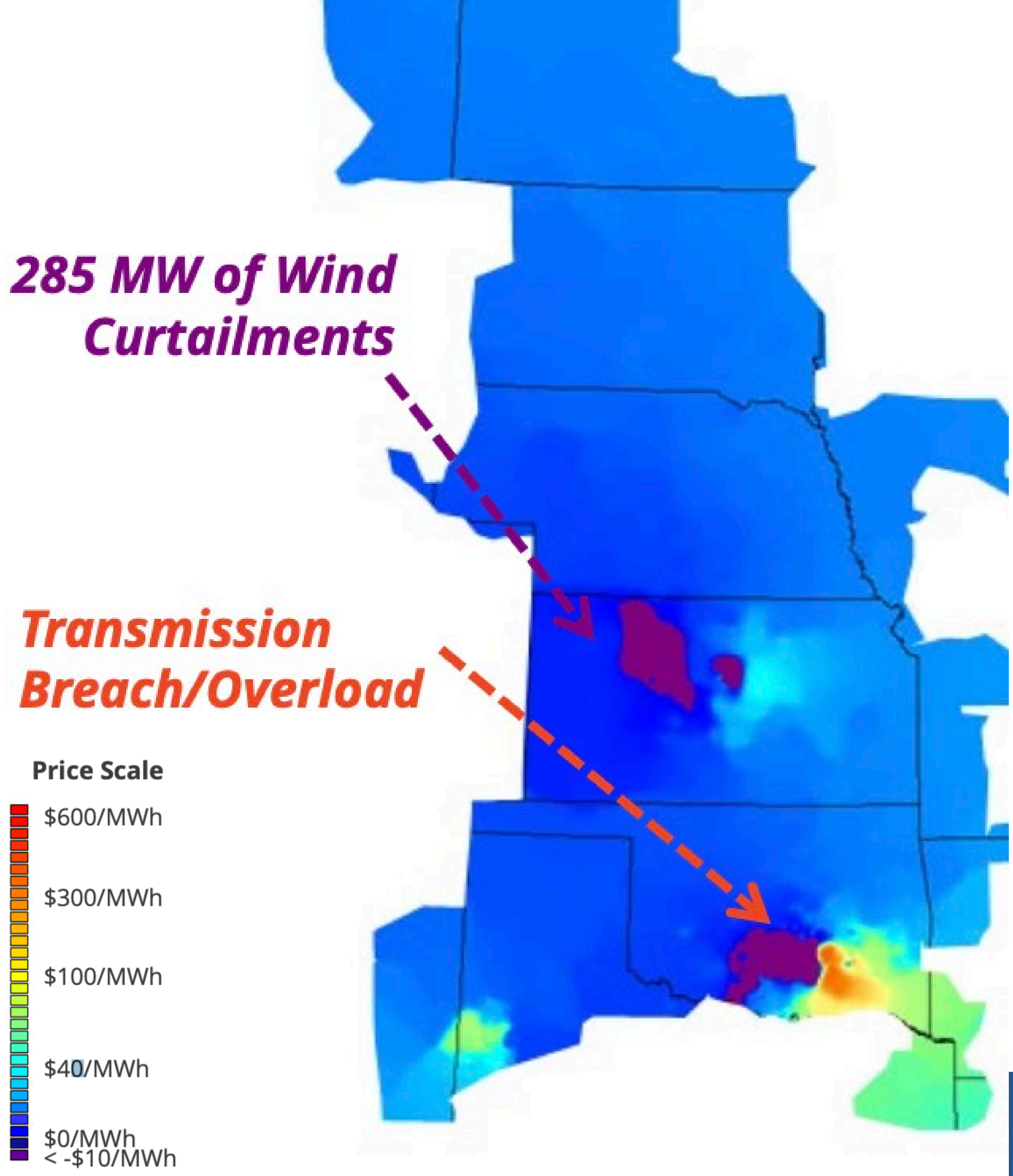
Power flow control technologies actively balance the flow on transmission lines.

DYNAMIC LINE RATING (DLR)

DLR monitors ambient conditions which heat or cool transmission lines to calculate the true capacity of transmission lines, based on their thermal limits.

TOPOLOGY OPTIMIZATION

Software identifies options to increase transfer capacity by redirecting flows.



Reduce grid congestion by 40%

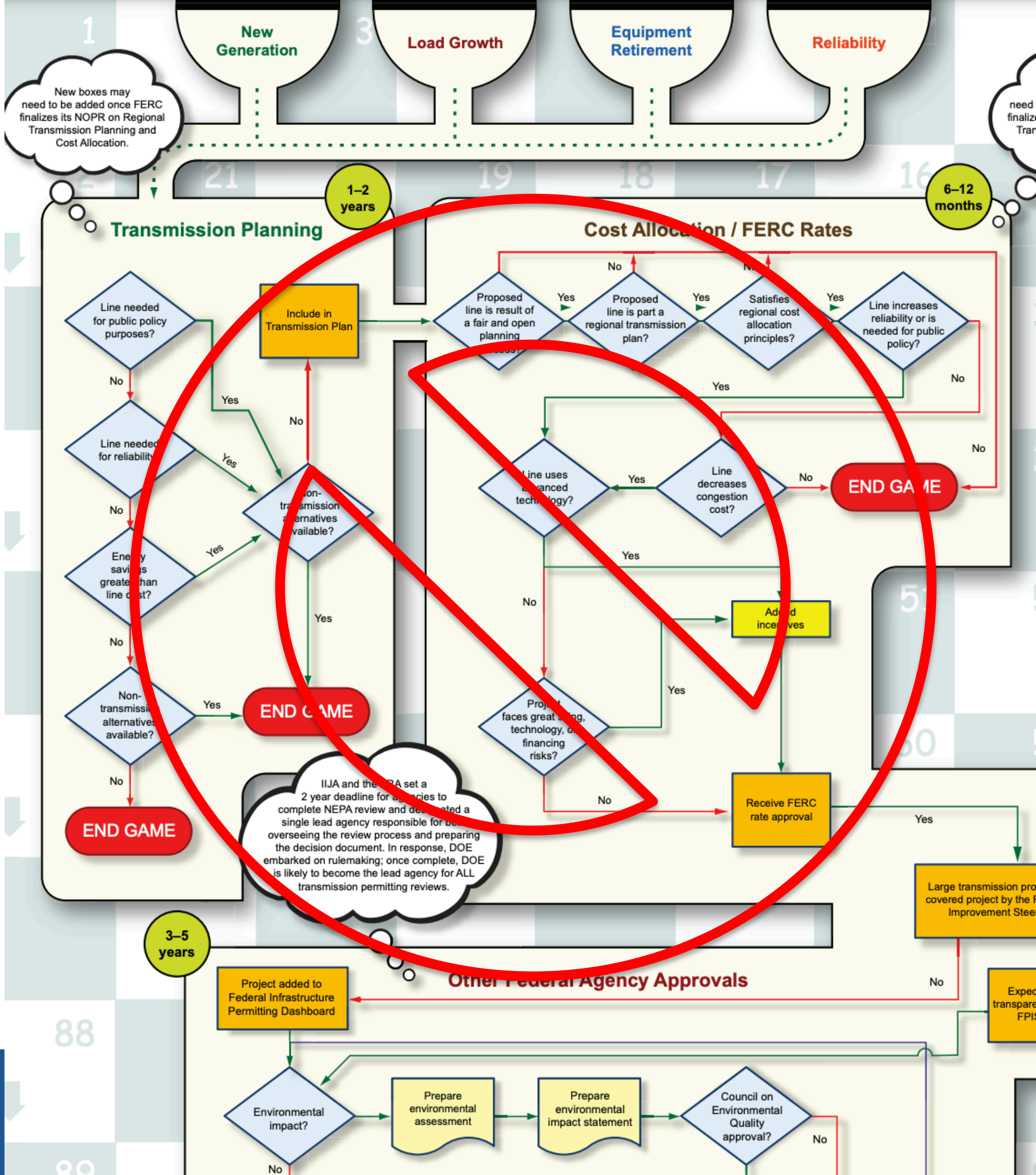
2x clean energy interconnection

NewGrid presentation to FERC

GETs deploy in *months*

For cheap!

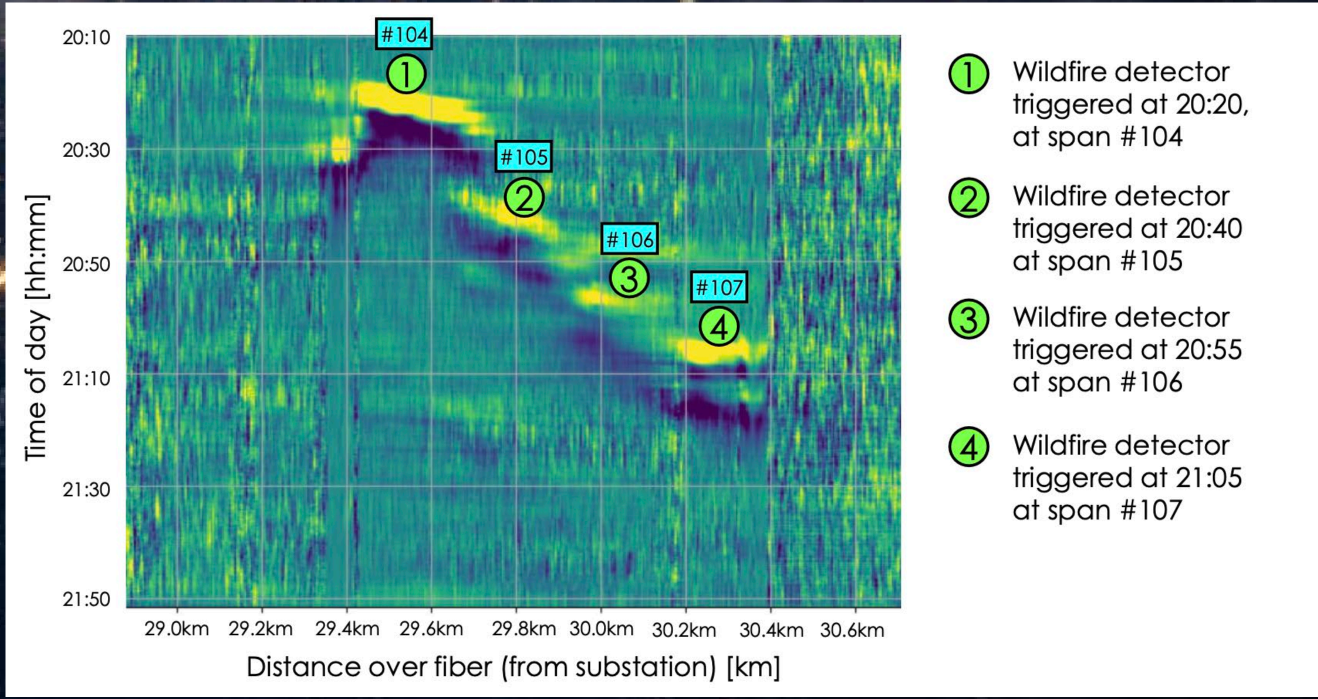
1/20-1/200th the cost



 NEMA 2024, continues for 2 more pages

Benefits of GETs:

Monitoring and control support resilience and reliability.



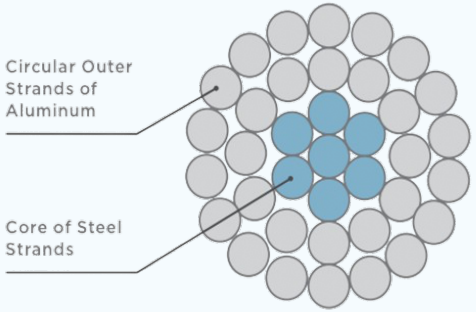
High Performance Conductors (HPCs)

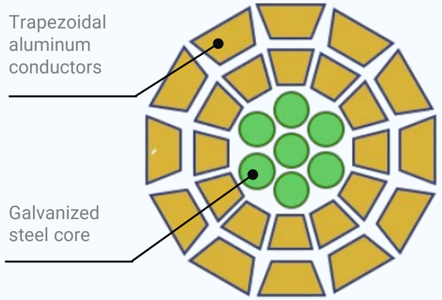
Grid Strategies

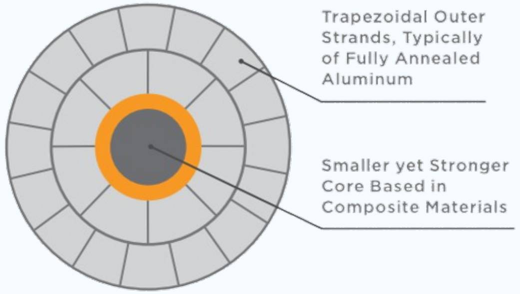
Conductor technology has evolved beyond traditional ACSR/ACSS to “High Performance Conductors” (HPCs)

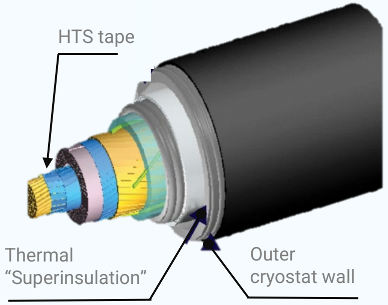
Evolution of conductors

ACSR → **ACSS (RW/TW)** → **HPCs (Carbon/composite core and superconductors)**









	ACSR	ACSS (RW/TW)	HPCs (Carbon/composite core)	HPCs (superconductors)
Additional Capacity *(Compared to ACSR)*		**150-200%**	**150-300%**	**500-1,000%**
Efficiency *(Compared to ACSR)*		**2-20%**	**20-40%**	**50-80%**
Line sag	**Thermal sag**	**Thermal sag**	**10% thermal sag**	**No thermal sag**

High Performance Conductor Benefits

Increased Capacity

- 2x for composite core conductors
- 5x for superconductors

Greater Efficiency

- Composite core conductors can reduce energy losses by 20% +
- Superconductors can reduce losses by 50-80%.

Additional Resilience

- Composite core conductors are stronger and have less thermal sag
- Superconductors are actively cooled and do not vary with ambient temperatures

Reduced Land Impacts

- Reconductoring/rebuilds utilize existing ROWs
- New builds reduce the number of transmission towers and size of ROW

GridStrategies

Reconductoring Potential: National Studies

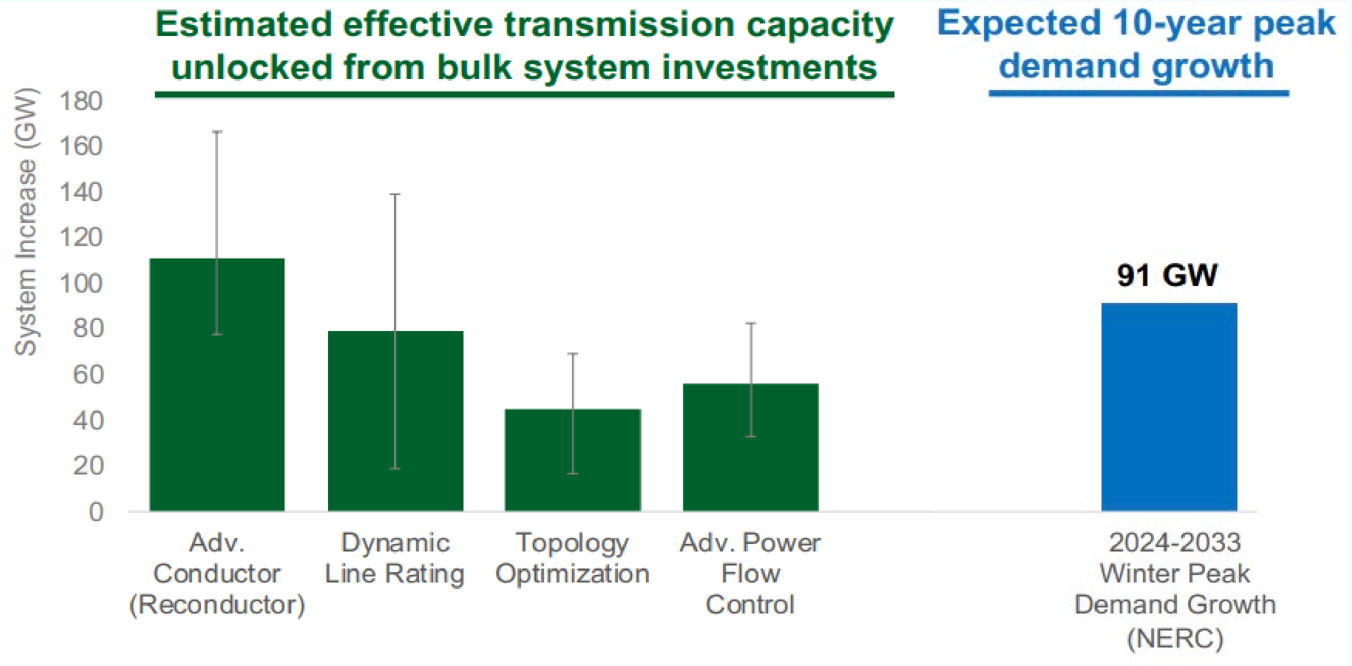
Reconductoring reuses original tower and right-of-way.

- Takes 1-3 years
- Doubles capacity on an existing corridor
- ~ ½ the cost of a new transmission line

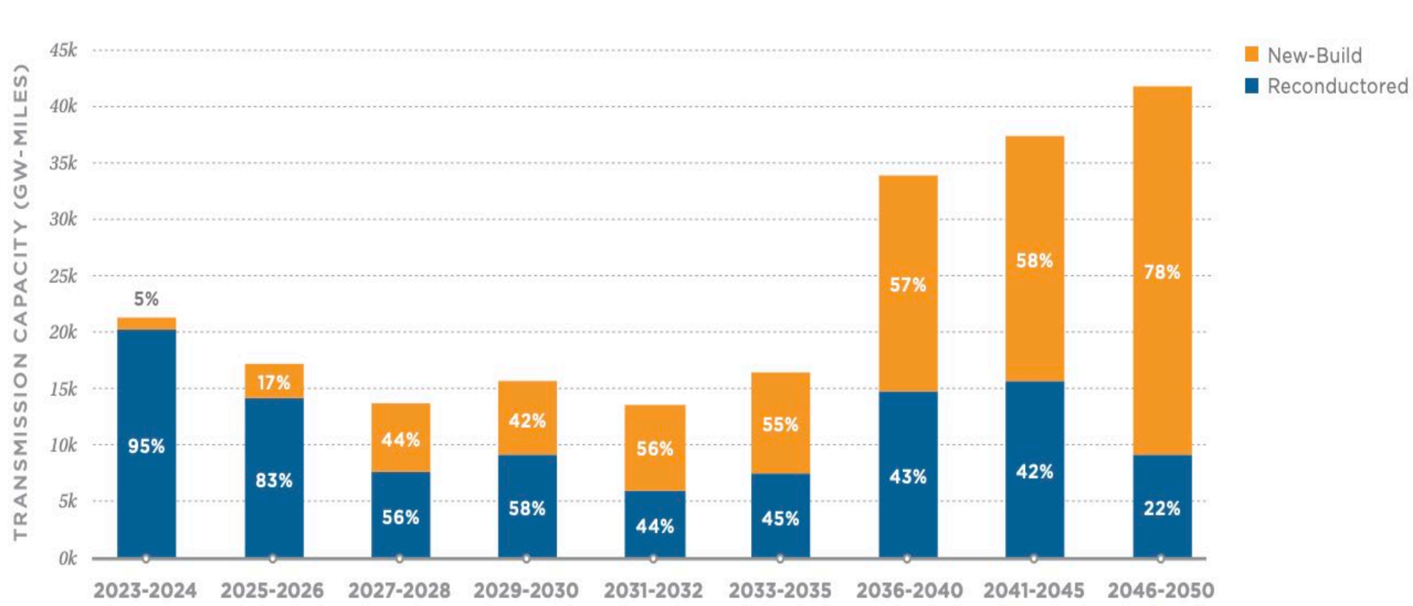
Rebuilds requires replacement of towers to accommodate larger conductors

- Longer process and more expensive
- Up to 10x the capacity

DOE Grid Modernization Report



Transmission Capacity from reconductoring and new-builds



Grid Strategies

SOURCE | GridLab, Reconductoring Technical Report (April 2024); DOE, Pathways to Commercial Liftoff: Innovative Grid Deployment, (April 2024).

Barriers to adoption

Grid Strategies

Barriers to adoption: Education, inertia, incentives, culture

Experience and expertise

New technologies need to get out of utility R&D groups and into many other teams – planning, operations, standards and asset management, etc.

Misaligned incentives

Grid efficiency is not rewarded in cost-of-service business model.

Understanding costs & benefits

HPCs or GETs could add incremental cost to a project, while unlocking transformative benefits.

Thank you!

Julia Selker, Executive Director, WATT Coalition;
jselker@gridstrategiesllc.com

We offer research and advising on

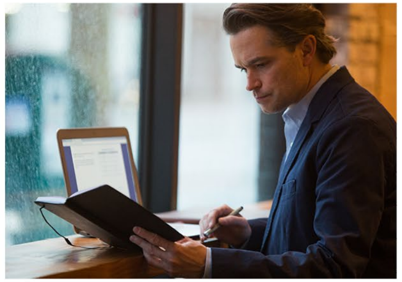
- Clean Energy Integration
- Business & Policy Solutions
- Regulatory Engagement

Founded in 2017, Grid Strategies works on policy to enable decarbonization and an affordable, reliable electricity system.

GridStrategies

Advanced Transmission Technologies(ATT) Technical Briefing

Utah Public Service Commission
July 15, 2025

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Advanced Transmission Technologies (ATT)

- ATT split into two categories
  - Grid Software &
  - Grid Hardware
- Grid Software ATT includes
  - Dynamic Line Rating System (DLR)
  - Topology Optimization
- Grid Hardware includes ATT's such as
  - Advanced Conductors & cables
  - Advanced Powerflow Controllers
  - Flexible AC Transmission Systems (FACTS)

PacifiCorp Existing Installations of ATT

- PacifiCorp has been implementing ATT in both the Grid Software & Grid Hardware form prior to recently established regulatory requirements
- The list below shows the existing installations of different ATT in PacifiCorp transmission system

ATT	# of existing installations
DLR	2
Advanced Conductors – ACCC	12 (approximately 49 miles)
Advanced Conductor – ACSS	30 (approximately 256 miles)
FACTS Devices – Series Capacitors	15
FACTS Devices - Static VAR Compensators (SVC) & STATCOM	5 (4 SVC and 1 STATCOM)

PacifiCorp proposed Installations of ATT

- PacifiCorp is actively proposing installation of ATT in form of reconductoring with advanced conductors as network mitigation to resolve reliability issues identified in different forms of network analysis
- Below is an example list of proposed installations of advanced conductor
  - Reconductor approximately 5 miles of 138 kV line with 530 ACCC Laredo conductor
  - Reconductor approximately 49 miles of 345 kV line with bundled 2x1222 ACCC conductor
  - Reconductor approximately 9.5 miles of 138 kV line with 1026 ACCC conductor
  - Reconductor approximately 60 miles of 345 kV line with bundled 2X1026 conductor

Benefits/Challenges with ATT

- Benefits
  - Provides good operational flexibility
  - Provides short term solution where implementing a long term solution may take time (such as building a new line)
  - Helps balancing the system with operational flexibility
  - Avoids congestion of lower magnitudes
- Challenges
  - Implementation and effectiveness of ATT dependent on system location/strength(e.g. DLR in wind rich area)
  - Equipment and communication failure on a DLR system resulting in derates during heavy transfer conditions
  - Facility rating and limiting elements other than the line conductor such as breakers and switches
  - Ongoing operations cost for data management and Incompatibility among different vendors
  - Modeling considerations in planning studies due to absence of futuristic forecast data 10 and 20 years out or regulation that allow transmission planner to use historical data for lines equipped with ATT
  - Absence of the available warranty for continuous operation of the High Temperature Low Sag conductor or the ACCC conductor at higher temperature without the loss of the life and degradation of the core strands. **This results in limiting the use of the advanced conductors for outage conditions only and limiting the advanced conductor's exposure to less time at higher temperatures**
  - Due to age of the transmission frequently the reconductoring projects using ATT requires significant amount of tower replacements increasing the overall cost of the project

Value and Potential for Advanced Transmission Technologies

Jay Caspary, Principal, TransGrid Advisors LLC

Utah Public Service Commission

July 15, 2025

Background

Major transmission expansion within, between and across regions are essential to capture diversity, resource adequacy and resilience benefits of an effective and efficient grid.

Advanced Transmission Technologies (ATTs) offer a near-term solution to **accelerate generation and load additions** while long-lead transmission upgrades are underway.

ATTs provide **critical situational awareness** that can enhance real-time grid operations and reliability.

ATTs can **improve the benefit–cost ratio** of long-term transmission portfolios by unlocking more value from existing infrastructure.

Study: The Brattle Group, Unlocking the Queue

Unlocking the Queue

Study Outline

- The SPP GI Queue shows over 9 GW of new generation with signed Interconnection Agreements (IA) awaiting in the KS/OK region.
- Can GETs (Dynamic Line Ratings, Advanced Topology Optimization, and Advanced Power Flow Control) help integrate these projects?
- Analysis performed for test year of 2025 (not enough time to build new transmission).
- Analysis looks at the combined benefits of the 3 GETs.

Slides following are excerpted from the full report.
The full report is available at: https://watt-transmission.org/2021/02/22/unlocking-the-queue/

Study Results - 1/4

GETs enable more than twice the amount of additional new generation to be integrated.

- Potential Generation Considered: 9,430 MW
  - Based on queue projects with IA executed.
- Integrated Generation (without further transmission upgrades)
  - Base Case: 2,580 MW
  - With GETs Case: 5,250 MW
  - Delta (With GETs Case – Base Case): 2,670 MW

GENERATION POTENTIAL ASSUMED FOR KANSAS AND OKLAHOMA

State	Wind	Solar	Total
Kansas	3,410	120	3,530
Oklahoma	5,760	140	5,900
Total	9,170	260	9,430

[Rounded to the nearest 10 MW]

~1.5 times the amount of wind SPP integrated in 2019 (1.8 GW).

ADDITIONAL GENERATION INTEGRATED

State	Base Case			With GETs Case			Delta (GETs - Base)		
	Wind	Solar	Total	Wind	Solar	Total	Wind	Solar	Total
Kansas	1,710	0	1,710	1,910	0	1,910	200	0	200
Oklahoma	770	100	870	3,200	140	3,340	2,430	40	2,470
Total	2,480	100	2,580	5,110	140	5,250	2,630	40	2,670

X2

[Rounded to the nearest 10 MW]

Slides excerpted from the full report, available at https://watt-transmission.org/2021/02/22/unlocking-the-queue/

Study Results - 2/4

GETs utilized in this study include:

- **Hardware solutions**: DLR on 56 lines and Advanced Power Flow Control on 8 locations.

Hardware Solutions by Voltage Level	345	230	161	138	115	69	Total
DLR*	10	3	11	22	3	7	56
Advanced Power Flow Control	3	0	4	1	0	0	8

- **Software solutions**: 204 unique Topology Optimization reconfigurations, averaging 13 per snapshot.**

Software Solutions by Voltage Level	345	230	161	138	115	69	Total
Lines	20	10	31	75	4	30	170
Substations	4	0	1	1	0	0	6
Transformers (high voltage terminal)	10	1	4	13	0	0	28

- Estimated costs for implementing the above GETs: ~$90 million.
  - Initial investment costs is estimated to be around $90 million.***
  - Ongoing costs of around $10 million per year.***

* Every DLR installation requires 15 to 30 sensors.

** Average actions represent the average number of actions that remain per case, not actions per hour. Based on other studies the average number of actions per hour is expected to be smaller, typically less than the number of topology changes due to planned outages.

*** Costs can vary project by project, and also on how the GETs service is provided—for example, Topology Optimization can be provided as a software subscription service to reduce the initial cost. We also assume utilities can incorporate these technologies without large costs.

Study Results - 3/4

GETs enable more than twice the amount of additional new generation to be integrated.

- Additional generation enabled by GETs: **2,670 MW / 8,776 GWh**.
  - 2,630 MW of **new wind** is assumed to produce over 8,640 GWh of energy per year.
  - 40 MW of **new solar** is assumed to produce about 60 GWh of energy per year.
  - GETs lower curtailment of **existing wind** by over 76,000 MWh per year.
- GETs installation cost is about $90 million.
  - Annual O&M costs is estimated to be around $10 million.
- GETs benefits (other than the value of additional generation) include:

ANNUAL PRODUCTION COST SAVINGS

$175 million

ANNUAL REDUCED CARBON EMISSIONS

3 million tons

Additional Generation enabled by GETs

2,670 MW / 8,776 GWh

LOCAL JOBS

650 long-term jobs and
11,300 short-term jobs

OTHER LOCAL BENEFITS

$15 million land lease and
$32 million tax revenues per year

Study Results - 4/4

Potential Nation-Wide Benefits

Extrapolating these results to a nation-wide level* indicate GETs to provide **annual benefits** in the range of:

- Over **$5 billion** (~$5.3 billion) in production cost savings.
- About **$1.5 billion** in local benefits (local taxes and land lease revenues).
- More than **330,000** short-term (only for first year) and nearly **20,000** long-term jobs.
- Investment cost is $2.7 billion (only for first year). Ongoing costs would be around $300 million per year.
- $90 million tons of reduced carbon emission (more than enough to offset ALL NEW automobiles sold in the U.S. a year).

Local Interconnection Benefits

$90 million investment enables interconnecting nearly 2,700 MW of additional generation.

- Would developers agree to pay for (or share some cost of) this?
- $90 million to interconnect 2,700 MW = Less than $34/kW.
- The average capital cost for onshore wind today is around $1,500/kW.
- $34/kW is only **~2% of this estimated capital cost** ($1,500/kW).

* EIA shows 2019 generation in Kansas and Oklahoma combined (136 TWh) was about 1/30 of the nationwide generation from utility-scale resources (4,100 TWh). EIA data, available at: https://www.eia.gov/electricity/state/kansas/, https://www.eia.gov/electricity/state/oklahoma/, and https://www.eia.gov/electricity/annual/html/epa_01_01.html

Study: Grid Strategies LLC, Advanced Reconductoring on Existing Transmission Lines

200,000+

miles of transmission line will need replacement across NERC Regions over the next 10 years...

...however, ISOs/RTOs have few planned reconductoring projects, and the majority are expected to use conventional conductors

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High Performance Conductors can help during...

1. **Reconductoring**: Replacing a conductor (wire) on an existing transmission or distribution structure
2. **Rebuilds and new transmission construction**: Low-sag characteristics allow for fewer or shorter towers

Key findings: Impacts from incremental capacity created by HPCs operating at higher temperatures

27 GW	of new generation capacity can be added every year over the next decade by reconductoring with HPCs on 25% of the 200,000 miles of transmission lines that need replacement*
21 million MWh	in reduced annual transmission line losses, which also helps lower total system peak demand by 5.9 GW
$140 billion	or more in savings for US customers over the next decade

*Assumptions: 5,000 miles of transmission reconductored annually. These projects break down into 100 50-mile projects that are each capable of providing an additional 200 MW of capacity.

Recommendations for transmission planners/owners and state regulators

Transmission planners and owners should:

- Integrate High Performance Conductor evaluations into all transmission expansion and interconnection plans and studies.

State regulators should:

- Require utilities to provide analyses on the opportunities for deploying state-of-the-art transmission technologies, including High Performance Conductors.
- Shift their evaluations from “least cost” to “maximum net benefits” when reviewing technology options for long term plans. Holistic assessments are paramount to consider life-cycle cost impacts.

Study: The Brattle Group, Incorporating GETs and HPCs into Transmission Planning Under FERC Order 1920

FERC Order 1920 requires transmission providers to develop long-term transmission plans

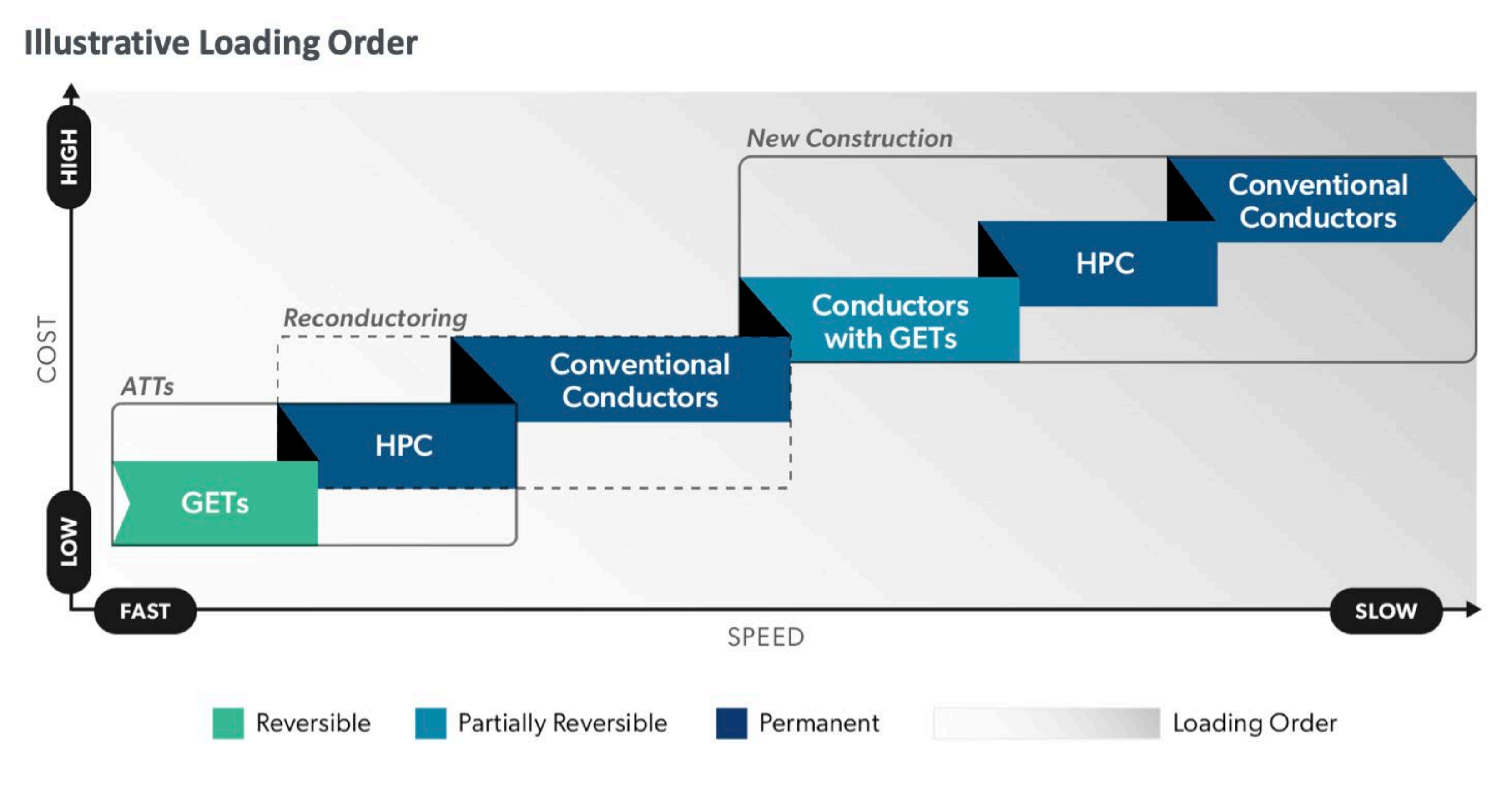
Transmission providers must quantify at least **seven reliability and economic benefits:**

1. Avoided / deferred transmission & aging infrastructure Investments
2. Loss of load probability and reduced planning reserve margins
3. Production cost savings
4. Reduced transmission losses
5. Reduced congestion due to transmission outages
6. Mitigation of extreme weather
7. Capacity cost benefits from reduced peak energy losses

	Technology	*Benefits*						
		1	2	3	4	5	6	7
1: DNV-GL PJM Study	APFC	x		x				
2: DOE Lift-off Report	GETs	x						
3: SCE HPC and Transmission Towers	HPC	x						
4: NY DLR	DLR	x						
5: DOE GETs Report	DLR, APFC	x						
6: 2018 "Bomb Cyclone" and DLR	DLR (AAR)		x				x	
7: SPP Winter Storm Jupiter	TS		x				x	
8: SPP Winter Storm Elliot	TS		x				x	
9: HPC Design and History	HPC						x	
10: Brattle SPP GETs Study	DLR, TS, APFC			x	x			
11: RMI PJM GETs Study	DLR, TS, APFC			x				
12: Transmission Switching Studies	TS			x			x	x
13: GRE DLR	DLR			x				
14: ELIA DLR	DLR			x				
15: Hydro Quebec Conductors Comparison	HPC				x			
16: APFC 2015	APFC					x		
17: EPM and AFC	APFC					x		
18: Transmission Switching Study	TS					x		
19: PJM Winter Storm Elliot	DLR						x	
20: Nevada Energy HPC	HPC						x	
21: Oklahoma Gas and Electric HPC	HPC						x	
22: California Wildfire and HPC	HPC						x	
23: Canada Icing and HPC	HPC						x	
24: Southeastern U.S. and HPC	HPC						x	
25: New York Phase Angle Regulators	APFC, TS							x

Example "Rule of Thumb" approaches to evaluating transmission solutions

- **Size**: Prioritize GETs for transfer increase needs of <20% and HPCs >50% when "right-sizing" opportunities are observed.
- **Timing**: Prioritize GETs for immediate needs
- **Cost thresholds**: Pre-screening cost threshold based on a potential solution's likelihood of producing certain monetizable *Benefits*, by analyzing historical and market data



Conclusions and further resources

Key insights from recent studies on GETs and HPCs

1. **Resource agnostic conclusions**: Most studies find that GETs and HPCs support accelerated integration of all resource types — including thermal generation resources – not just renewables.*

2. **Transferable to large loads**: The same tools used to assess GETs and HPCs for generation interconnection can be readily applied to evaluate their benefits for major load additions (e.g., data centers).

* Lone exception would be of the value of DLR facilitating the integration of local wind resources given strong correlation between wind turbine output and cooling impacts on conductor loadability.

Conclusions

1. **ATTs are proven:** These technologies have been deployed successfully and integrated into grid operations for decades. While standards are important, the definition of "Advanced Conductor" should not create confusion.
2. **Barriers are institutional:** Barriers to broadscale implementation of ATTs are policy, planning, and organizational inertia
3. **Documentation is abundant:** Case studies, deployment roadmaps, and planning guidelines are readily available to support implementation.
4. **Collaboration is active:** Multiple industry forums and working groups exist to share lessons learned and best practices.
5. **Progress shouldn't wait for perfection:** Ongoing innovation in ATTs is valuable but should not delay prudent near-term deployments.
6. **Planning must evolve:** Data from deployed ATTs should be used to improve long range transmission planning

Resources by author

ACORE

- Brattle report on how GETs and HPCs can be incorporated into transmission planning under Order 1920 and provide the seven delineated benefits
- Playbooks for Policymakers on GETs and HPCs
- Electric Power Engineers technical report on Assessment and Evaluation of GETs

AMP Coalition

- Grid Strategies and ACORE study showed reconductoring with HPCs could add 27 GW of new generation annually

EPRI GET SET Initiative

- Dedicated webpage with white papers just posted on applications and opportunities for individual GETs

ESIG GETs User Group

- Report forthcoming, end of July 2025

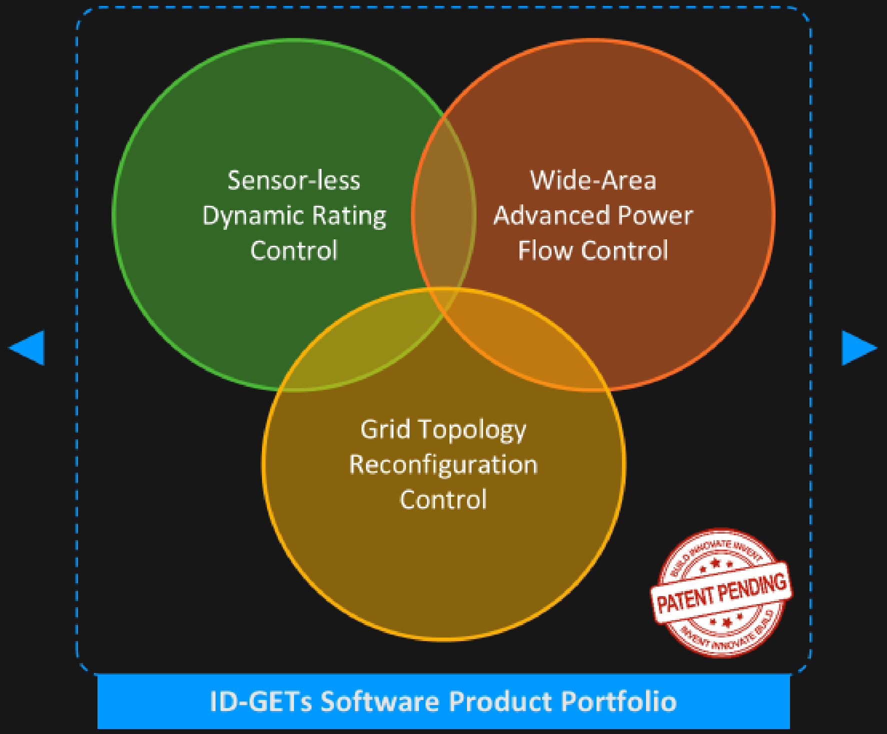
WATT Coalition

- Brattle study showed GETs could double capacity for new generation, without new lines

Appendix

Software that optimizes across GETs can help address grid congestion issues

For Addressing
Grid Congestion Issues in
Long-Term Grid Planning



For Addressing
Grid Congestion Issues in
Short-Term Grid Operations

GridAstra

An example of GETs optimization software in interconnection planning

***FUSION-T* Interconnection Planner**
(using ID-GETs)

1 POI Capacity Analysis

DFAX-based Incremental Power Injection Analysis

2 Steady State Cluster Study Analysis

Powerflow & Contingency Analysis

3 GETs-based Line Overload Mitigation Analysis

ID-GETs Analysis based Automated Suggestions for optimally placing and using APFCs in co-ordination with Grid Topology Reconfiguration

4 FERC 2023 Compliance

GETs Analysis is now mandated by FERC as a part of Generation Interconnection Studies

A Real World Example: Mitigation of Thermal Line Overloads caused by a Hybrid Project (Solar + BESS) of a Developer in MISO

Case-1: Thermal Line Overload Mitigation using Conventional Network Upgrades

Description	Value
Interconnection Project (Solar + BESS) Proposed Generation	~ 300 MW
No. of Lines Overloaded by the Hybrid Project	**10**
No. of Line Rebuilds for Line Overload Mitigation	5
No. of Line Reconductoring for Line Overload Mitigation	5
No. of GETs-based Devices for Line Overload Mitigation	0
Total Cost of Network Upgrades	***~ $151 Million***

v/s

Case-2: Thermal Line Overload Mitigation using GETs (suggested by ***FUSION-T*** **Interconnection Planner**)

Description	Value
Interconnection Project (Solar + BESS) Proposed Generation	~ 300 MW
No. of Lines Overloaded by the Hybrid Project	**3**
No. of Line Rebuilds for Line Overload Mitigation	3
No. of Line Reconductoring for Line Overload Mitigation	0
No. of GETs-based Devices for Line Overload Mitigation	**3**
Total Cost of Network Upgrades (Estimated)	***~ $68 Million***

3 APFCs
In Inductive Reactance Compensation Mode

~28 %
Line Overload MVA Rerouted through Less Loaded Lines

~70 %
Reduction in No. of Network Upgrades

~55 %
Reduction in Network Upgrade Costs

Advanced Transmission Technologies

Utah H.B. 212

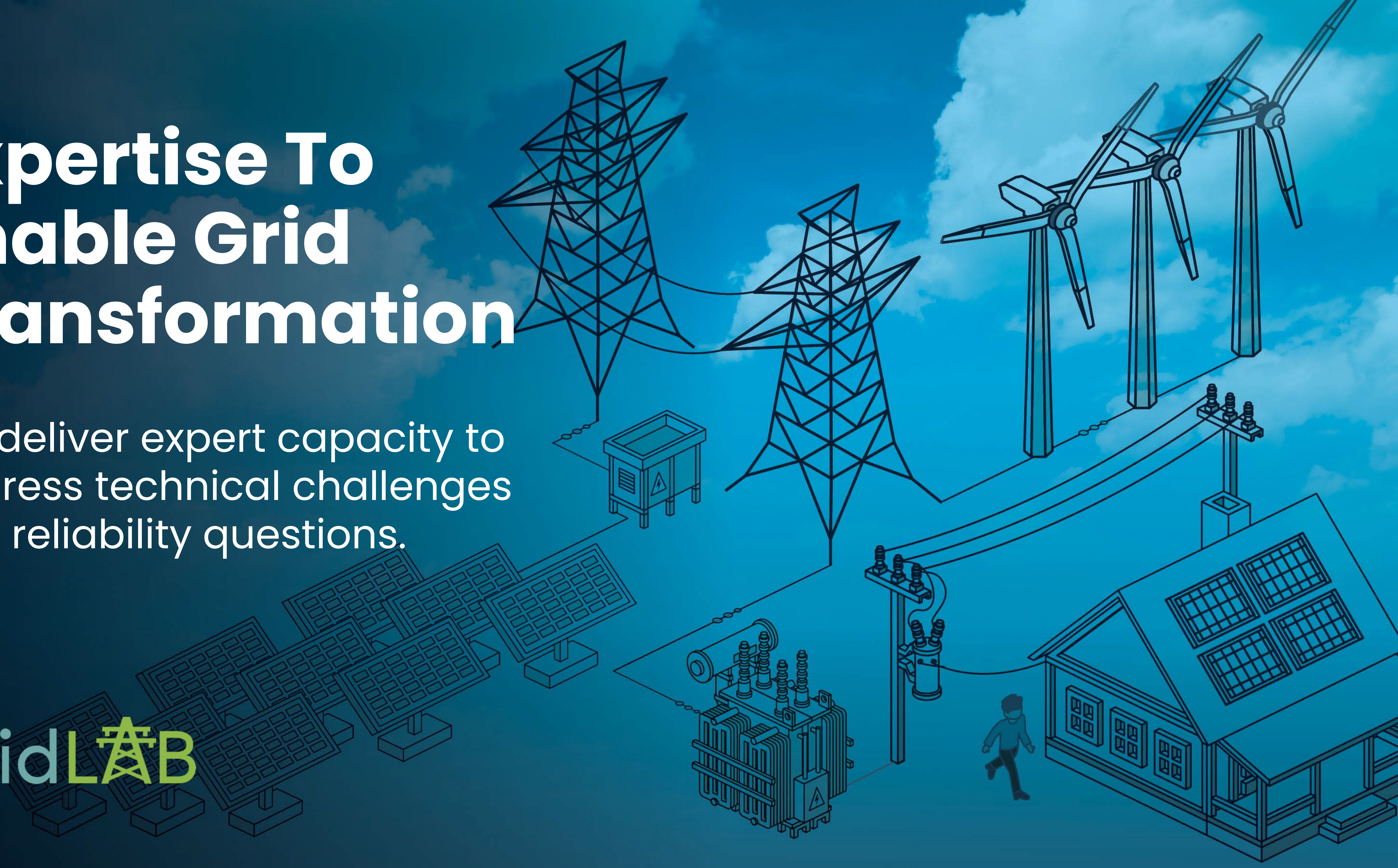
Casey Baker

July 15, 2025

GridLAB

Expertise To Enable Grid Transformation

We deliver expert capacity to address technical challenges and reliability questions.



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Operation Gigawatt

Operation Gigawatt will secure Utah's energy abundance through four key goals:

- Increasing transmission capacity so more power can be placed on the grid and moved to where it's needed.
- Expanding and developing more energy production. This includes investing in what we currently have while developing new sustainable sources.
- Enhancing Utah's policies to enable clean, reliable energy like nuclear and geothermal.
- Investing in Utah innovation and research that aligns with our energy policies.

https://energy.utah.gov/wp-content/uploads/Operation-Gigawatt-Press-Release.pdf

Utah HB 212

"Advanced transmission technology" means a technology that increases the **capacity**, **efficiency**, or **reliability** of electric transmission infrastructure.

(i) technology that dynamically adjusts the rated capacity of transmission lines based on real-time conditions;

(ii) advanced power flow controls used to actively control the flow of electricity across transmission lines to optimize usage and relieve congestion;

(iii) software and hardware used to identify optimal transmission grid configurations and enable routing power flows around congestion points;

(iv) advanced transmission line conductors that increase the power transfer capacity of transmission lines;

(v) energy storage technologies that facilitate energy storage during times of excess generation and discharge of stored energy during times of high demand to support transmission system operation.

Use the right tool for the job…

ADVANCED TRANSMISSION TECHNOLOGY	DEVELOPMENT TIME	TYPICAL CAPACITY INCREASE	PERMITTING SPEED	DESIGN SPEED	CONSTRUCTION SPEED	VIABLE OPPORTUNITIES	COST
GETS including Dynamic Line Ratings	3+ MONTHS	10-30%	green	green	green	MOST	$
(FACTS) Flexible AC Transmission Systems	8-18 MONTHS	30-50%	green	orange	yellow	MORE	$$
Reconductoring w/ Advanced Conductors	18 - 36 MONTHS	50-110%	yellow	yellow	yellow	MOST	$$
Tower Raising	2-4 YEARS	10%	orange	yellow	yellow	LEAST	$$
Double Circuit Towers	2-4 YEARS	80-100%	orange	yellow	orange	MOST	$$$
Advanced Tower Design	2-4 YEARS	30-100%	orange	orange	orange	MOST	$$$
Voltage Uprate	3-5 YEARS	100-300%	orange	orange	red	LEAST	$$$
HVDC Conversion	5-7 YEARS	100-300%	orange	red	red	LEAST	$$$$
Greenfield Transmission	5-15 YEARS	N/A	red	red	red	LEAST	$$$$

Address the Bottlenecks

Planning/ Technical
- Data gaps
- Long Lines
- Structure Health

Institutional
- Equipment Standards/ Procurement
- Workforce Shortages
- Training

Coordination
- Outages
- Lack of Standards
- Supply Chain Shortage

Permitting
- Limited Space for Construction
- Lack of permitting clarity
- Can trigger new permitting concerns

Cost
- "Gold Plating"
- High upfront cost
- Regulator education

NV Energy

NV Energy has **installed more than 125 miles of composite core conductors over 25 lines** in Nevada to increase the capacity of existing transmission corridors, reduce sag for public safety, and allow for rapid load growth.

NV Energy started using HPCs in 2009 on a 115 kV reconductor project to avoid replacing existing structures.

After using HPCs over the past 15 years, **NV Energy crews now prefer working with HPC to bundled ACSR**, and projects using HPCs have faster construction timelines.

Equipment Standards/ Procurement

Training

Wildfire burned the poles to the ground but HPC stayed intact

Source: CTC Global
https://ctcglobal.com/video-library/

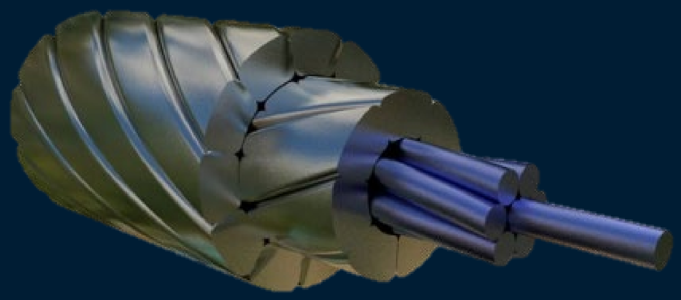
Evergy

In 2003, KCP&L (predecessor to Evergy) performed a **<u>energized reconductoring</u>** of the LaCygne to Stillwell line using ACSS/TW on a 345kV 32-mile line.

The cost savings of the added transmission capacity paid for the cost of the upgrade in 14 months.

Outages

High upfront cost



Source: Idaho National Labs
https://inl.gov/content/uploads/2024/02/23-50856_R4a_-Use-Case-Studies.pdf

Lower Rio Grande Valley Reconductoring Project (Texas)

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Outages

Long Lines

The southeastern Texas Lower Rio Grande Valley reconductoring project 2016, involved reconductoring **two 345 kV 120- mile transmission lines** while energized with composite core conductor. The **project increased the summer peak rating by 75 percent.**

Conventional solutions such as new lines were considered but were seen as too risky due to permitting delays.

Energized reconductoring of the line emerged as the only option, which did not require time-intensive permitting for new land acquisition.

National Grid

Structure Health

Can trigger new permitting concerns

In 2018, NG rebuilt the Somerset-Fall River line which had originally been constructed in 1923. In addition to being 100 years old, the very large structures were occupying a large amount of valuable real estate on the Taunton River.

During the rebuild, smaller structures were used that not **only took up less space on the ground but were also considerably shorter**, which reduced the risk to aviation.

To enable the **shorter, smaller structures**, NG used a composite core conductor

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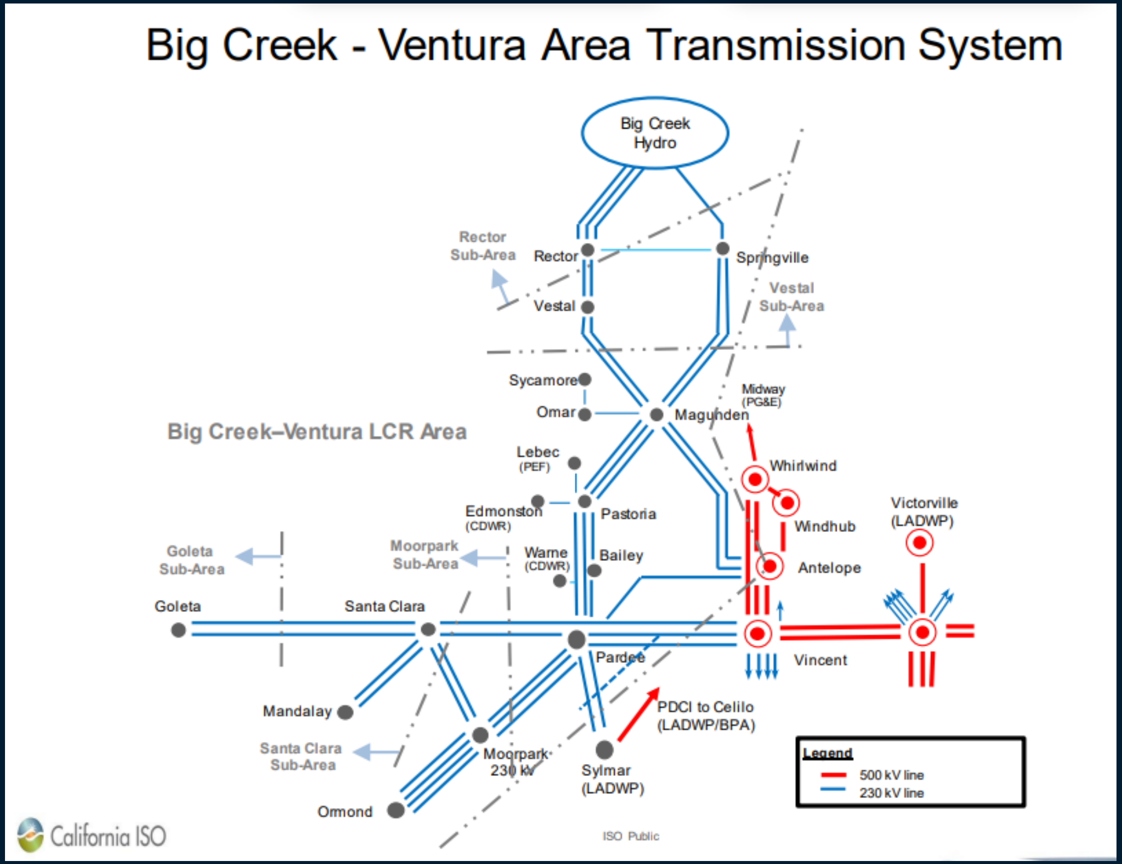
Southern California Edison

Structure Health

Lack of permitting clarity

Pursued the Big Creek Corridor Upgrade (220 kV) for wildfire risk and **instead of raising towers**, reconductored with composite core conductor

Installed under a capital maintenance program, and CAISO leveraged the increased capacity improvements at terminating substations to increase the corridor transmission capacity



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Northwestern Energy

Structure Health

Regulator education

NorthWestern implemented two parallel composite core reconductoring jobs on their 100 kV Great Falls Project in Black Eagle, Montana.

The capacity of the lines is being doubled **without the need to modify or replace any of the existing steel monopoles or H-frame structures**.

The project includes roadway, railway and a 1,700 foot span crossing over the Missouri River.

Source: CTC Global

Hydro-Québec/ Sask Power

Structure Health

Outages

Energized 110kV Double Circuit Tower Restoration

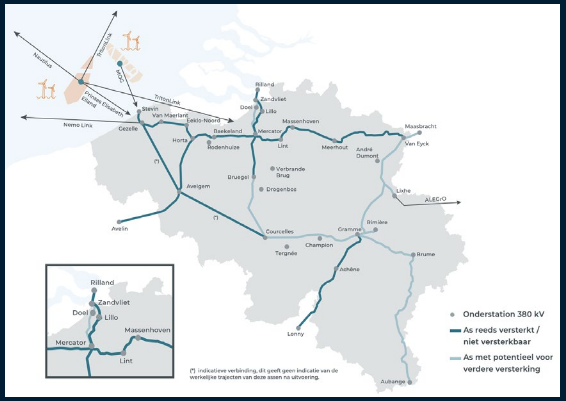
https://www.ampjack.ca/saskpower-energized-115kv-double-circuit-tower-restoration/

Workers raising 735 kV Tower with lines in place

Source: https://www.ampjack.ca/hydro-quebec-historical-735kv-tower-raise-project//

High performance Conductors are being deployed at scale around the world

Belgium

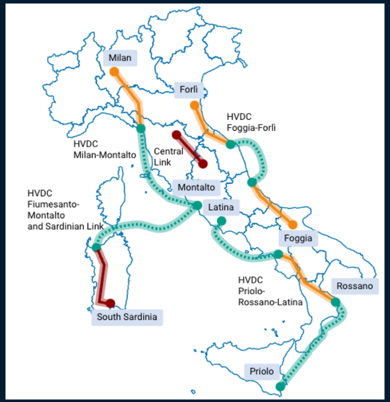


Belgium's Transmission System Operator (TSO) Elia is reconductoring most high voltage (380 kV) lines by 2035 in order to accommodate increasing offshore wind capacity and rapid electrification

Netherlands

The Dutch TSO TenneT is similarly reconductoring their high voltage grid, recognizing their value in faster project realization, avoiding permitting delays and much lower project Capex

Italy



In addition to reconductoring, Italy is building out a multi-terminal HVDC network, with new subsea HVDC lines and converting existing AC lines to DC

India

India's transmission planning philosophy encourages the optimization of existing ROW first, leading to the adoption of efficient HPCs and smart grid technologies

China

China, which sees $50 billion in transmission investment each year, is utilizing HPCs in both reconductoring as well as new-build projects to keep up with growing electricity demand

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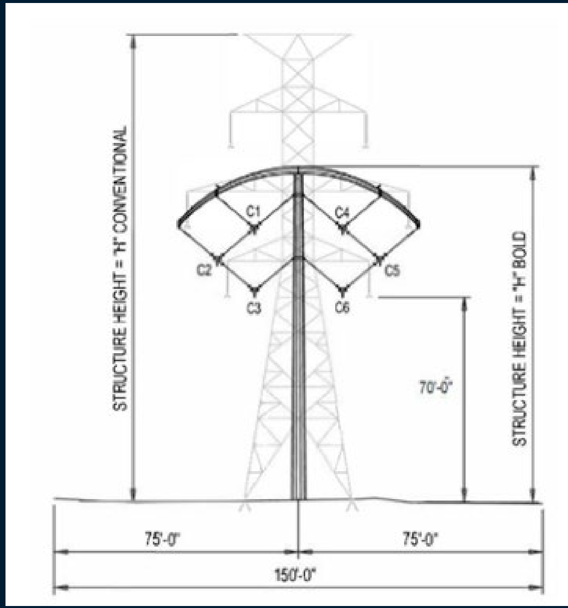
Emerging Techniques for ATTs

- ATTs can provide **temporary extra capacity** during construction of neighboring facilities
- ATTs can be combined with **traditional techniques** (tower raising, voltage uprating, line tensioning etc.)
- **Pole technology** has improved significantly and can simultaneously address multiple needs (capacity, wildfire resiliency, height limitations, etc.)
- ATTs are well suited to increase capacity of low-mid voltage (69-230kV) system to **support new regional transmission**



https://www.boldtransmission.com/wp-content/uploads/2016/02/BOLD-345-kV-Specifications19.pdf

https://www.resilient-structures.com/

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

WestTEC
POWERED BY WPP

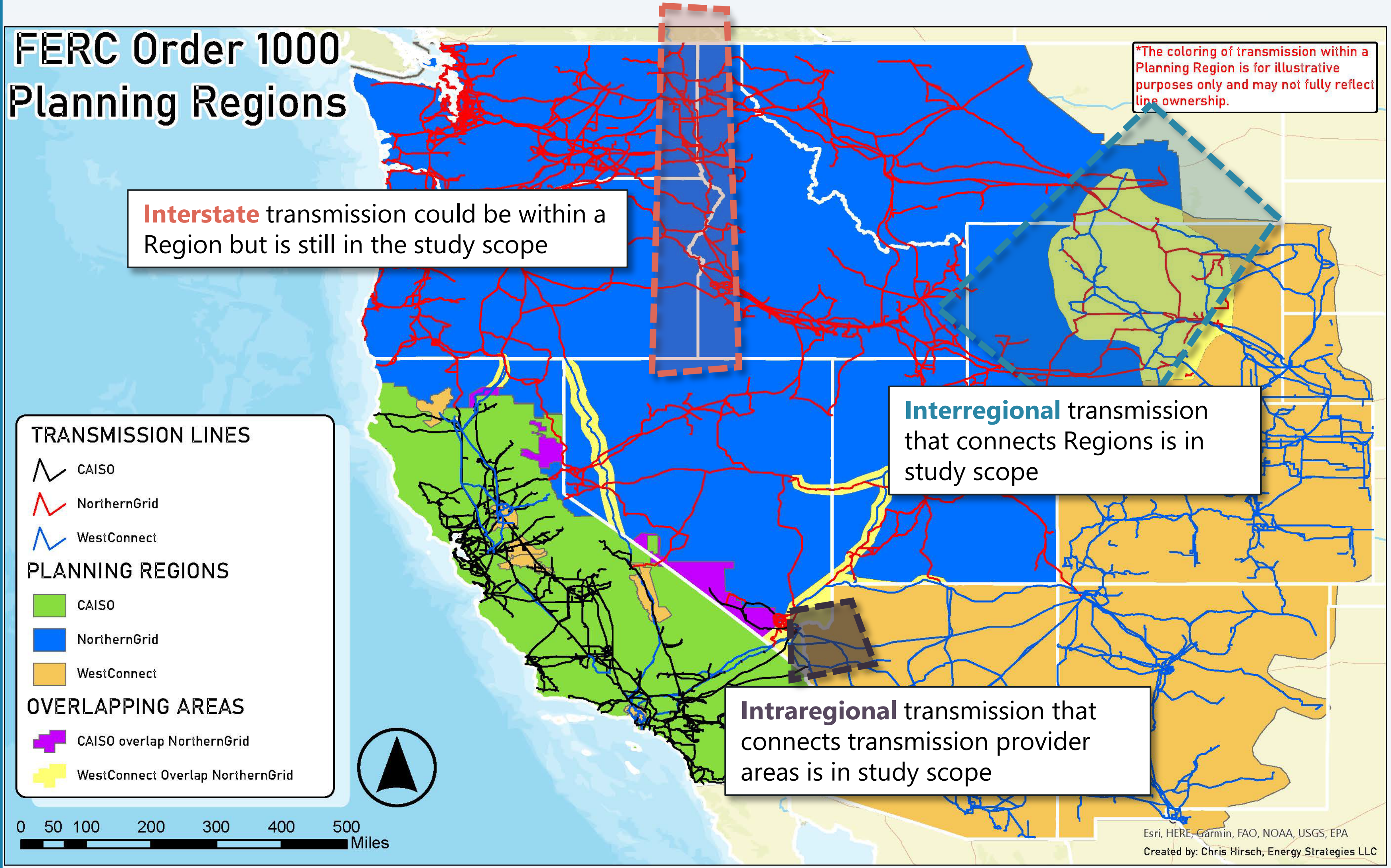
WestTEC Steering Participants

Western Electricity Coordinating Council
Clean Grid Initiative
Bonneville Power Administration
California ISO
Southwest Power Pool
Powerex
Clean Energy Buyers Association
Amazon Energy
PacifiCorp
Puget Sound Energy
Portland General Electric
Salt River Project
Colorado River Energy Distributors Association
Arizona Public Service
Renewable Northwest
GridLiance
Snohomish PUD
Grid United
Xcel Energy
Avista

Western Interstate Energy Board
Washington Department of Commerce
Interwest Energy Alliance
Invenergy
Warm Springs Power & Water Enterprises
Idaho Power Company
NorthWestern
NV Energy
GridWorks/Liaison with States
Public Service Company of New Mexico
Western Area Power Administration
Northwest & Intermountain Power Producers Coalition
Public Power Council
LS Power
Tacoma Power
Grant County PUD
Pacific Northwest Utilities Conference Committee
Pattern Energy
Cascade Renewable Transmission

WestTEC
POWERED BY WPP

What transmission will the study address?



Source: WestConnect

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

WestTEC POWERED BY WPP

WestTEC Project Timeline

WestTEC
POWERED BY WPP

Thank you!

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