

# Transmission Benefits and Opportunities for Improved Planning under Order 1920

PREPARED BY

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PRESENTED AT

ESIG FERC Order 1920 Task Force  
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# Topics discussed today

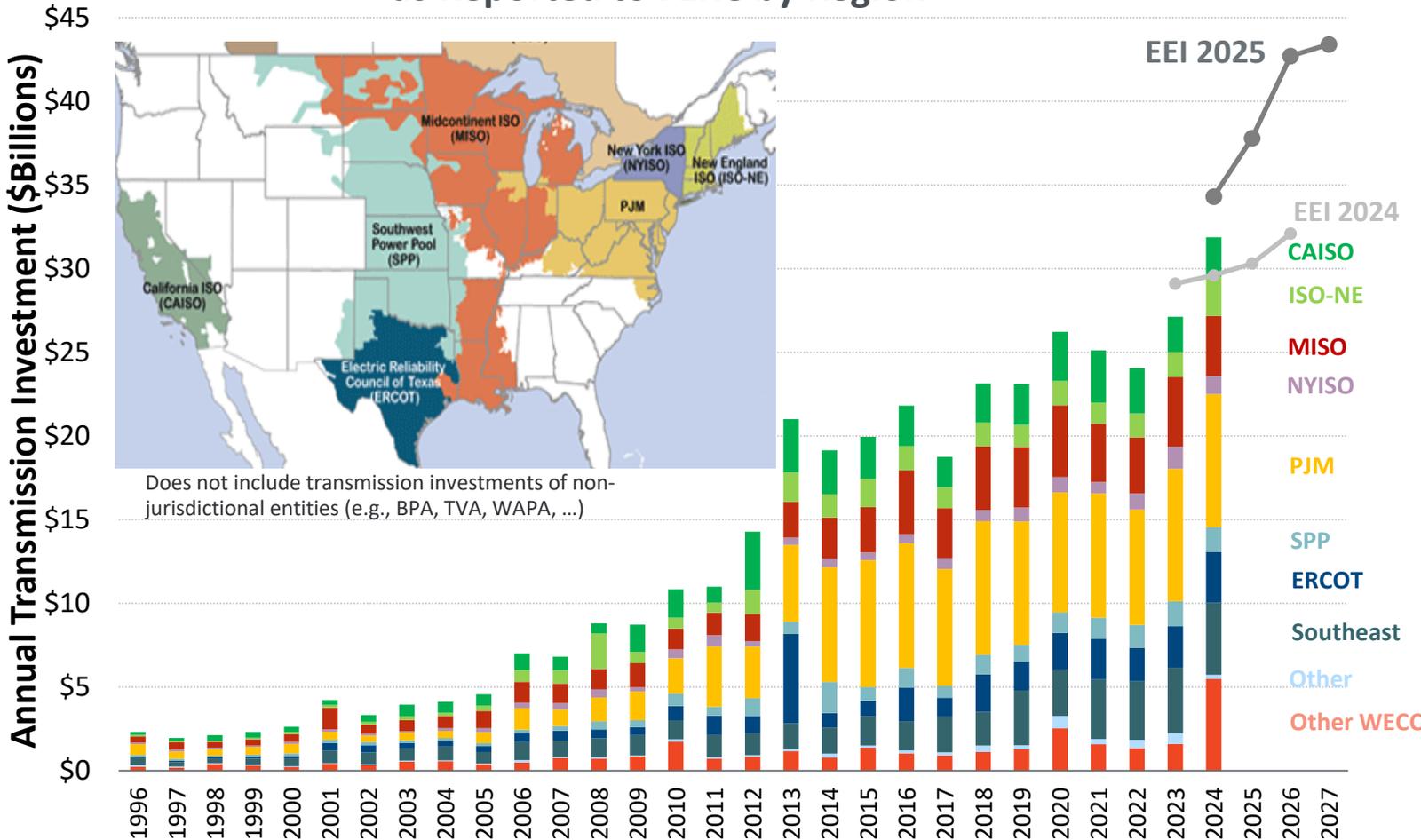
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1. Background (Slides 2-5)
  - How much are we investing in transmission?
  - The need for more consolidated planning processes
  - Opportunities created by Order 1920
2. Transmission benefits (Slides 6-10)
3. How to deal with uncertainty and minimize planning regrets? (Slides 11-14)

(Additional Slides, including on Oder 1920 interregional requirements)

# Annual U.S. Transmission Investments 1996-2024

Annual Transmission Investment as Reported to FERC by Region

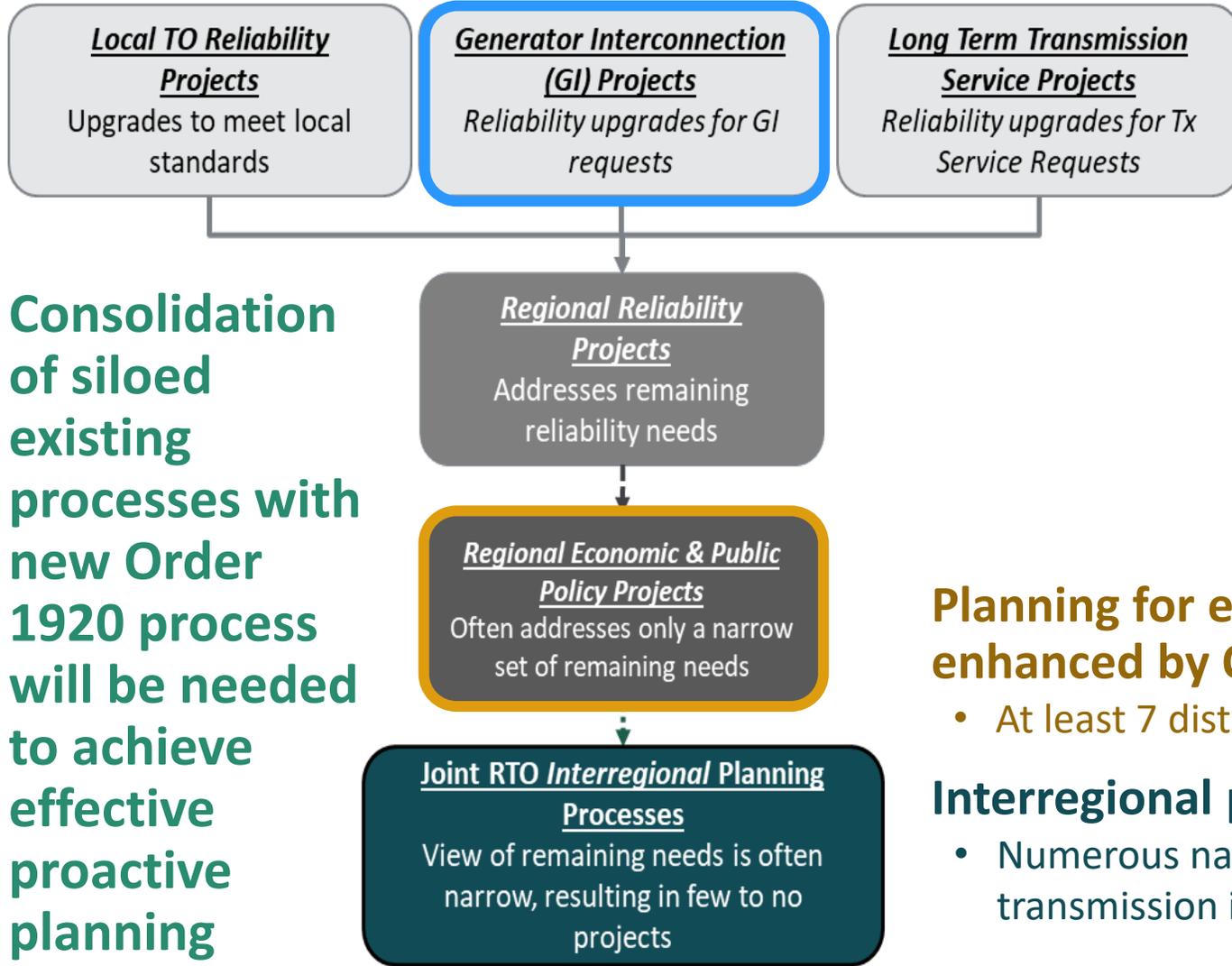


**Total US transmission investment has increased from \$3 to \$30 billion in the last 30 years!**

- About 90% of it is justified solely based on reliability needs (without benefit-cost analysis)
- About 50% based on “local” utility criteria (aging assets; without going through regional planning processes)
- Other than in MISO, only a few projects are justified based on multi-driver planning in other regions
- Essentially no interregional transmission is being planned (other than by merchant developers)

Sources: The Brattle Group analysis of FERC Form 1 Data; EEI "Historical and Projected Transmission Investment" most recent accessed here [https://www.eei.org/-/media/Project/EEI/Documents/Resources-and-Media/bar\\_actual\\_and\\_projected\\_trans\\_investment.pdf](https://www.eei.org/-/media/Project/EEI/Documents/Resources-and-Media/bar_actual_and_projected_trans_investment.pdf)

# Transmission planning is too siloed and reliability-focused



**Consolidation of siloed existing processes with new Order 1920 process will be needed to achieve effective proactive planning**

**These solely reliability-driven processes account for > 90% of all U.S. transmission investments**

- None involve any assessments of economic benefits (i.e., cost savings offered by the new transmission)

**Incremental generation interconnection has become the primary tool (and efficiency barrier) to support public policy goals**

**Planning for economic & public-policy needs will be enhanced by Order 1920 minimum requirements**

- At least 7 distinct benefits (cost savings and reliability) considered

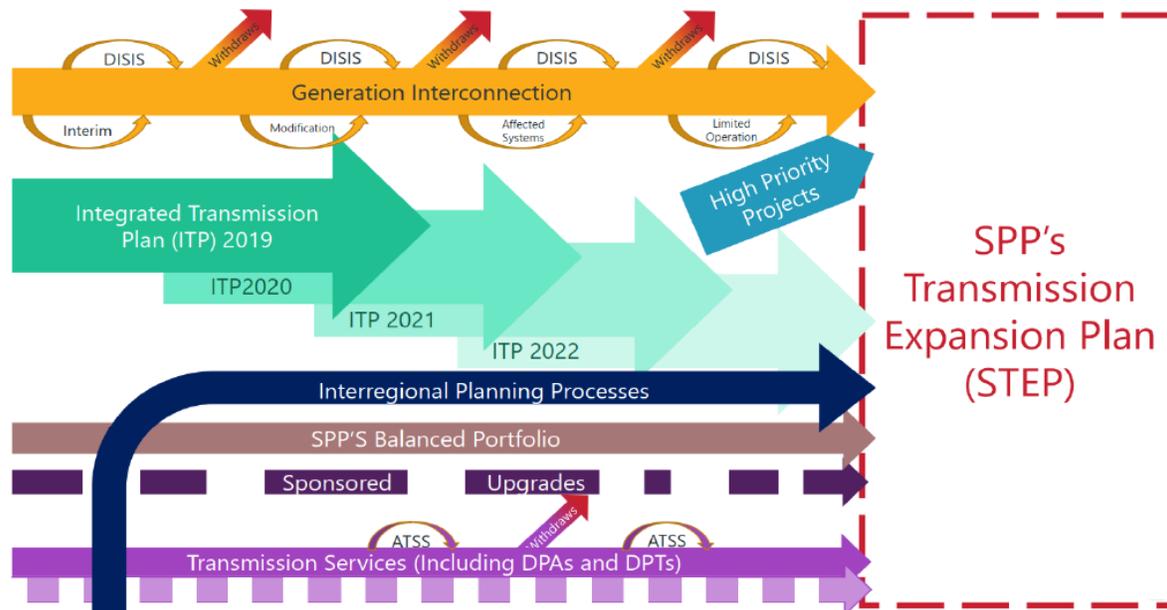
**Interregional planning processes are large ineffective**

- Numerous national studies show that more interregional transmission is needed to reduce total system costs

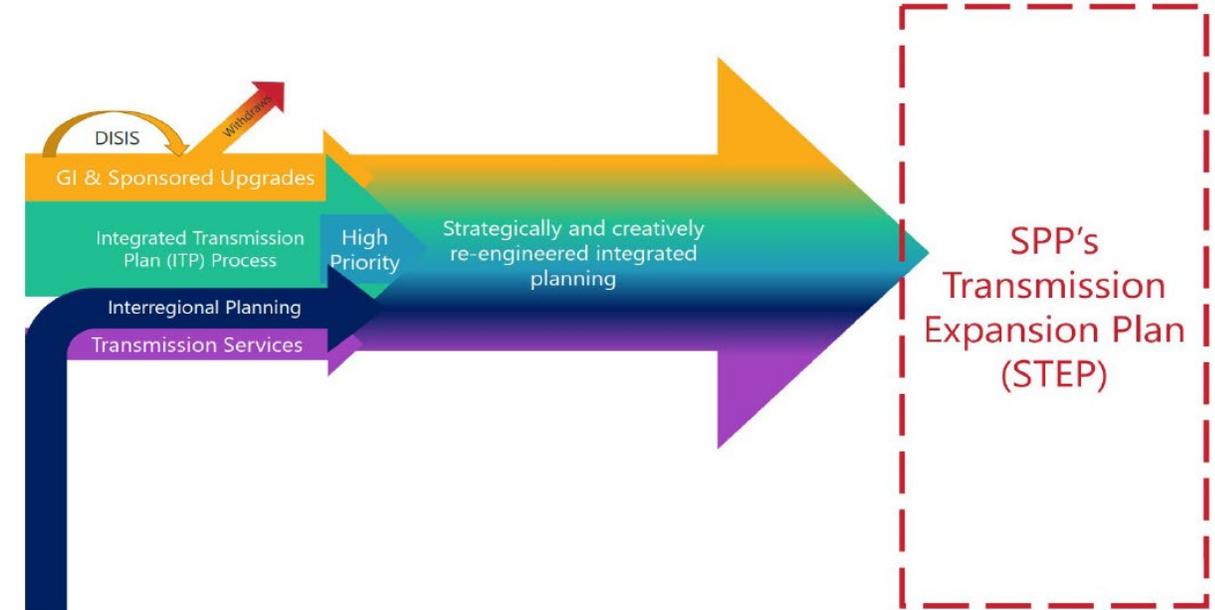
# Example: SPP's Consolidated Planning Process (CPP)

The Southwest Power Pool (SPP) is consolidating its siloed planning processes (e.g., for generator interconnection, integrated regional transmission, transmission service requests, and interregional planning) into a single (FERC-approved) process:

## Current Planning Process



## New Consolidated Planning Process



# FERC's Order 1920 leaves room for improvements

**Order 1920 compliance offers opportunities to improve transmission planning processes beyond the Order's mandated minimum requirements:**

1. Better deal with long-term uncertainties through proactive, **scenario-based planning**
2. Use best-practice experience for comprehensive benefit quantification (beyond 7 benefits and understated quantification)
3. Consolidate siloed (near- and long-term) planning processes
4. Employ **least-regrets** planning criteria to minimize the risk of both over-building and under-sizing
5. Develop more **flexible** solutions
6. Get more out of the existing grid, focus on cost effectiveness, and include cost-control incentives
7. Explicitly consider interregional solutions to regional needs

## **Key planning tools for an uncertain future**

(beyond transmission):

- Scenario based
- Flexible, least-regrets solutions

For more detail, see [Integrated System Planning under Uncertainty](#), September 23, 2025.

# “Transmission Benefits” – what are they?

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**Multi-value transmission planning allows the selection of transmission solutions that offer the greatest net benefits**

- But what are these (often abstract) “transmission benefits”?

**Transmission benefits = Cost savings (or better reliability) offered by the upgrade**

**Examples of savings from right-sized, multi-value transmission investments:**

- Enable lower-cost generation to displace higher-cost generation = production cost savings
- Reduce need for reserve capacity through geographic diversification = investment cost savings
- Avoid costs of other transmission upgrades or refurbishments = investment cost savings
- Allow generation construction in lower-cost areas/regions = investment cost savings  
(Note: this benefit is not in Order 1920’s list of seven required benefit metrics)

**Studies show: if planned well, every \$1 billion spent on transmission saves \$2-3 billion**

**Bottom line: Sometimes you have to spend money to save money!**

# Over a decade of US experience already exists for identifying and quantifying a broad range of transmission-related benefits

## SPP 2016 RCAR, 2013 MTF

### Quantified

1. **production cost savings\***
  - value of reduced emissions
  - reduced ancillary service costs
2. **avoided transmission project costs**
3. **reduced transmission losses\***
  - capacity benefit
  - energy cost benefit
4. **lower transmission outage costs**
5. **value of reliability projects**
6. **value of mtg public policy goals**
7. **Increased wheeling revenues**

### Not quantified

8. **reduced cost of extreme events**
9. **reduced reserve margin**
10. **reduced loss of load probability**
11. **increased competition/liquidity**
12. **improved congestion hedging**
13. **mitigation of uncertainty**
14. **reduced plant cycling costs**
15. **societal economic benefits**

(SPP Regional Cost Allocation Review [Report](#) for RCAR II, July 11, 2016. SPP Metrics Task Force, [Benefits for the 2013 Regional Cost Allocation Review](#), July, 5 2012.)

## MISO MVP Analysis

### Quantified

1. **production cost savings \***
2. **reduced operating reserves**
3. **reduced planning reserves**
4. **reduced transmission losses\***
5. **reduced renewable generation investment costs**
6. **reduced future transmission investment costs**

### Not quantified

7. **enhanced generation policy flexibility**
8. **increased system robustness**
9. **decreased natural gas price risk**
10. **decreased CO<sub>2</sub> emissions output**
11. **decreased wind generation volatility**
12. **increased local investment and job creation**

(Proposed Multi Value Project Portfolio, Technical Study Task Force and Business Case Workshop August 22, 2011)

## CAISO TEAM Analysis

(DPV2 example)

### Quantified

1. **production cost savings\*** and **reduced energy prices from both a societal and customer perspective**
2. **mitigation of market power**
3. **insurance value for high-impact low-probability events**
4. **capacity benefits due to reduced generation investment costs**
5. **operational benefits (RMR)**
6. **reduced transmission losses\***
7. **emissions benefit**

### Not quantified

8. **facilitation of the retirement of aging power plants**
9. **encouraging fuel diversity**
10. **improved reserve sharing**
11. **increased voltage support**

(CPUC Decision 07-01-040, January 25, 2007, Opinion Granting a Certificate of Public Convenience and Necessity)

## NYISO PPTN Analysis

(AC Upgrades)

### Quantified

1. **production cost savings\*** (includes savings not captured by normalized simulations)
2. **capacity resource cost savings**
3. **reduced refurbishment costs for aging transmission**
4. **reduced costs of achieving renewable and climate policy goals**

### Not quantified

5. **protection against extreme market conditions**
6. **increased competition and liquidity**
7. **storm hardening and resilience**
8. **expandability benefits**

(Newell, et al., [Benefit-Cost Analysis of Proposed New York AC Transmission Upgrades](#), September 15, 2015)

\* Fairly consistent across RTOs

# Well-documented: proven practices for quantifying a broad set of transmission benefits

## Take advantage of proven practices (as referenced in Order 1920)

- See our [report](#) with Grid Strategies for a summary of quantification practices, incl. benefits beyond Order 1920's mandated ones →

## Most recent developments:

- Use [weather-reflective](#) (rather than weather-normalized) production cost and long-term expansion planning simulations (e.g., for 20-30 weather years)
- Production cost simulations with both [day-ahead](#) and [real-time](#) cycles to capture unpredictable real-time challenges and associated transmission value

Benefit Category	Transmission Benefit
1. Traditional Production Cost Savings	Adjusted Production Cost (APC) savings as currently estimated in most planning processes
2. Additional Production Cost Savings	i. Impact of generation outages and A/S unit designations
	ii. Reduced transmission energy losses
	iii. Reduced congestion due to transmission outages
	iv. Reduced production cost during extreme events and system contingencies
	v. Mitigation of typical weather and load uncertainty, including the geographic diversification of uncertain renewable generation variability
	vi. Reduced cost due to imperfect foresight of real-time system conditions, including renewable forecasting errors and intra-hour variability
	vii. Reduced cost of cycling power plants
	viii. Reduced amounts and costs of operating reserves and other ancillary services
	ix. Mitigation of reliability-must-run (RMR) conditions
	x. More realistic "Day 1" market representation
3. Reliability and Resource Adequacy Benefits	i. Avoided/deferred cost of reliability projects (including aging infrastructure replacements) otherwise necessary
	ii. (a) Reduced loss of load probability or (b) reduced planning reserve margin
4. Generation Capacity Cost Savings	i. Capacity cost benefits from reduced peak energy losses
5. Market Facilitation Benefits	ii. Deferred generation capacity investments
	iii. Access to lower-cost generation resources
6. Environmental Benefits	i. Increased competition
	ii. Increased market liquidity
7. Environmental Benefits	i. Reduced expected cost of potential future emissions regulations
	ii. Improved utilization of transmission corridors
7. Public Policy Benefits	Reduced cost of meeting public policy goals
8. Other Project-Specific Benefits	Examples: increased storm hardening and wild-fire resilience, increased fuel diversity and system flexibility, <b>reduced cost of future transmission needs</b> , increased wheeling revenues, HVDC operational benefits

# Benefits Example: Production Cost Savings

**Production cost savings = fuel and operating cost savings from better utilizing the existing and projected future generation fleet**

- Tools typically used to estimate: Nodal “production cost” (market simulation) models
- **Simulations tend to understate production-cost savings** (by 40% or more) because they:
  1. Only simulate **normal weather and loads** (i.e., no heat waves, cold snaps, or extreme weather)  
[LBNL](#): 50% of savings come from 5-10% of the most challenging hours in a decade (more interregionally)
  2. Only assume **normal fuel prices** (e.g., no spikes in gas prices or basis differentials)  
[Example](#): Jan 2026 polar vortex increased Henry Hub prices to \$7/MMBtu but Boston gas prices spiked to \$120/MMBtu
  3. Do not usually simulate operations during **transmission outages or unusual generation outages**  
[Example](#): 60+GW gen outages during winter storms Uri/Elliot; considering transmission outages increases savings by 10-20%
  4. Assume **perfect foresight** of all real-time market conditions  
[LBNL](#): most transmission-related savings in 5-10% of the most challenging hours are not foreseeable on a day-ahead basis  
[BU Study](#): quantified transmission benefits much higher when uncertainties are considered in simulations
- **What’s missed by typical production cost simulations can (and should be) quantified**
  - **Only parts of 1 and 3 (extreme weather, transmission outages) are explicitly required by Order 1920**
  - See Brattle [report](#) with Grid Strategies

# Benefits Example: Generation Investment Cost Savings

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- **Resource adequacy benefits** = lower reserve margins or higher reliability

- Diversifying loads and resources reducing the necessary planning reserve margins and installed generation capacity needs (by sharing reserve capacity across larger footprint)
  - ▶ Larger footprint = larger diversification savings = interregional T offers larger benefits
  - ▶ Highest benefits by creating footprints that are larger than the weather

Note: a region with adequate reserve margin may (a) initially benefit from higher reliability and (b) achieve capacity cost savings once the enabled lower reserve margin reduces generation investments

- **Other generation cost savings**: transmission that allows for additional generation development in lower-cost regions/areas

- Access areas with lower land/construction costs (particularly relative to locations near load centers)
- Access to areas with lower fuel costs (e.g., mine-mouth coal plants built in 1970s)
- Create access to areas with hydro potential or with higher wind/solar capacity factors (to generate more MWh for every MW built) (e.g., Texas CREZ)

Note: this is not one of Order 1920's required list of seven benefits

# Benefits Example: Avoided Transmission Costs

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- Planning proactively for multiple future transmission needs creates more holistic **solutions that avoid (or defer) piecemeal/incremental transmission upgrades** that would be approved through planning for only one transmission need at a time
  - Upgrades that capture cost savings in addition to meeting reliability requirements set out in NERC transmission planning standards avoid the reliability-only upgrades that would have to be made otherwise.
  - Note: avoided T upgrades need to be considered in simulation “base case” to avoid double counting
- Example: reliability need requires replacing aging 230kV line for \$800 million
  - Replacing the aging existing line with an (upsized) 345kV line instead may cost \$1 billion but offers:
    - ▶ An additional 1 GW of added transfer capability
    - ▶ Congestion relief and associated production cost savings
    - ▶ Additional headroom for load and generation interconnection
  - In addition to these benefits, the upsized \$1 billion 345kV solution **avoids other transmission costs**:
    - ▶ The known \$800 million in-kind reliability upgrade (now or in the future) → added T cost is only \$200 million
    - ▶ Likely additional future reliability upgrades (typically not yet identified)

# Scenario-based planning: Explicitly recognize an uncertain future

Scenario-based planning is a process first developed in the 1940s and 1950s as a tool for integrating uncertainties into long-term strategic planning:

- Used by Shell with great success since the 1970s for long-term planning under large uncertainties
- **Allows planners to think, in advance, about the many ways the future may unfold and how to respond effectively and flexibly as uncertain future outcomes become reality**
- Ranks among the top-ten management tools in the world today\*
- Scenario = one fully-defined, plausible view of what the future may look like

This type of scenario-based planning is a multi-step process:

1. Define scenarios of plausible futures by scanning the current reality, trends and forecasts, uncertainties, and important internal and external drivers
2. Develop a series of plans (initiatives, projects, policies, tactics) that work well across multiple scenarios (e.g., by developing solutions that are flexible and robust across all plausible futures)
3. Implement preferred plan and define indicators to alert planners that a certain future is likely to occur, so they can take action (e.g., exercise options to address the new developments)

\*See [Living in the Futures \(hbr.org\)](https://hbr.org) and [Using Scenario Planning to Reshape Strategy](#) (MIT Sloan Management Review)

# Least-regrets Planning: How can risks be mitigated?

The concept of “least-regrets” planning is widely popular but poorly understood. What is it?

Should least-regrets planning identify resource and grid plans that offer:

1. The lowest transmission cost for the chosen “reference/base-case” scenario (least-cost planning)?
2. The lowest total system costs (G+T+reliability costs) for the reference/base-case scenario?
3. Investments needed only for the least challenging scenario (to avoid building too much)?
4. Sufficient capacity to handle even the most challenging scenario (to avoid being “caught short”)?
5. The lowest average cost (highest average benefits) across all scenarios (i.e., best probability-weighted outcome)?
6. The lowest “cost of being wrong” across all scenarios (i.e., minimize risk)?
7. The best combination of (5) and (6)?



**This is what least-regrets planning should focus on!**

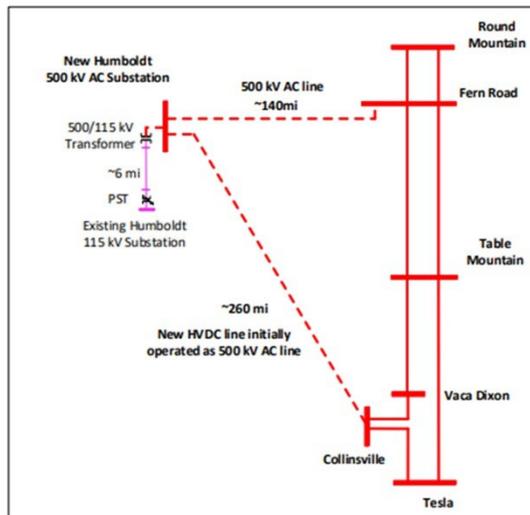
Example: AEMO [least-regrets framework](#) used in its Integrated System Plan (ISP)

# Examples: Flexible solutions to reduce costs and minimize regrets

Planning processes need to develop more flexible (lower-regret) generation and grid solutions that create valuable options, given high long-term uncertainties:

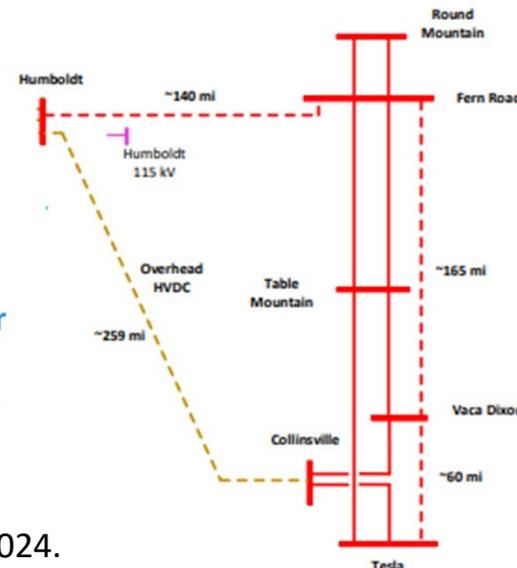
- Example 1 – rebuild aging single-circuit 230kV line as 345kV-ready with double-circuit towers to create option to: (1) initially operate circuit at 230kV, (2) later add 1 GW of transfer capability by stepping it up to 345kV (with transformation), and (3) if needed, expand the capacity by adding a second circuit
- Example 2 – CAISO’s expandable offshore-wind integration solution with HVDC-ready 500kV line:

Phase 1: Base Case Plan  
(1,607 MW)



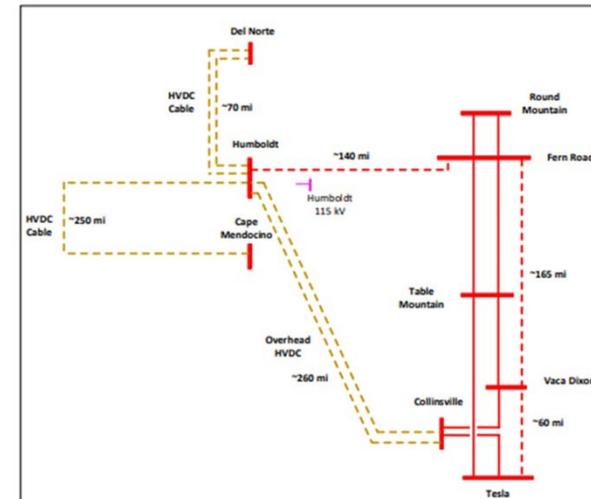
Two new 500kV lines, of which one is “HVDC-ready”

Phase 2: DC Conversion  
(3,100 – 3,300 MW?)



Add DC converter stations to each end of the line

Phase 3: Expanded Plan (Option B)  
(8,045 MW)

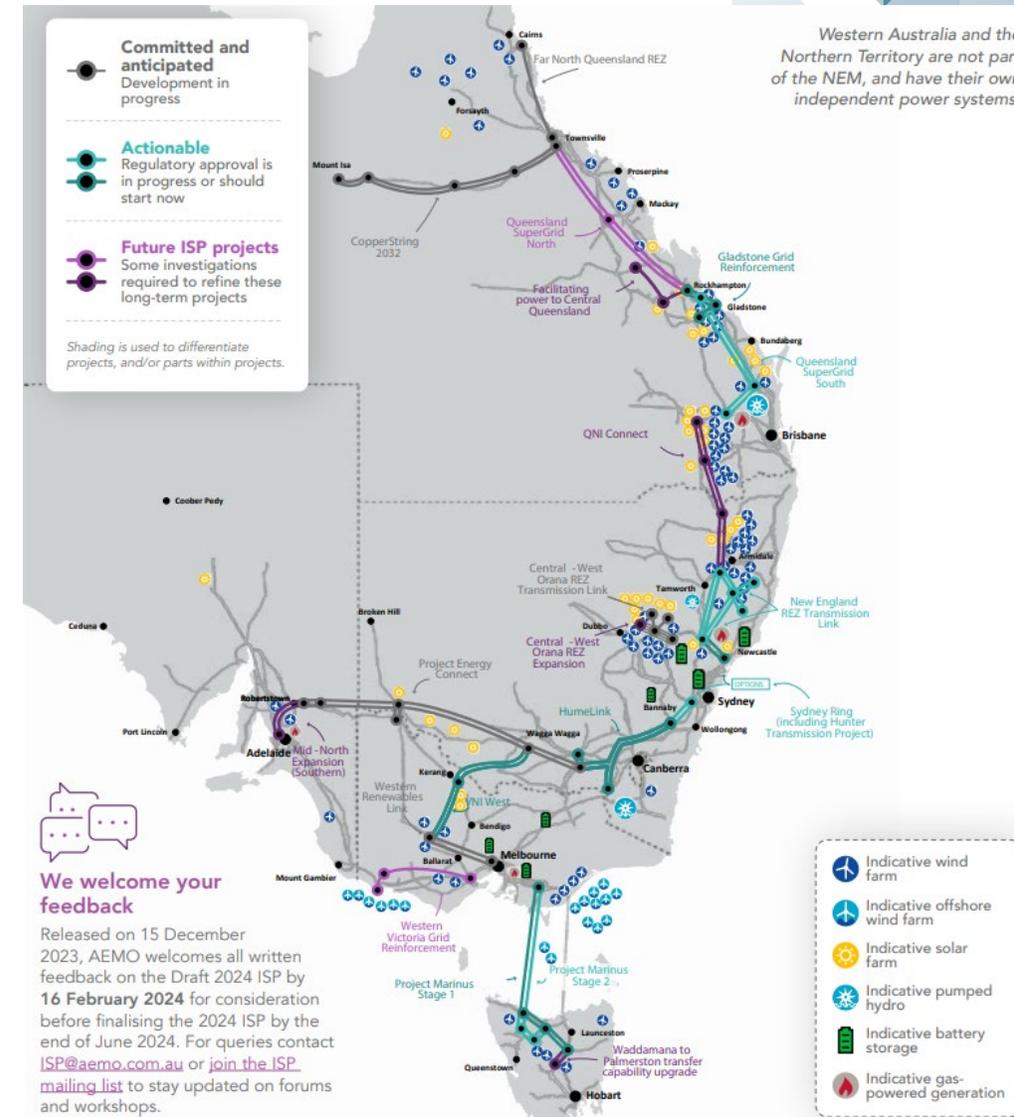


Add a second HVDC line

# Example: Australian Integrated System Plan (ISP)

The Australian Energy Market Operator (AEMO) integrated planning process is “best in class” for proactive, scenario-based, least-regrets planning:

- **Clearly-specified but flexible** methodology ([link](#)) produces updated plans every two years with extensive stakeholder consultations (see [Draft 2024 ISP](#))
  - **Scenario-based** analysis explicitly considers long-term uncertainties and risk mitigation over next 30 years ([link](#))
  - **Least regrets** planning values optionality that can be exercised if/when needed (e.g., projects that can be built/expanded in stages; or undertaking “early works” to develop shovel-ready projects that can be constructed quickly in the future)
  - **Both near- and longer-term needs:** (1) actionable projects for which the need is certain enough now to move forward; and (2) future projects that are likely needed at some point
- **Guidelines** for cost-benefit framework, forecasting, and “investment tests” from the Australian Energy Regulator (AER) make AEMO plans actionable ([link](#))





**Thank You!**

(Additional Slides)

# About the Speaker

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**Johannes (Hannes) Pfeifenberger**, a Principal at The Brattle Group, is an economist with a background in electrical engineering and over twenty-five years of experience in wholesale power market design, renewable energy, electricity storage, and transmission. He is a Visiting Scholar at MIT's Center for Energy and Environmental Policy Research (CEEPR), a former Senior Fellow at Boston University's Institute of Sustainable Energy (BU-ISE), an IEEE Senior Member, and currently serves as an advisor to research initiatives by the US Department of Energy, the National Labs, and the Energy Systems Integration Group (ESIG).

Mr. Pfeifenberger specializes in wholesale power markets and transmission. He has analyzed transmission needs, transmission benefits and costs, transmission cost allocations, and renewable generation interconnection challenges for independent system operators, transmission companies, generation developers, public power companies, industry groups, and regulatory agencies across North America. He has worked on transmission matters in SPP, MISO, PJM, New York, New England, ERCOT, CAISO, WECC, and Canada and has analyzed offshore-wind transmission challenges in New York, New England, and New Jersey.

He received an M.A. in Economics and Finance from Brandeis University's International Business School and an M.S. and B.S. ("Diplom Ingenieur") in Power Engineering and Energy Economics from the University of Technology in Vienna, Austria.

# Major Grid Challenges Looking Forward

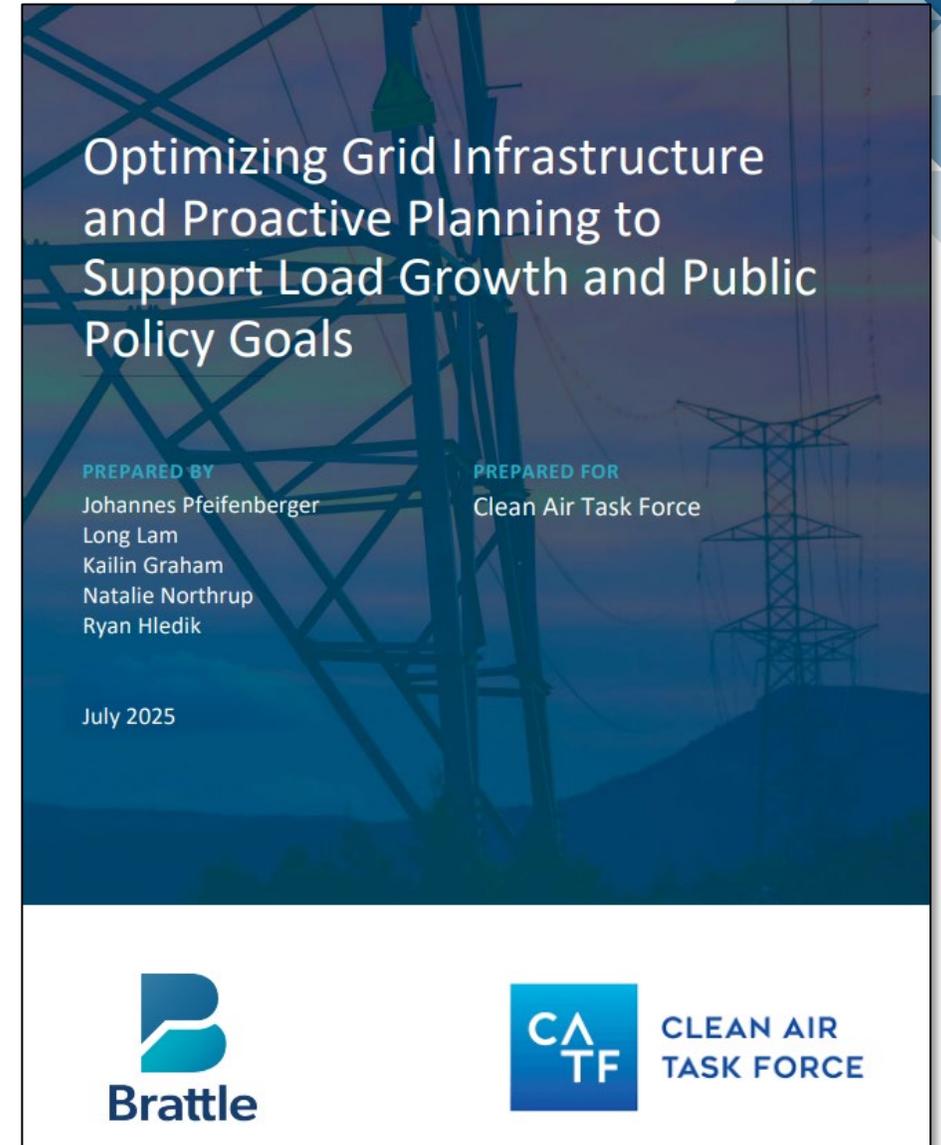
The US electric power system is entering a period of rapid and transformational change due to:

- Accelerating electrification of buildings and transportation
- Re-shoring of industrial activity
- Unprecedented surge in demand from data centers
- Aging grid and generation infrastructure

Meeting this demand will require significant investments grid infrastructure, which can be costly and take a long time:

- Many new large customers are prepared to pay a premium or invest in this infrastructure themselves to avoid interconnection delays
- Capital needs likely exceed the financial capabilities of many utilities
- Affordability challenges and impacts on existing customers create challenges and regulatory risks

**Key question:** How can utilities, system planners, policymakers, and regulators collaborate to serve new loads more quickly and cost-effectively, while still meeting state and corporate energy goals reliably and affordably?



[Report link](#)

# How to Support Load Growth and Policy Goals Quickly and Efficiently



**I. Maximize the Value of Existing Power System**



**II. Cost-Effectively Accelerate New Grid Connections**



**III. Implement Proactive Planning & Procurement**



**IV. Introduce Targeted Affordability Measures**

For each of these key areas, the [full report](#) offers case studies, cross references to industry experience and commercially-available technologies, and a discussion of best practices.

# Success Will Require Coordination & Collaboration among Key Stakeholders

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SOLUTION	REGULATORS	UTILITIES	GRID PLANNERS /OPERATORS	GOVERNORS LEGISLATORS	OTHERS
I. Maximize the Value of Existing Power System	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Third-party DER aggregators
II. Cost-Effectively Accelerate New Grid Connections	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Energy park developers
III. Implement Proactive Planning & Procurement	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Power procurement authorities; state energy offices
IV. Introduce Targeted Affordability Measures	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	State energy offices

(See more detailed table in Executive Summary of our [July 2025 report](#).)

# Transmission options for more cost-effective, affordable outcomes

## Achieving cost-effective transmission-planning outcomes requires a multi-faceted approach:

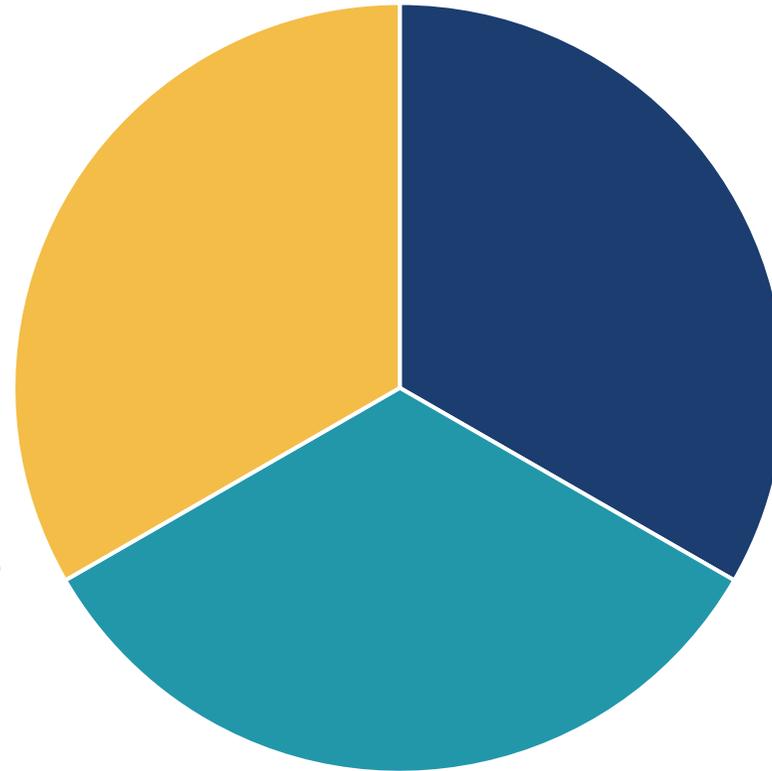
1. More **proactive and comprehensive transmission planning** (as mandated by Order 1920)
  - Multi-driver/value planning (incl. for generator interconnection) to find lowest-total-cost solutions
  - Least regrets planning to mitigate risk and costs of both overbuilding and undersizing
2. “**Loading order**” for transmission planning that prioritizes lower cost/impact options
  - Optimize existing grid → upsize existing lines → add new lines
3. **Cost control incentives**
  - Soft/hard cost caps, broad-based PBR, or targeted incentives (such as shared savings/overruns)
4. **Competitive solicitations**
  - Where possible and practical; with added cost-control incentives
5. **End-use efficiency and demand flexibility**
  - To reduce transmission, distribution, generation, and resource-adequacy costs

(See our NESCO slides: [Ensuring Cost-Effective Transmission in Support of a Clean Energy Transition](#), Aug 2024)

# We need to double or triple US transmission capability ... and can do at least some of it quickly and cost-effectively!

## 1. Advanced, grid enhancing technologies

- Dynamic line ratings
- Flow control devices
- Topology optimization
- Grid-optimized DER/storage
- Remedial action schemes
- Grid-forming inverters



## 2. Upgrades of existing lines

- Advanced conductors
- Rebuild aging lines at higher voltage
- Conversions to HVDC

## 3. New transmission

- Highway/railroad corridors
- ROW-efficient AC designs
- HVDC transmission
- Submarine/underground
- New greenfield overhead

### Examples:

[Priority order](#) required by the German “[NOVA Principle](#)”

MA [CETWG Report](#): “Loading Order” and ATT/GETs recommendations

# Order 1920's enhances "Interregional Transmission Coordination"

As FERC's [Explainer](#) states: "Order No. 1920 requires transmission providers in neighboring transmission planning regions to modify their existing [interregional transmission coordination procedures](#) to align with long-term regional transmission planning reforms. Order No. 1920 established the following requirements to adapt existing procedures with this requirement.

1. Require transmission providers to share information regarding long-term transmission needs and [identify and jointly evaluate interregional transmission facilities](#) to address those needs
2. [Allow entities to propose](#) interregional transmission facilities as more efficient or cost-effective solutions to long-term transmission needs

Transmission providers are mandated to make the following information publicly available through their website or e-mail list to [enhance transparency and information sharing](#).

1. Long-term transmission needs discussed in interregional transmission coordination meetings
2. Interregional transmission facilities proposed or identified as part of long-term regional transmission planning
3. Details such as voltage level, estimated cost, and estimated in-service date of proposed interregional transmission facilities
4. Results of [cost-benefit evaluations](#) for such interregional transmission facilities, including overall benefits and region-specific benefits
5. Selection of interregional transmission facilities to meet long-term transmission needs, if any

These reforms aim to ensure that identified long-term transmission needs are considered in interregional coordination and cost allocation processes, thereby promoting fair rates."

# Why interregional transmission and what's holding us back?

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## **Q: Why interregional transmission? A: It is uniquely beneficial**

- Larger geographic footprint offers more substantial diversity-related economic and reliability value
  - Capturing full (load and resource) diversity value requires a grid that is larger than the weather
- Peak-load and resource availability diversity = reduced regional resource adequacy requirements
- Temporary lower-cost/surplus generation in a region can be shared across larger footprint
- Larger scale of interregional solutions can be more cost effective than multiple regional solutions

## **Q: Why don't we see much of it getting planned? A: Many barriers** (slide 21)

- No defined interregional reliability standards or planning requirements
- Each region prefers meeting its reliability needs on its own
- Largely ignored in RTOs' regional multi-value planning processes
- Addressing local needs before regional, and regional needs before interregional, pre-empts more cost-effective interregional opportunities
- ISOs prefer to avoid the added complexity of multi-regional coordination and cost allocation
- Result: only merchant transmission developers have been proposing major new interregional projects

# Limitations of National Studies

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**Although existing many studies demonstrate the benefits of transmission expansion, they have not been successful motivating actual transmission project developments.**

**The reasons include some or all of the following:**

- Some studies **analyze aspirational targets or scenarios that do not reflect the actual policies and mandates** applicable for the next 10-15 years
  - This makes it difficult demonstrate a compelling “need” to policy makers, regulators, and permitting agencies
- The studies are **not transmission planning studies**: they often do not identify specific transmission projects and do not connect with RTO planning processes and needs identification
- Studies **do not to identify how benefits and costs are distributed** across utility service areas, states, or RTO/ISO under different scenarios, as would be necessary to gain broad support and develop feasible cost allocations
  - The studies typically do not consider or propose how to recover (“allocate”) transmission costs
- There has not been **an analysis of the state-by-state economic impact and job creation** from interregional transmission development, reduction in electricity prices, and shifts in the locations of clean-energy investment
- Most studies do not address the many barriers to planning processes and to the permitting/development of specific interregional transmission projects

# Reminder: Significant Barriers to Interregional Transmission



## A. Leadership, Alignment and Understanding

1. Insufficient leadership from RTOs and federal & state policy makers to prioritize interregional planning
2. Limited trust amongst states, RTOs, utilities, & customers
3. Limited understanding of transmission issues, benefits & proposed solutions
4. Misaligned interests of RTOs, TOs, generators & policymakers
5. States prioritize local interests, such as development of in-state renewables

## B. Planning Process and Analytics

- 6. Benefit analyses are too narrow, and often not consistent between regions**
7. Lack of proactive planning for a full range of future scenarios
- 8. Sequencing of local, regional, and interregional planning**
9. Cost allocation (often too contentious or overly formulaic)

## C. Regulatory Constraints

10. Overly-prescriptive tariffs and joint operating agreements
11. State need certification, permitting, and siting

Source: The Brattle Group. Appendix A of [A Roadmap to Improved Interregional Transmission Planning](#), November 30, 2021. Based on interviews with 18 organizations representing state and federal policy makers, state and federal regulators, transmission planners, transmission developers, industry groups, environmental groups, and large customers.

# Seams currently prevent efficient use of interregional transmission

**Significant seams-related inefficiencies exist between RTO markets (and other regions) that prevent us from effectively planning and taking full advantage of (existing and new) interregional transmission infrastructure:**

1. **Interregional transmission planning** is mostly ineffective
2. **Generator interconnection** delays and cost uncertainty created by affected-system impact studies (and effectiveness coordination through means such as the SPP-MISO JTIQ, reducing costs by 50%)
3. **Loop flow management** inefficiencies through market-to-market coordinated flowgates (with shares of firm flow entitlements) under the existing JOAs
- ➔ 4. **Inefficient trading** across contract-path market seams and the need for intertie optimization\*
- ➔ 5. **Resource adequacy** value of interties (often not considered in RTO's resource adequacy evaluations) and barriers to capacity trades (often created by RTOs' restrictive capacity import requirements and incompatible resource accreditations)\*\*

\*See [Intertie Optimization: Achieving Efficient Use of Interregional Transmission](#), IEEE PES Energy and Policy Forum, April 2025.

\*\* See [How To Realize the Maximum Value of Interregional Transmission | NLR Report](#) , June 2024.

# MISO-SPP JTIQ example: Lower-cost interregional solutions

**MISO's and SPP's Joint Targeted Interconnection Queue (JTIQ) Study shows that proactively studying a larger interregional set of generator interconnection requests offers substantial cost savings**

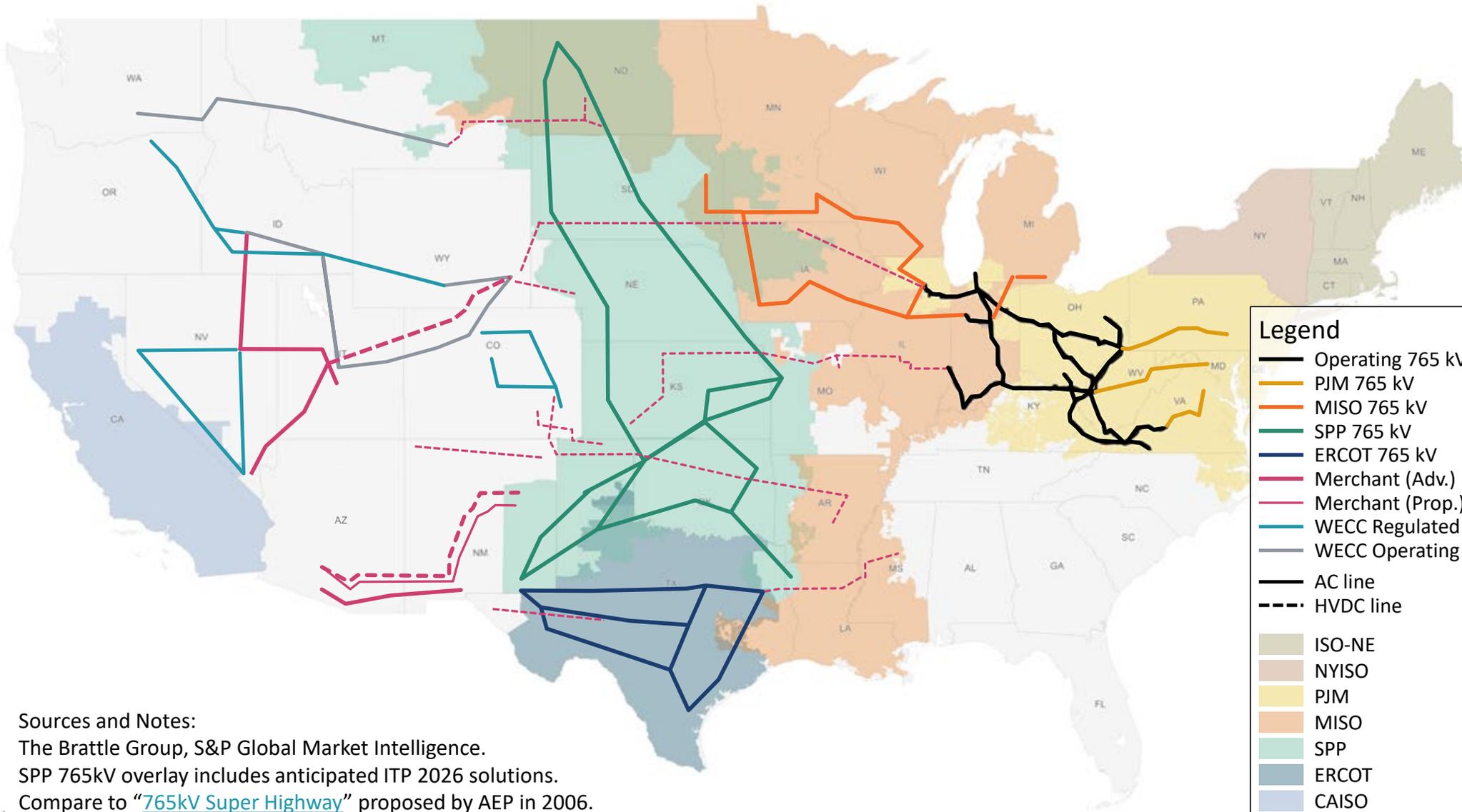
- **Goal:** Identify more comprehensive, cost-effective and efficient interregional network upgrades than could be found through the RTO's individual sequential interconnection queue and affected system coordination processes
  - Pooled GI requests for 5 (and 10) years in both regions near seam
- **Result:** Seven-project, **\$1.65 billion JTIQ Portfolio** expected to fully address the transmission needs along the MISO-SPP seam previously identified in MISO and SPP individual generation interconnection studies
  - Able to support 9 GW of existing generator interconnection requests and enable an additional 20 GW of projects near the SPP-MISO seam
  - Additionally yields estimated \$1 billion in production cost savings (\$724 million in MISO and \$247 million in SPP)
- JTIQ generator interconnection costs: **\$58/kW** with 100% participant funding; and **\$28/kW** if production cost savings to regional loads are netted
  - **Less than half of SPP's and MISO's individual GI costs of \$100-130/kW!**



See [MISO-SPP Joint Targeted Interconnection Queue Study](#), March 2022.

Tsuchida, [Proactive Planning for Generation Interconnection A Case Study of SPP and MISO](#) (August 17, 2022) at 9

# We may soon be half-way to a more interregional “Macro Grid”



The 765 kV systems planned by PJM, MISO, SPP, and ERCOT are adjacent to each other!

- They could (should?) be planned to be connected, which would create an interregional Macro Grid
- Then should also be integrated with HVDC lines, including into ERCOT and WECC

Sources and Notes:  
The Brattle Group, S&P Global Market Intelligence.  
SPP 765kV overlay includes anticipated ITP 2026 solutions.  
Compare to “[765kV Super Highway](#)” proposed by AEP in 2006.

# Examples of Brattle Reports on Regional and Interregional Transmission Planning and Benefit-Cost Analyses

**Well-Planned Electric Transmission Saves Customer Costs:**  
Improved Transmission Planning is Key to the Transition to a Carbon-Constrained Future

PREPARED FOR  
 **Link: [Well-Planned Transmission](#)**

PREPARED BY  
Judy W. Chang  
Johannes P. Pfeifenberger

May 2014

THE **Brattle** GROUP

**Toward More Effective Transmission Planning:**  
Addressing the Costs and Risks of an Insufficiently Flexible Electricity Grid

PREPARED FOR  
 **Link: [Effective Transmission Planning](#)**

PREPARED BY  
Johannes P. Pfeifenberger  
Judy W. Chang  
Akash Shellenbranath

April 2015

*The Brattle Group*

**Link: [Transmission Benefits](#)**

**The Benefits of Electric Transmission: Identifying and Analyzing the Value of Investments**

July 2013

Judy W. Chang  
Johannes P. Pfeifenberger  
J. Michael Hagerty

**Link: [Diversity Value](#)**

 Boston University Institute for Sustainable Energy

The Value of Diversifying Uncertain Renewable Generation through the Transmission System

September • 2020



**Transmission Planning for the 21st Century: Proven Practices that Increase Value and Reduce Costs**

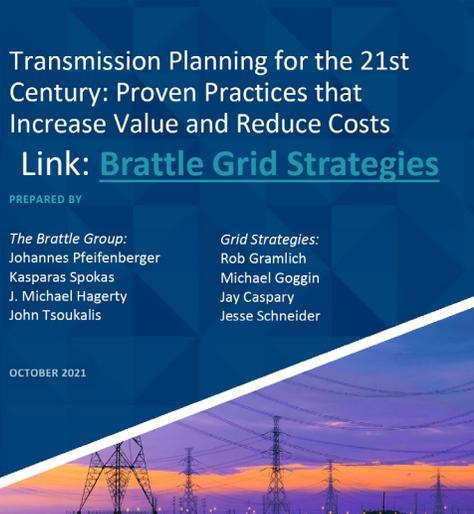
**Link: [Brattle Grid Strategies](#)**

PREPARED BY

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Johannes Pfeifenberger  
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John Tsoukalis

*Grid Strategies:*  
Rob Gramlich  
Michael Goggin  
Jay Caspary  
Jesse Schneider

OCTOBER 2021



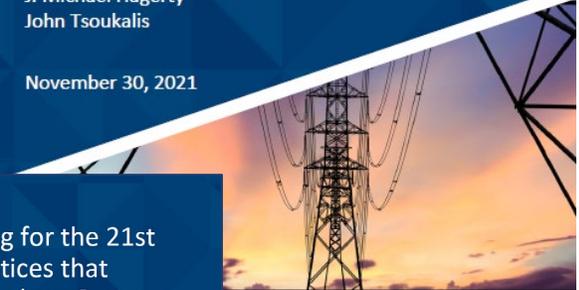
**Brattle** **GRID STRATEGIES LLC**

**A Roadmap to Improved Interregional Transmission Planning**

**Link: [Interregional Roadmap](#)**

PREPARED BY  
Johannes P. Pfeifenberger  
Kasparas Spokas  
J. Michael Hagerty  
John Tsoukalis

November 30, 2021



Summarizes proven approaches to quantifying various benefits

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- Pfeifenberger, [Order 1920 Compliance: An Opportunity to Improve Transmission Planning beyond Mandates](#), ESIG, Oct 22, 2024.
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# Brattle Group Practices and Industries

## ENERGY & UTILITIES

Competition & Market  
Manipulation  
Distributed Energy  
Resources  
Electric Transmission  
Electricity Market Modeling  
& Resource Planning  
Electrification & Growth  
Opportunities  
Energy Litigation  
Energy Storage  
Environmental Policy, Planning  
and Compliance  
Finance and Ratemaking  
Gas/Electric Coordination  
Market Design  
Natural Gas & Petroleum  
Nuclear  
Renewable & Alternative  
Energy

## LITIGATION

Accounting  
Analysis of Market  
Manipulation  
Antitrust/Competition  
Bankruptcy & Restructuring  
Big Data & Document Analytics  
Commercial Damages  
Environmental Litigation  
& Regulation  
Intellectual Property  
International Arbitration  
International Trade  
Labor & Employment  
Mergers & Acquisitions  
Litigation  
Product Liability  
Securities & Finance  
Tax Controversy  
& Transfer Pricing  
Valuation  
White Collar Investigations  
& Litigation

## INDUSTRIES

Electric Power  
Financial Institutions  
Infrastructure  
Natural Gas & Petroleum  
Pharmaceuticals  
& Medical Devices  
Telecommunications,  
Internet, and Media  
Transportation  
Water

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