Why Aren't Beneficial Transmission Projects Getting Built?

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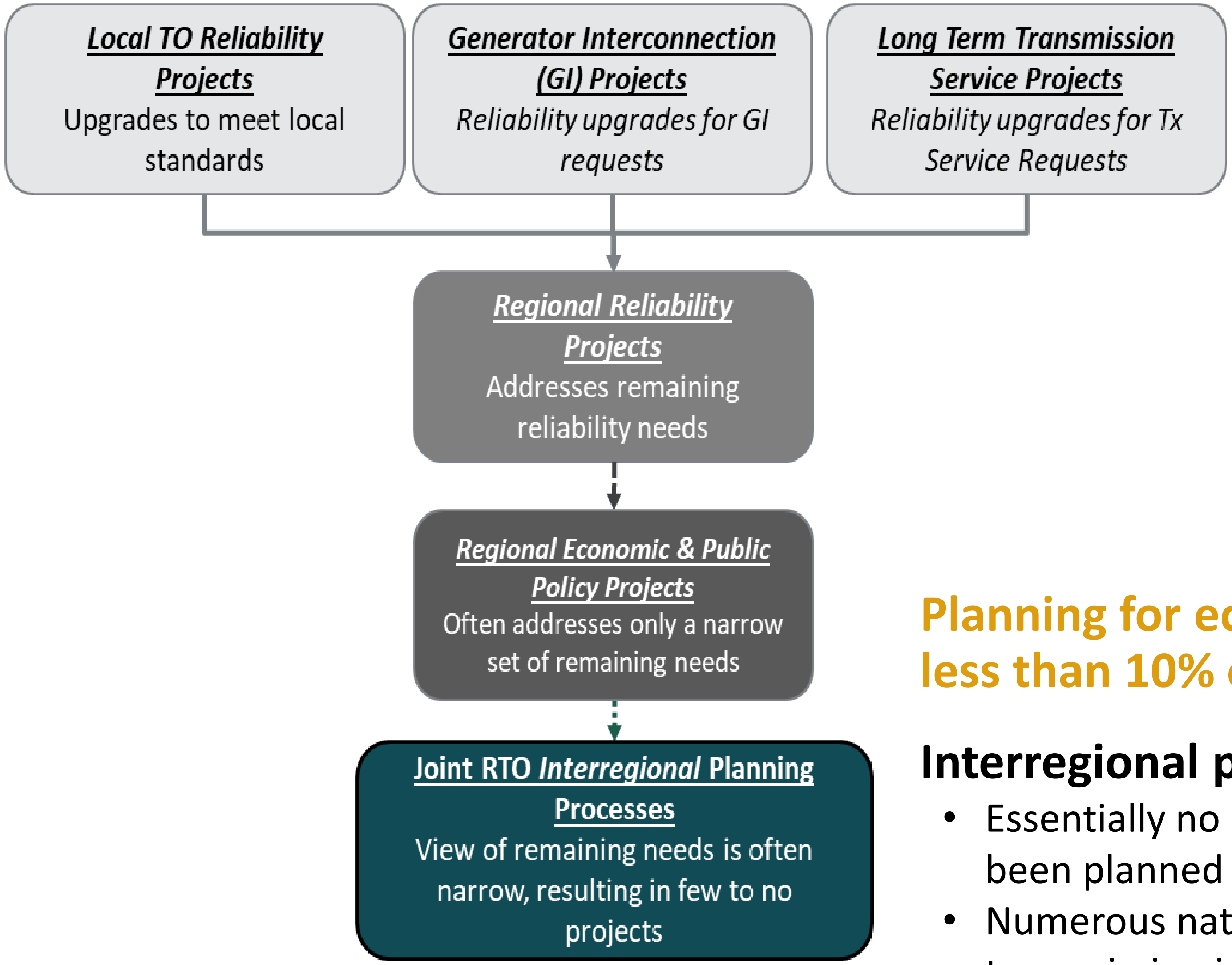
Brattle

Current U.S. Transmission Planning is Fragmented and Inefficient



These solely reliability-driven processes account for > 90% of all 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 results in less than 10% of all U.S. transmission investments

Interregional planning processes are large ineffective

- Essentially no major interregional transmission projects have been planned and built in the last decade
- Numerous national studies show that more interregional transmission is needed to reduce total system costs

Current U.S. Transmission Planning = Higher Total Costs

Current planning processes do not yield the most valuable transmission infrastructure and result in higher overall costs:

- Reactive, reliability-driven planning results in piecemeal, higher-cost transmission solutions
  - For example: PJM generation interconnection studies for 15.5 GW of individual offshore wind plants identified $6.4 billion in onshore transmission upgrades
  - In contrast: A recent PJM study that proactive evaluated onshore upgrade needs for 17 GW of offshore wind (along with 14.5 GW of onshore wind and 45.6 GW of solar) identified only $3.2 billion in onshore upgrades
  - Result: **at least 50% lower costs** if renewable interconnection is planned proactively for the entire region’s public policy needs (rather than one project at the time through the generation interconnection process)
- Failure to evaluate multiple benefits of transmission projects does not result in the selection of the highest-value projects that reduce system-wide costs
- Failure to evaluate the full range of plausible futures (to explicitly account for long-term uncertainties), results in higher-cost outcomes when the future deviates from base case planning assumptions, which usually are based on “business-as-usual” or “current-trends” forecast
- Failure to consider interregional transmission solutions result in higher-cost regional and local transmission investments

Brattle Experience with Identifying Barriers

- Through past engagements, we have interviewed **various stakeholders** across the industry on their views about interregional transmission planning
- Topics covered in the interviews included:
  - **Benefits of Interregional Projects:** What are the primary benefits or interregional projects to your region? What are the risks of investments or insufficient investments in interregional projects?
  - **Barriers to Interregional Planning:** What are the primary barriers to realizing planning? Are some of these barriers specific to the individual RTOs and seams?
  - **Potential Solutions for Interregional Planning**: What should be done to make interregional planning more effective? To what extent are effective improvements broadly applicable or specific to the individual RTOs and seams?

Stakeholder Groups Interviewed

- RTO Planners
- State Policy-makers & Regulators
- Large Customers
- Industry and Environmental Groups
- Utilities and Transmission Owners
- Federal Policy-makers & Regulators

Identified 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 (too contentious or overly formulaic)
C. Regulatory Constraints	10. Overly-prescriptive tariffs and joint operating agreements 11. State need certification, permitting, and siting

Proposal: Transmission Planning for the 21st Century*

FERC NOPR efforts and available experience point to proven planning practices that can reduce total system costs and risks, but are rarely used today:

1. **Proactively plan for future generation and load** by incorporating realistic projections of the anticipated generation mix, public policy mandates, load levels, and load profiles over the lifespan of the transmission investment
2. **Account for the full range of transmission projects' benefits** and **use multi-value planning** to comprehensively identify investments that cost-effectively address all categories of needs and benefits
3. **Address uncertainties and high-stress grid conditions explicitly through scenario-based planning** that takes into account a broad range of plausible long-term futures as well as real-world system conditions, including challenging and extreme events
4. **Use comprehensive transmission network portfolios** to address system needs and **cost allocation** more efficiently and less contentiously than a project-by-project approach
5. **Jointly plan inter-regionally across neighboring systems** to recognize regional interdependence, increase system resilience, and take full advantage of interregional scale economics and geographic diversification benefits

* Brattle & Grid Strategies Report: Transmission Planning for the 21st Century: Proven Practices that Increase Value and Reduce Costs, October 2021.

Examples of Proactive Multi-Value Transmission Planning

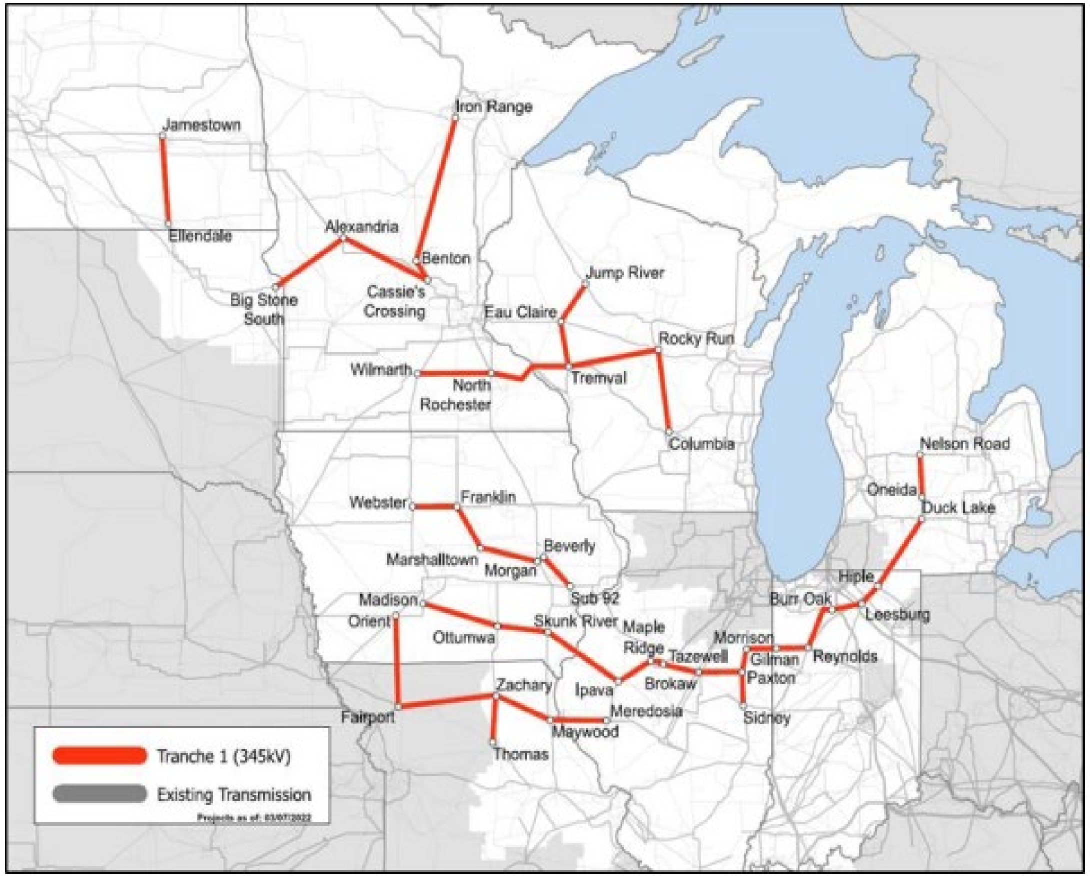
Proactive multi-value transmission planning will be necessary to create a cost-effective grid and to reduce the cost and time required to interconnect renewables at scale

MISO 2022 LRTP results

- Tranche 1: $10 billion portfolio of proposed new 345 kV transmission projects for its Midwestern footprint
- Supports interconnection of 53,000 MW of renewable resources
- Reduces other costs by $37-68 billion

PJM Transmission Study

- Proactively evaluated all existing state public policy needs
- Identified only $3.2 billion in upgrades to integrate 75,000 MW of renewables ($40/kW)
- Would be significantly more cost effective than continued reliance on incremental upgrades through PJM's interconnection process



Checklist of Transmission Benefits With Proven Quantification Practices

As we have documented in our recent report (filed with ANOPR comments) available proven practices:

1. Consider the full set of benefits transmission can provide for each project or synergistic portfolio of projects (*see* table)
2. Identify the benefits that plausibly exist and may be significant for that particular project or portfolio
3. Focus on quantifying those benefits

(See our recent report with Grid Strategies for a summary of quantification practices)

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
	ii. Deferred generation capacity investments
	iii. Access to lower-cost generation resources
5. Market Facilitation Benefits	i. Increased competition
	ii. Increased market liquidity
6. 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, reduced cost of future transmission needs, increased wheeling revenues, HVDC operational benefits

We have a Decade of Experience with Identifying and Quantifying a Broad Range of Transmission 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_2 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

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John Tsoukalis is a Principal at The Brattle Group with experience assisting clients in across a broad range of issues related to wholesale electric power markets.

John has expertise in analyzing transmission investment opportunities and in North America. He has helped clients assess the transmission investment landscape and forecast the growth of investment in transmission development over the next 10-15 years. He has experience in electric market modeling, analyzing the benefits of regional market participation, market design, the benefits of transmission infrastructure, detection of market manipulation and damages analyses, and electric sector strategic planning. He has lead efforts to model the power system to assess the benefits of participation in wholesale power markets, value generation assets, and analyze the benefits of new transmission. John has worked with ISOs and RTOs to develop and implement market rules governing capacity auctions, wholesale power markets, ancillary services, and financial energy products. He has helped ISOs and RTOs design market power mitigation regimes and auction clearing mechanisms.

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