

Future for Competitive Transmission:

What Have We Learned and Where Do We Go From Here?

PRESENTED BY:

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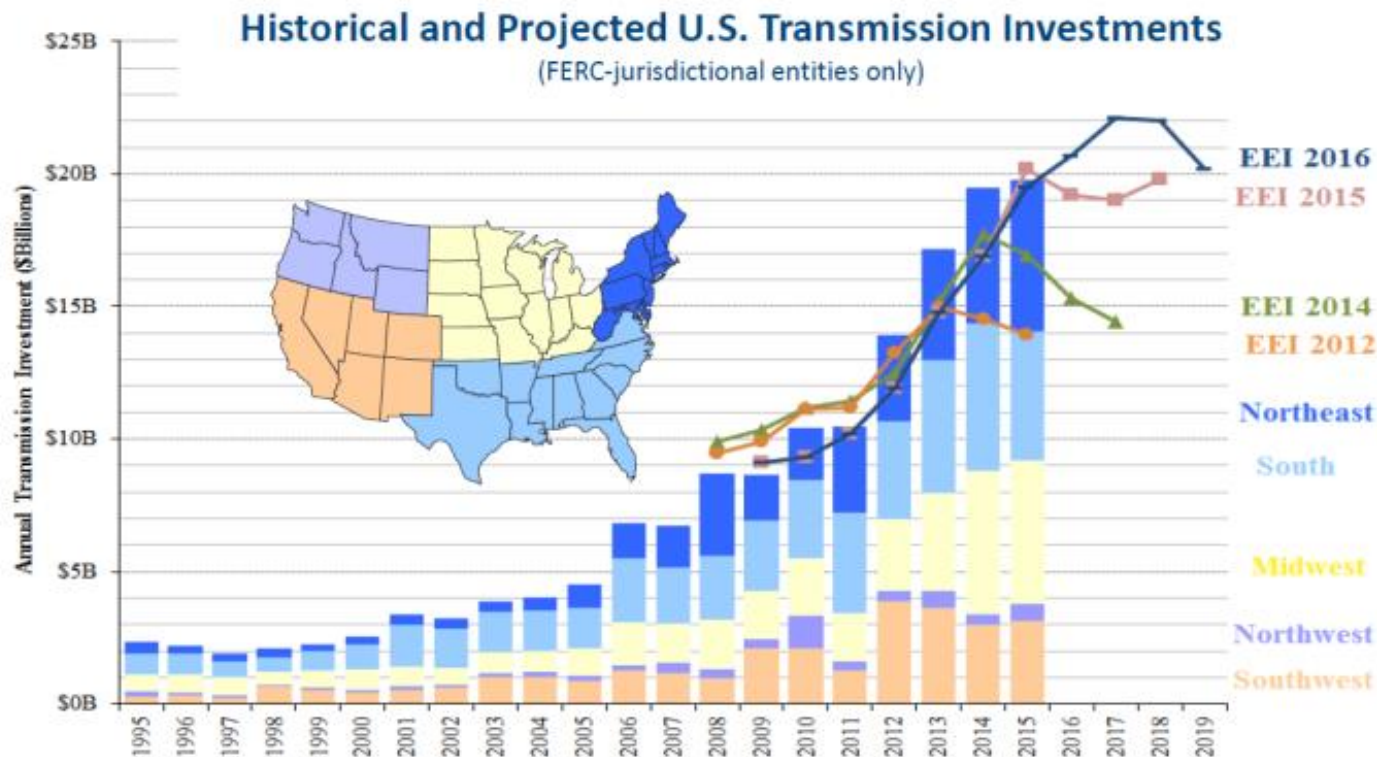
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Investment Levels

- U.S. transmission investments by FERC-jurisdictional transmission providers increased has been ~\$15-20 billion/year in last several years
- We project \$120-160 billion of investments over the next decade (for reliability, to integrate new resources, upgrade/replace aging existing facilities built in 1950-70s)



Sources and Notes: The Brattle Group's analysis of FERC Form 1 data compiled in Ventyx's Velocity Suite.

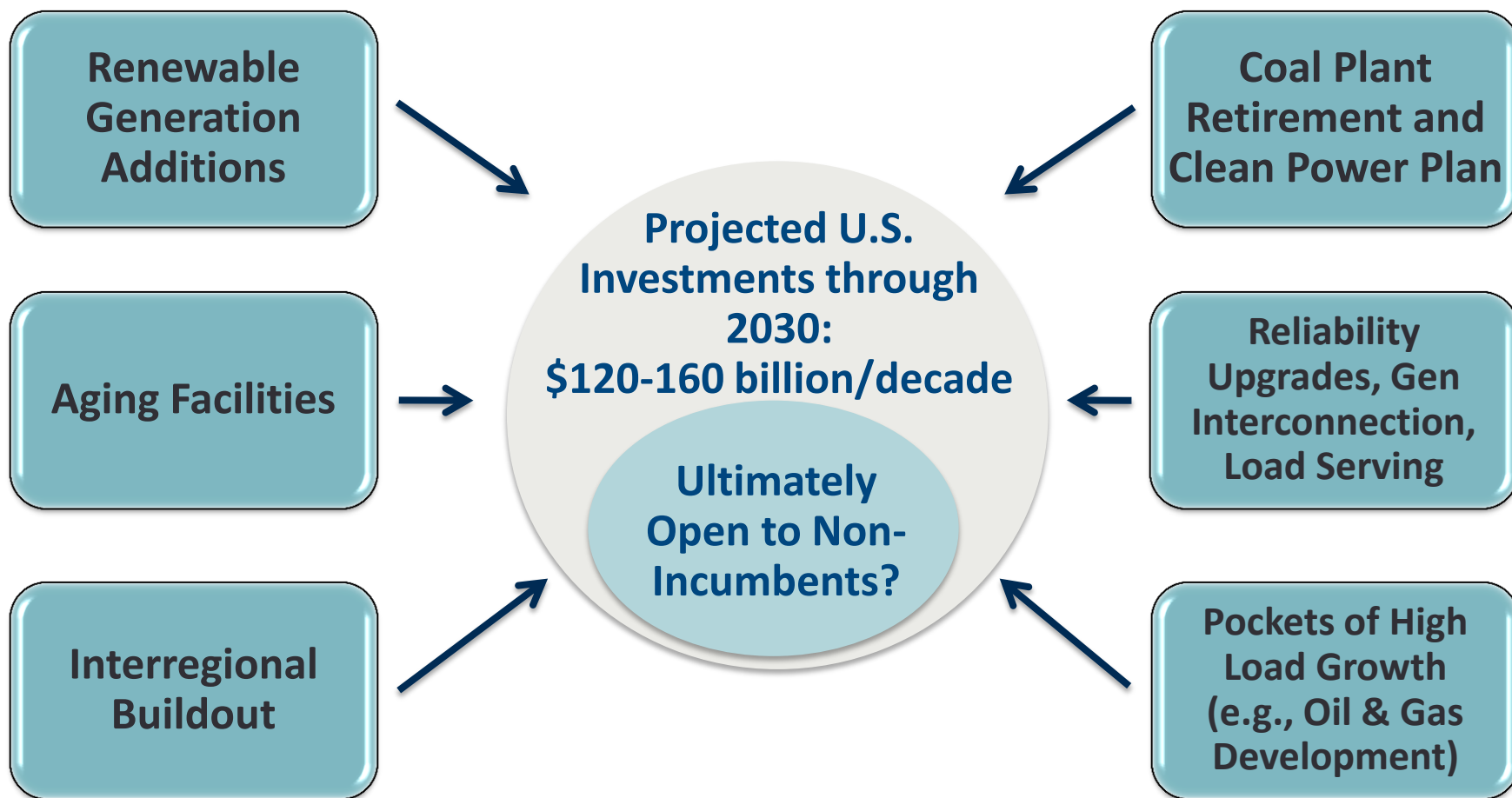
Based on EIA data available through 2003, FERC-jurisdictional transmission owners estimated to account for 80% of transmission assets in the Eastern Interconnection, and 60% in WECC and ERCOT. Facilities >300kV estimated to account for 60-80% of shown investments.

EEI annual transmission expenditures updated October 2015 shown (2008-2018) based on prior year's actual investment through 2014 and planned investment thereafter.

Main Drivers of Transmission Needs

- **Maintain system reliability**
- **Load diversity:** reduce cost of resource adequacy
- **Congestion relief/market efficiency:** reduce generation dispatch costs and improve market efficiency
- **Access to lower-cost renewables:** regional and interregional transmission to interconnect low-cost wind, solar, geothermal, and hydro resources
- **Renewable energy and fuel diversity:** diversify fuel mix and the short and long-term variability of wind, solar, and hydro generation
- **Increasingly stringent environmental regulations:** regional integration offers lower-cost environmental compliance in a range of plausible futures
- **Aging facilities**

Projected Transmission Investment Opportunities



Sources and Notes:

The \$120-160 billion per decade was originally developed in conjunction with WIRES for “Employment and Economic Benefits of Transmission Investment in the US and Canada,” May 2011. This projection has since been refined and regionalized in several client-confidential analyses.

Non-Incumbent Transmission Businesses

Non-incumbent transmission developers have become increasingly active through a number of business models, for example:

Business Model	Examples
1 Project-specific transmission partnerships with incumbents	JVs to bid transmission in Alberta, Ontario, and CAISO
2 Public-private partnerships	MATL, Transbay Cable, Path15
3 Independent transmission project developers	Cleanline, Anbaric/PowerBridge, TDI, TransElect, AWC, Anschutz, GridLiance, others...
5 Transmission (initially) bundled with renewables/generation	NextEra, LS Power, RES Americas
6 Incumbent-owned transmission development subsidiaries and JVs	Transource, Duke-ATC, BHE and Ameren Transmission Cos., many more
7 Independent and semi-independent transmission companies	ITC, ATC, Hunt

Experience to Date With Competitive Transmission Across U.S. RTOs

- Experiences from various regions have shown that ratepayers are getting the benefits of lower project costs
- Experiences also show that the vetting process is meticulous and careful
- The industry and the RTOs/ISOs are getting better at evaluating proposals
- Project sponsors are getting conducting internal “competitive advantage assessments”

Region	Sample Recent Projects	Ultimate Competitive Forces
PJM	Artificial Island	Ability to bear risk & cost containment
CAISO	Delaney-Colorado River (and several others)	Cost
SPP	Walkemeyer to North Liberal (southwest Kansas)	Incumbent advantage and cost
Alberta	Fort McMurray West	Cost
NYISO	New York AC Transmission	On-going
MISO	Duff-Coleman	On-going

CAISO Competitive Solicitation Projects by Planning Year and Type

Planning Year	Project Type	Number of Projects #	Estimated Project Cost Million \$
2012-2013	Reliability	2	\$226 - \$356
2012-2013	Public Policy	1	\$25
2013-2014	Economic	2	\$444
2013-2014	Reliability	4	\$190 - \$270
2013-2014	Public Policy	1	\$50 - \$75

Various Approaches to Evaluation Criteria

- RTO evaluation criteria are multi-faceted and quite comprehensive
- **Advantages:** Thorough and thoughtful; developed with stakeholder input
- **Disadvantages:** Complex and therefore may seem not sufficiently transparent

MISO's Selection Criteria for Duff-Coleman

Tariff Criteria & Sub Criteria	Max Points
Cost & Design	30
Project Cost Estimate & Rigor	
ATRR Estimate & Rigor	
Capital Resources Available	
Facility Design & Rigor	
Project Implementation	35
Detailed Project Implementation	
Project Management	
Route Evaluation	
Regulatory Permitting	
Right-of-Way Acquisition	
Engineering & Surveying	
Material Procurement	
Construction	
Commissioning	

Tariff Criteria & Sub Criteria	Max Points
O&M	30
Forced Outage Response	
Switching	
Emergency Repair	
Preventative/Predictive Maintenance (including vegetation management)	
Spare Parts, Structures, & Equipment	
Major Facility Replacements or Rebuilds	
Planning Participation	5
Relevant Planning Studies Performed & Results	
Transmission Project Ideas Submitted	
Grand Total	100

Ultimate Question for FERC

What are or should be the intentions of bringing competition to Transmission?

- Opportunities for non-incumbents?
- Lower project costs?
- Identify lower-cost or higher-value solutions?

How do we allow competition to work for ratepayers?

- How should the transmission rate-making process be adapted to the evolving competitive process?
- Can the traditional cost-based rate-making process evolve in concert to support the competitive processes and results?

Speaker Bio and Contact Information



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Note:

The views expressed in this presentation are strictly those of the presenter and do not necessarily state or reflect the views of *The Brattle Group, Inc.*

Ms. Judy Chang is an energy economist and policy expert with a background in electrical engineering and 20 years of experience in advising energy companies and project developers with regulatory and financial issues. Ms. Chang has submitted expert testimonies to the U.S. Federal Energy Regulatory Commission, U.S. state and Canadian provincial regulatory authorities on topics related to transmission access, power market designs and associated contract issues. She also has authored numerous reports and articles detailing the economic issues associated with system planning, including comparing the costs and benefits of transmission. In addition, she assists clients in comprehensive organizational strategic planning, asset valuation, finance, and regulatory policies.

Ms. Chang has presented at a variety of industry conferences and has advised international and multilateral agencies on the valuation of renewable energy investments. She holds a BSc. in Electrical Engineering from University of California, Davis, and Masters in Public Policy from Harvard Kennedy School, is a member of the Board of Directors of The Brattle Group, and the founding Director of New England Women in Energy and the Environment.

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Johannes (Hannes) Pfeifenberger is an economist with a background in power engineering and over 20 years of experience in the areas of public utility economics and finance. He has published widely, assisted clients and stakeholder groups in the formulation of business and regulatory strategy, and submitted expert testimony to the U.S. Congress, courts, state and federal regulatory agencies, and in arbitration proceedings.

Hannes has extensive experience in the economic analyses of wholesale power markets and transmission systems. His recent experience includes reviews of RTO capacity market and resource adequacy designs, testimony in contract disputes, and the analysis of transmission benefits, cost allocation, and rate design. He has performed market assessments, market design reviews, asset valuations, and cost-benefit studies for investor-owned utilities, independent system operators, transmission companies, regulatory agencies, public power companies, and generators across North America.

Hannes received an M.A. in Economics and Finance from Brandeis University and an M.S. in Power Engineering and Energy Economics from the University of Technology in Vienna, Austria.

Brattle-WIRES Reports on Transmission Planning

Well-Planned Electric Transmission Saves Customer Costs:

Improved Transmission Planning is Key to the Transition to a Carbon-Constrained Future

PREPARED FOR



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May 2016

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[http://wiresgroup.com/docs/reports/WIRES%20Brattle%20Report TransmissionPlanning_June2016.pdf](http://wiresgroup.com/docs/reports/WIRES%20Brattle%20Report%20TransmissionPlanning_June2016.pdf)

Toward More Effective Transmission Planning:

Addressing the Costs and Risks of an Insufficiently Flexible Electricity Grid

PREPARED FOR



http://wiresgroup.com/docs/reports/WIRES%20Brattle%20Rpt_TransPlanning_042315.pdf

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April 2015

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<http://wiresgroup.com/docs/reports/WIRES%20Brattle%20Rpt%20Benefits%20Transmission%20July%202013.pdf>

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

July 2013

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J. Michael Hagerty

Appendix: Additional Reading

Chang and Pfeifenberger, “Well-Planned Electric Transmission Saves Customer Costs: Improved Transmission Planning is Key to the Transition to a Carbon-Constrained Future,” WIRES and The Brattle Group, June 2016, at

http://wiresgroup.com/docs/reports/WIRES%20Brattle%20Report_TransmissionPlanning_June2016.pdf

Pfeifenberger, Chang, and Sheilendranath, “Toward More Effective Transmission Planning: Addressing the Costs and Risks of an Insufficiently Flexible Electricity Grid,” WIRES and The Brattle Group, April 2015, at

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Chang, Pfeifenberger, Newell, Tsuchida, Hagerty, “Recommendations for Enhancing ERCOT’s Long-Term Transmission Planning Process,” October 2013, at <http://www.brattle.com/news-and-knowledge/news/brattle-consultants-assist-ercot-in-scenario-planning-and-improving-its-long-term-transmission-planning-process>

Chang, “Implications of the Increase in Wind Generation for Alberta’s Market: Challenges of Renewable Integration,” presented at 13th Annual Alberta Power Summit, Calgary, Alberta, November 28, 2012.

Chang, “Challenges of Renewable Integration: Comparison of Experiences,” presented at Transmission Executive Forum West 2012, Meeting Public Policy Objectives through Transmission Investment, October 22, 2012.

Pfeifenberger and Hou, “Seams Cost Allocation: A Flexible Framework to Support Interregional Transmission Planning,” April 2012, online at:

http://www.brattle.com/system/publications/pdfs/000/004/814/original/Seams_Cost_Allocation_Report_Pfeifenberger_Hou_Apr_2012.pdf?1378772132

Pfeifenberger, Johannes, “Transmission Investment Trends and Planning Challenges,” presented at the EEI Transmission and Wholesale Markets School, Madison, WI, August 8, 2012, online at:

http://www.brattle.com/system/publications/pdfs/000/004/432/original/Transmission_Investment_Trends_and_Planning_Challenges_Pfeifenberger_Aug_8_2012_EEI.pdf?1378772105

Pfeifenberger, Hou, Employment and Economic Benefits of Transmission Infrastructure Investment in the U.S. and Canada, on behalf of WIRES, May 2011, online at:

http://www.brattle.com/system/publications/pdfs/000/004/501/original/Employment_and_Economic_Benefits_of_Transmission_Infrastructure_Investment_Pfeifenberger_Hou_May_2011_WIRES.pdf?1378772110

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