Transmission As a Market Enabler: The Costs and Risks of an Insufficiently Flexible Electricity Grid

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Agenda

1. Historical Transmission Investment and Projected Needs
2. Key Barriers to Planning a More Robust Transmission Grid
3. Often Overlooked Benefits of a Flexible and Robust Transmission Grid
   - Numerous benefits that increase reliability and lower the cost of generating and delivering power to consumers
4. The High Costs and Risks of Inadequate Transmission Infrastructure
5. The Need for More Effective Interregional Transmission Planning
6. Recommendations for Policy Makers
Historical Circuit-Mile Additions

Document Aging Grid

- Most of the existing grid was built 30-50+ years ago
- Even relatively high recent and projected circuit miles additions are below levels of additions in 1960s and 1970s
Growing Transmission Investments


Sources and Notes: The Brattle Group's analysis of FERC Form 1 data compiled in Ventyx's Velocity Suite. Based on EIA data available through 2003, FERC-jurisdictional transmission owners estimated to account for 80% of transmission assets in the Eastern Interconnection, and 60% in WECC and ERCOT. Facilities >300kV estimated to account for 60-80% of shown investments. EEI annual transmission expenditures updated May 2014 shown (2008-2017) based on prior year's actual investment through 2012 and planned investment thereafter.
Transmission Investment Drivers Looking Forward

Nationwide Transmission Investments: $120-160 billion/decade

- Renewable Generation Additions
- Aging Facilities
- Interregional Buildout
- Coal Plant Retirement and Clean Power Plan
- Reliability Upgrades, Gen Interconnection, Load Serving
- Pockets of High Load Growth (e.g., Oil & Gas Development)
Key Barriers to More Effective Grid Planning

We identified 3 key barriers to identifying and developing the most valuable transmission infrastructure investments:

1. Planners and policy makers do not consider the full range of benefits that transmission investments can provide and thus understate the expected value of such projects.

2. Planners and policy makers do not account for the high costs and risks of an insufficiently robust and insufficiently flexible transmission infrastructure on electricity consumers and the risk-mitigation value of transmission investments to reduce costs under potential future stresses.

3. Interregional planning processes are ineffective and are generally unable to identify valuable transmission investments that would benefit two or more regions.

Additional challenges related to regional cost recovery and state-by-state permitting processes.
The Need for More Effective Grid Planning

If not addressed, the identified barriers to more effective regional and interregional transmission planning will lead to:

– Underinvestment in transmission, which results in higher overall costs of delivered electricity

– Lost opportunities to identify and select alternative infrastructure solutions that are lower-cost or higher-value in the long term than the (mostly reliability-driven) projects proposed by planners

– An insufficiently robust and flexible grid that exposes customers and other market participants to higher costs and higher risk of price spikes
The Full Range of Transmission-Related Benefits

- Transmission accounts for 10% of customer bills but will greatly affect at least half of the other 90%
- Omitting many transmission-related benefits (or assuming they are zero) ignores the costs and risk imposed on customers through a higher overall cost of power
# Checklist of Transmission Benefits

<table>
<thead>
<tr>
<th>Benefit Category</th>
<th>Transmission Benefit (see Appendix for descriptions and detail)</th>
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<tbody>
<tr>
<td>Traditional Production Cost Savings</td>
<td>Production cost savings as currently</td>
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<tr>
<td>1. Additional Production Cost Savings</td>
<td>a. Impact of generation outages and A/S unit designations</td>
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<tr>
<td></td>
<td>b. Reduced transmission energy losses</td>
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<td></td>
<td>c. Reduced congestion due to transmission outages</td>
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<td></td>
<td>d. Mitigation of extreme events and system contingencies</td>
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<td></td>
<td>e. Mitigation of weather and load uncertainty</td>
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<td></td>
<td>f. Reduced cost due to imperfect foresight of real-time system</td>
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<td></td>
<td>g. Reduced cost of cycling power plants</td>
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<td></td>
<td>h. Reduced amounts and costs of operating reserves and other</td>
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<tr>
<td></td>
<td>i. Mitigation of reliability-must-run (RMR) conditions</td>
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<tr>
<td></td>
<td>j. More realistic “Day 1” market representation</td>
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<td>2. Reliability and Resource Adequacy</td>
<td>a. Avoided/deferred reliability projects</td>
</tr>
<tr>
<td>Benefits</td>
<td>b. Reduced loss of load probability or c. reduced planning</td>
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<tr>
<td></td>
<td>reserve margin</td>
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<tr>
<td>3. Generation Capacity Cost Savings</td>
<td>a. Capacity cost benefits from reduced peak energy losses</td>
</tr>
<tr>
<td></td>
<td>b. Deferred generation capacity investments</td>
</tr>
<tr>
<td></td>
<td>d. Access to lower-cost generation resources</td>
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<td>4. Market Benefits</td>
<td>a. Increased competition</td>
</tr>
<tr>
<td></td>
<td>b. Increased market liquidity</td>
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<tr>
<td>5. Environmental Benefits</td>
<td>a. Reduced emissions of air pollutants</td>
</tr>
<tr>
<td></td>
<td>b. Improved utilization of transmission corridors</td>
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<tr>
<td>6. Public Policy Benefits</td>
<td>Reduced cost of meeting public policy goals</td>
</tr>
<tr>
<td>7. Employment and Economic</td>
<td>Increased employment and economic activity; Increased tax</td>
</tr>
<tr>
<td>Stimulus Benefits</td>
<td>revenues</td>
</tr>
<tr>
<td>8. Other Project-Specific Benefits</td>
<td>Examples: storm hardening, fuel diversity, flexibility, reducing</td>
</tr>
</tbody>
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Example: Why Considering all Transmission Benefits is Important

- With current economic transmission planning approaches, the project is rejected.
- Adding other savings significantly increases overall benefits.

- Annualized Cost of Transmission Project ($71 Million)
- Production Cost Savings - Base Case
- All Savings - Base Case

- Competitiveness
- Reduced Emissions/Losses
- Operational
- Generation
- Production Cost
**Inadequate Transmission Imposes High Risks**

Most transmission planning efforts do not adequately account for **short- and long-term risks** and uncertainties affecting power markets

- Economic transmission planning generally evaluates only on only "normal" system conditions
  - Ignores the high cost of short-term **challenges and extreme market conditions** triggered by weather, outages, fuel supply disruption, unexpected load growth
- Planning does not adequately consider the full range of long-term scenarios and does not capture the extent to which a less robust and flexible transmission infrastructure will **foreclose lowest-cost options**

Costs of inadequate infrastructure typically are not quantified but, under some circumstances, can be much greater than the costs of the transmission investments
Inadequate Transmission Imposes High Risks

Planning processes largely ignore the risk mitigation and insurance value of transmission infrastructure

- Given that it can take a decade to develop new transmission, delaying investment can easily limit future options and result in a higher-cost, higher-risk outcomes
  - “Wait and see” approaches limits options, so can be very costly in the long term;
  - The industry needs to plan for short- and long-term uncertainties more proactively
- “Least regrets” planning today mostly focuses on identifying those projects that are beneficial under most circumstances
  - Does not consider the many potentially “regrettable circumstances” that could result in very high-cost outcomes
  - Focuses too much on the cost of insurance without considering the cost of not having insurance when it is needed
Ineffective Inter-Regional Transmission Planning

Divergent criteria result in “least-common-denominator” planning approaches that create significant barriers for transmission between RTOs.

Experience already shows that few (if any) interregional projects will be found to be cost effective under this approach.

Multiple threshold tests create additional hurdles.
Ineffective Inter-Regional Transmission Planning

Need is compartmentalized into “reliability,” “market efficiency,” “public policy,” and “multi-value” projects within most regional planning processes.

Projects Considered in MISO-PJM Planning:
(as Ordered by FERC)

<table>
<thead>
<tr>
<th>Project Type in RTO-1</th>
<th>Reliability</th>
<th>Market Efficiency</th>
<th>Public Policy</th>
<th>Multi-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>Yes</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Market Efficiency</td>
<td>no</td>
<td>Yes</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Public Policy</td>
<td>no</td>
<td>no</td>
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Creates additional barriers at the interregional level by limiting projects to be of the same type in both regions.

Eliminates many projects from consideration.
Recommendations for State and Federal Policy Makers

Policy makers, including industry regulators, play a key role in influencing the scope of regional and interregional transmission planning efforts. We therefore recommend that they encourage planners to:

– Consider the full range of transmission-related benefits
– Better document and understand the high risks and high costs of an insufficiently robust and flexible grid
– Move from compartmentalizing projects into “reliability,” “economic,” and “public policy” projects to considering the multiple values provided by all transmission investments
– Improve interregional planning processes to avoid least-common-denominator approaches and consider the multiple but different values that projects can provide to individual regions
Additional Reading / About Brattle


The Brattle Group provides consulting and expert testimony in economics, finance, and regulation to corporations, law firms, and governmental agencies around the world.