

Transmission and Distribution Investment and Cost Recovery

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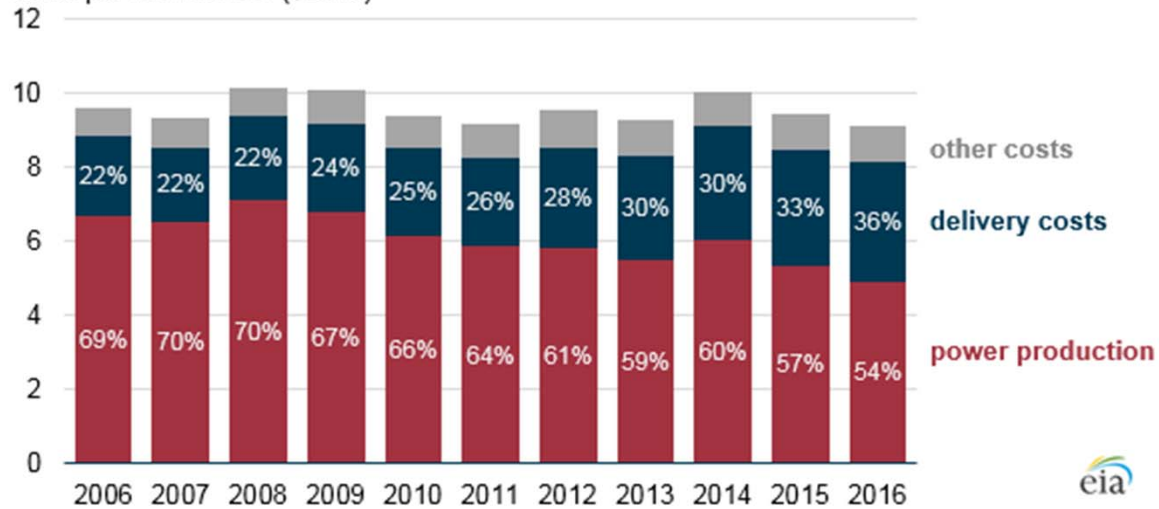
Why Transmission and Distribution?

- Lots of research on wholesale market design and performance
- Lots of research on integrating wholesale market design with efficient management and pricing of transmission congestion given reliability constraints
- Limited research on performance of retail competition in the U.S.
- Almost no research on ISO/RTO governance and regional transmission planning
- Almost no research on the regulatory mechanisms and performance associated with FERC regulation of transmission costs
- Almost no research on the regulatory mechanisms and performance of state regulation of distribution (aside from work on rate design)
 - A lot more research in Europe and Latin American

Why Transmission and Distribution?

- T&D (delivery) investments and T&D costs have been rising rapidly over the last 10-15 years
 - Congestion costs are small relative to charges customers pay (“revenue requirements”) for the transmission network
- FERC regulatory procedures for cost recovery and tariff development are not transparent and have not been modernized
 - COS/ROR regulation with little regulatory review of investment plans and costs
 - “Revenue Requirements”
 - Tariff design
 - COS/ROR on steroids for transmission due to FERC “incentives”
 - FERC has apparently never disallowed a transmission cost as being “imprudent”
 - Rejected formal performance based regulation
 - New “experiment” with competitive bidding
- State regulation of distribution investment and costs (“revenue requirements”)
 - Oversight of distribution planning and costs varies widely by state
 - Limited bandwidth in most states
 - Little if any research on regulatory mechanisms and their performance in the U.S.
- Decarbonization of the electricity sector will require reconfiguration and significant additional investment in T&D over which FERC and state regulatory will have great influence
 - Wind, solar, storage
 - DER
 - EVs
 - DR
 - Micro-grids
- These are neglected research areas

Federal Energy Regulatory Commission-regulated utility spending
cents per kilowatthour (\$2016)



<https://www.eia.gov/todayinenergy/detail.php?id=32812>

PAUL'S BILLS

cents/kWh

	<u>October 2006</u>	<u>November 2018</u>	<u>% Change</u>
<u>Distribution</u>	4.27	6.14	44%
<u>Transmission</u>	1.28	3.1	342%
<u>Generation</u>	11.44	11.39	0%

All New England customers (R,C,I) transmission prices:

2008: 0.6 cents/kWh

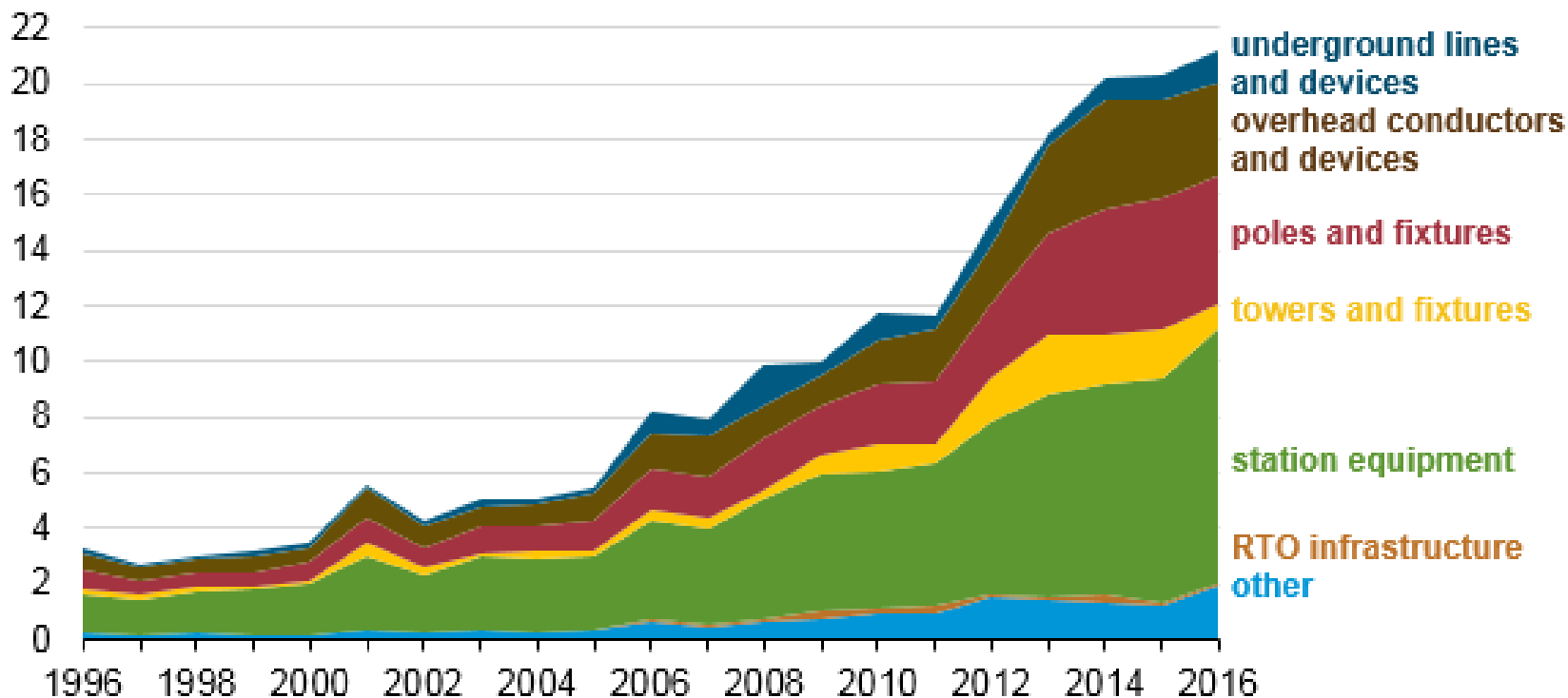
2018: 1.7 cents/kWh

% increase: 183%

ISO-NE (March 12, 2019)

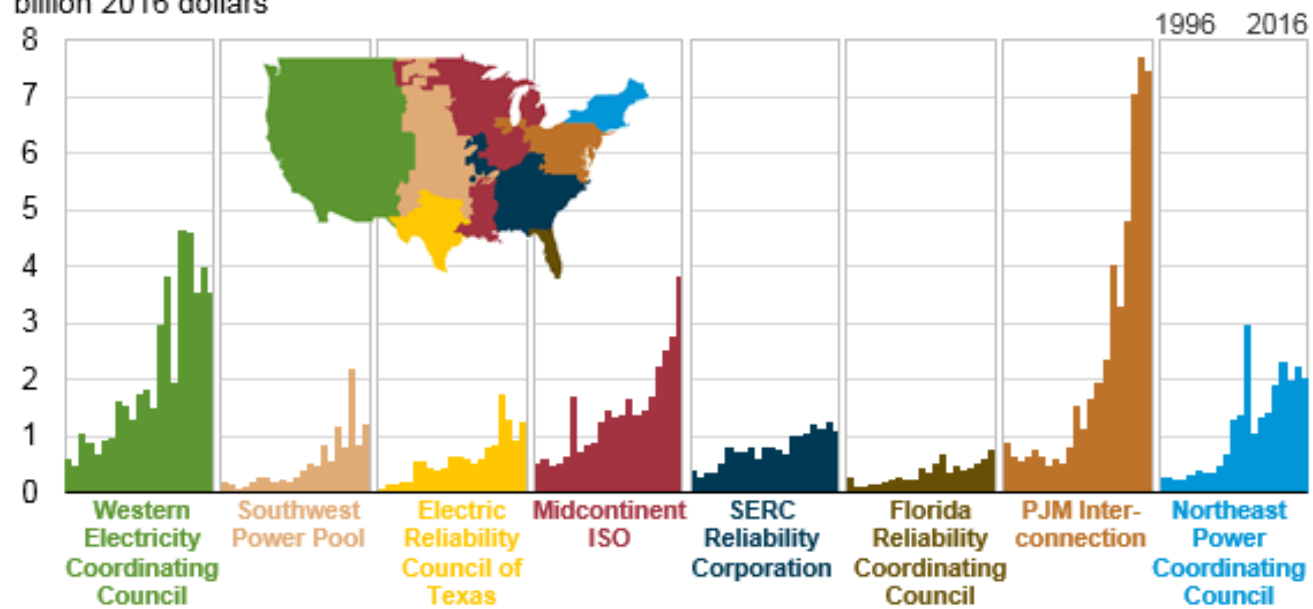
Investment in transmission infrastructure by major utilities (1996-2016)

billion 2016 dollars



Utility transmission investments by NERC region (1996-2016)

billion 2016 dollars



EIA

CALIFORNIA TRANSMISSION CHARGES AND CONGESTION COSTS

“Revenue Requirements” → Transmission charges

2007: \$1.1 billion

2017: \$3.3 billion

Increase: 200%

Congestion Costs (Internal):

2012: \$225 million

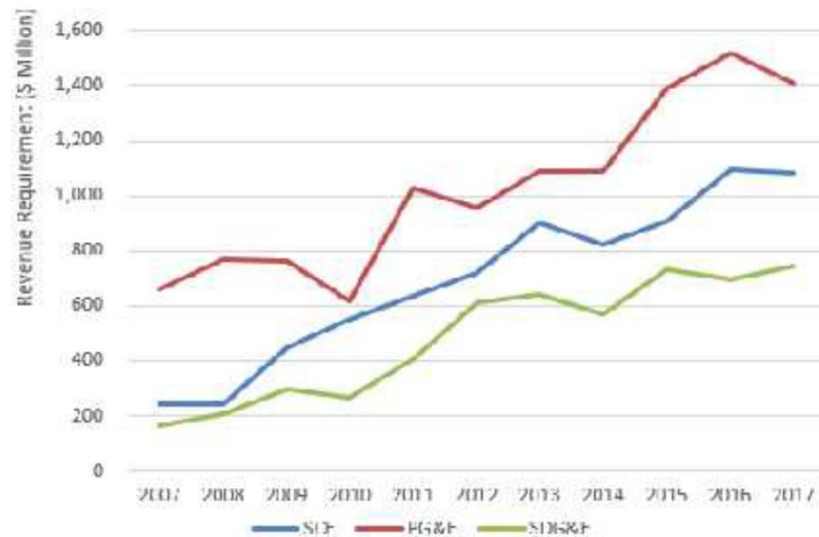
2013: \$230 million

2014: \$350 million

2015: \$170 million

2016: \$150 million

2017: \$180 million



CALIFORNIA UTILITY RATE BASE COMPONENTS

Transmission Rate
Base
 2007: \$ 4.5 billion
 2017: \$15.4 billion
 % increase 242%

Distribution Rate
Base
 2007: \$18 billion
 2017: \$35 billion
 % increase: 94%

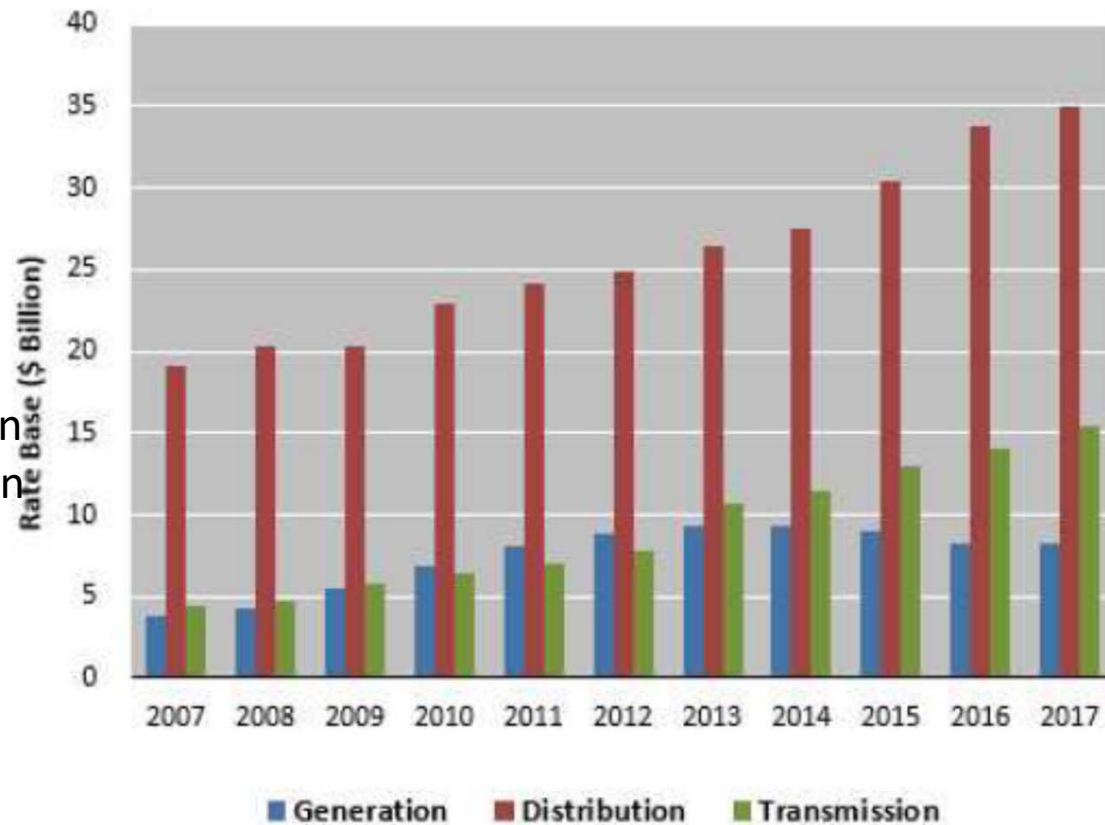
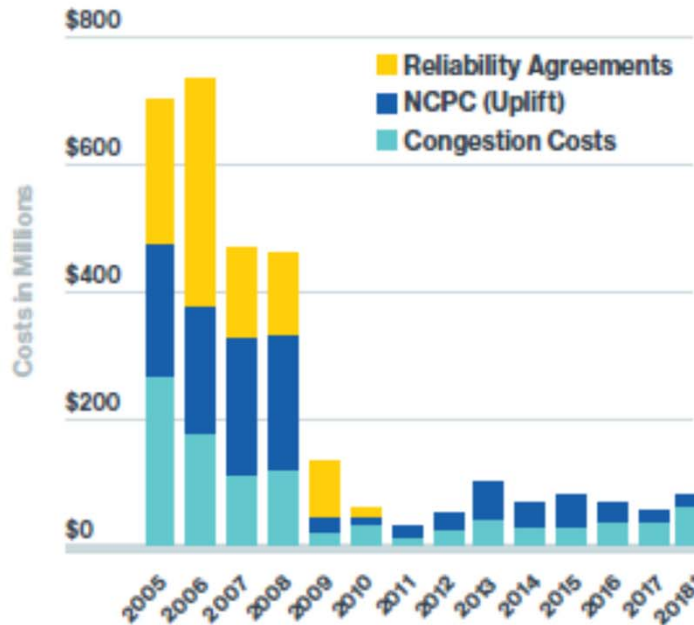


Figure 4: Trends in Utility Rate base - All IOUs

Costs for Congestion, Uplift, and Reliability Agreements



Note: Congestion is a condition that arises on the transmission system when one or more restrictions prevents the economic dispatch of electric energy from serving load. Net Commitment-Period Compensation is a payment to an eligible resource that operated out of merit and did not fully recover its costs in the energy market. Reliability Agreements are special reliability contracts between the ISO and an approved generator whereby the generator continues to operate, even when it is not economical to do so, to ensure transmission system reliability.

Note: Reliability agreements have not been used in the region since 2010.

NPCP is Net Commitment-Period Compensation

Source: Regional System Plans, Annual Markets Reports

Transmission Revenue Requirement:

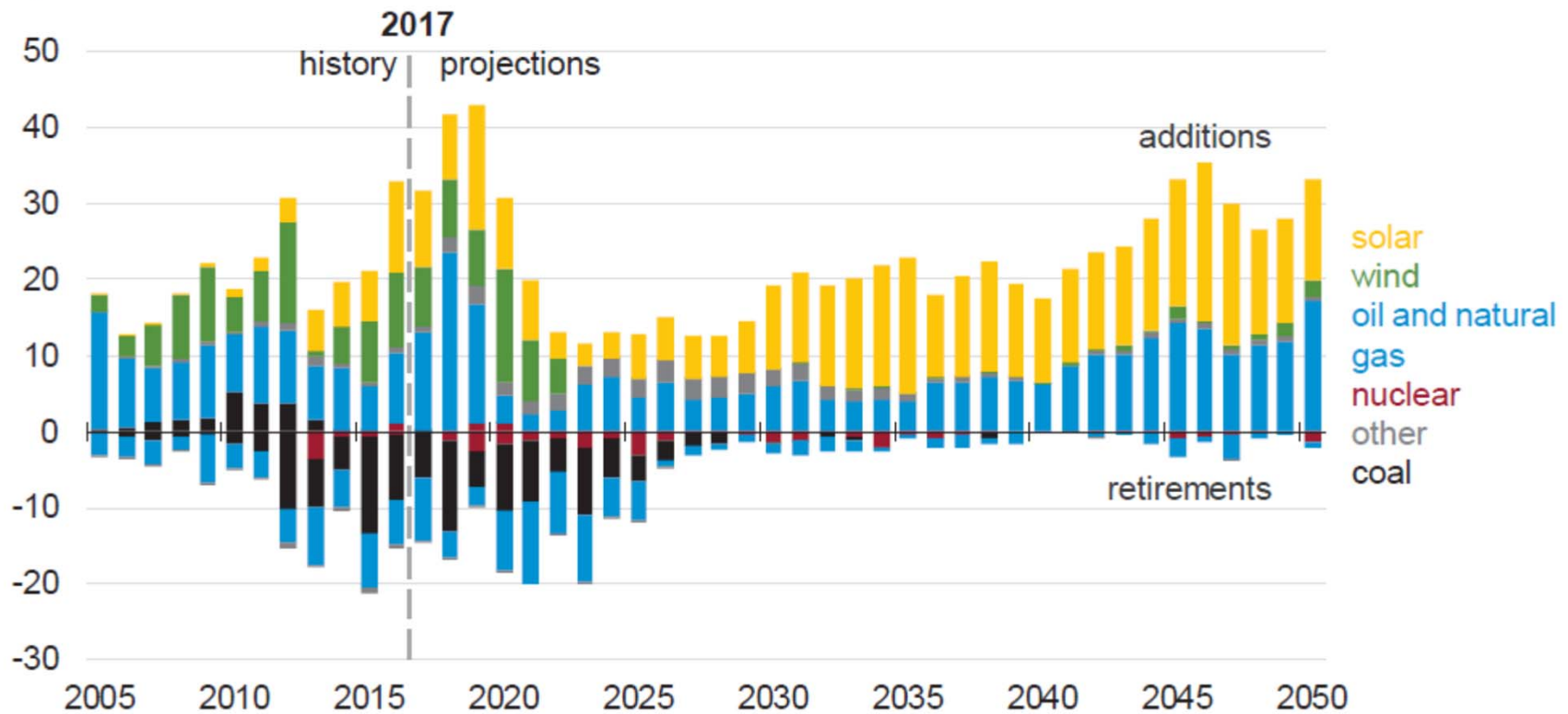
2008: ~ \$0.89 billion

2018: ~ \$2.2 billion

% increase: 147%

Renewables and natural gas comprise most of the capacity additions through the projection period in the Reference case—

Annual electricity generating capacity additions and retirements (Reference case)
gigawatts



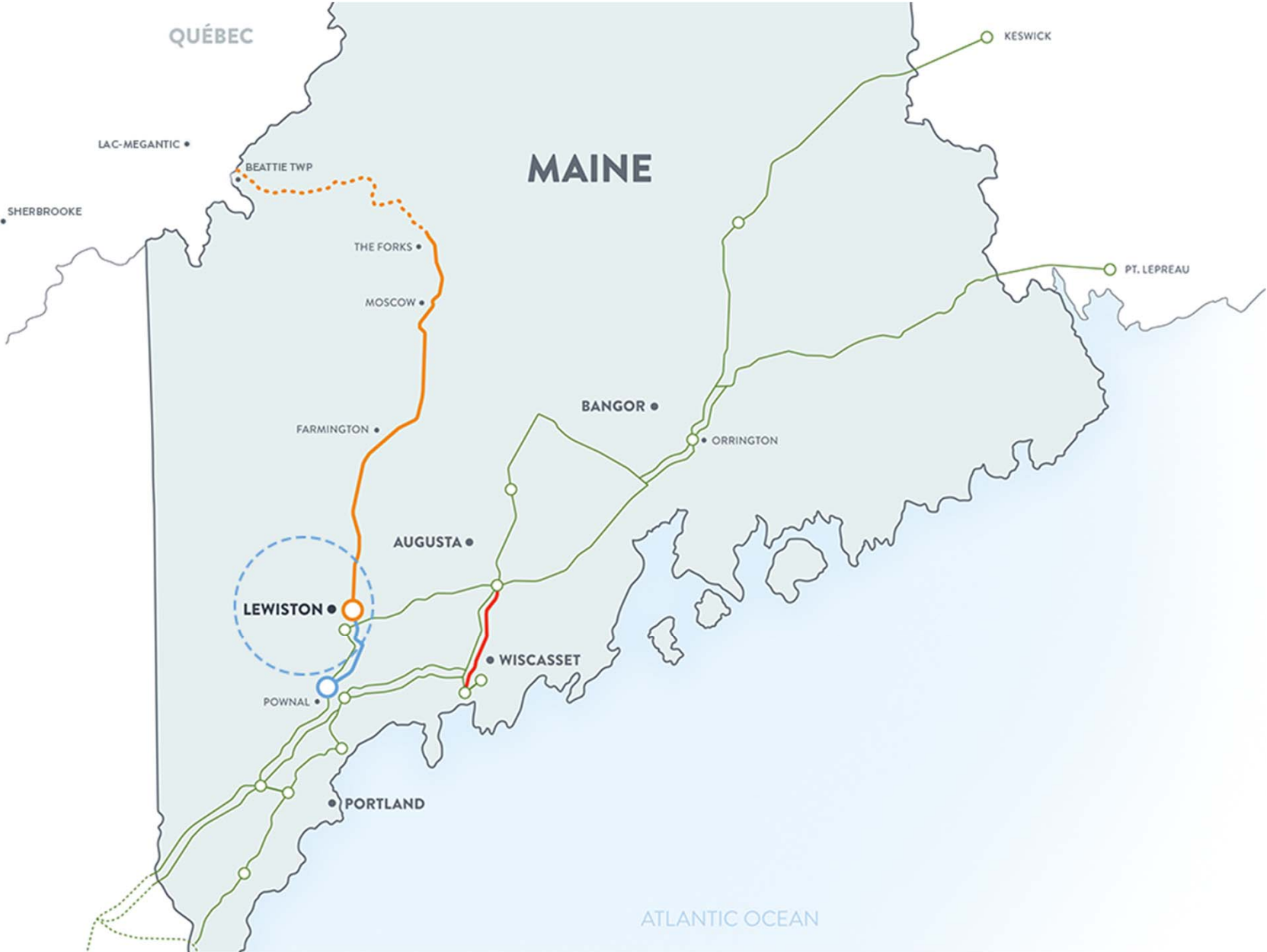
Transmission Planning and Regulatory Framework

- ISOs obligated to manage ongoing open regional transmission planning process
 - Regulated by FERC
 - Order 890 (2007): Open up transmission planning process to non-incumbents and other stakeholders
 - Order 1000 (2011): Eliminate incumbent right of first refusal, authorize competitive bidding, revise cost allocation rules, extend to non-iso regional planning
 - Local planning processes have limited ISO oversight but represent a significant fraction of FERC jurisdictional transmission investment
 - Inter-ISO planning is still weak
- FERC is the economic regulator for almost all transmission charges
 - Transmission charges: “Revenue Requirements” and tariff design
 - Rate of return/cost of service regulation to establish revenue requirements
 - Transmission incentive payments – ROR/COS on steroids
 - Little if any review of whether costs incurred are reasonable/prudent
 - No structured performance based regulation
- State and local regulation of siting and construction permits

Categories of Transmission Investment

- Interconnection: Generators, merchant transmission, storage
- Reliability:
 - Primary investment rationale to date
 - FERC regulated cost recovery
 - Cost allocation and revenue requirements governed by ISO OATT
- Market Efficiency (regulated):
 - Reduce congestion
 - B/C ratio > 1.25
 - Few projects approved to date
- Merchant-regulated: FERC jurisdictional tariff separate from ISO OATT
- Merchant-classical:
 - Original viewed as a path to introducing competition, cost containment, reducing congestion.
 - Very few successful projects and several dry holes (Hogan (1992), Bushnell and Stoft 1996, Joskow & Tirole 2005)

Clean Energy Connect





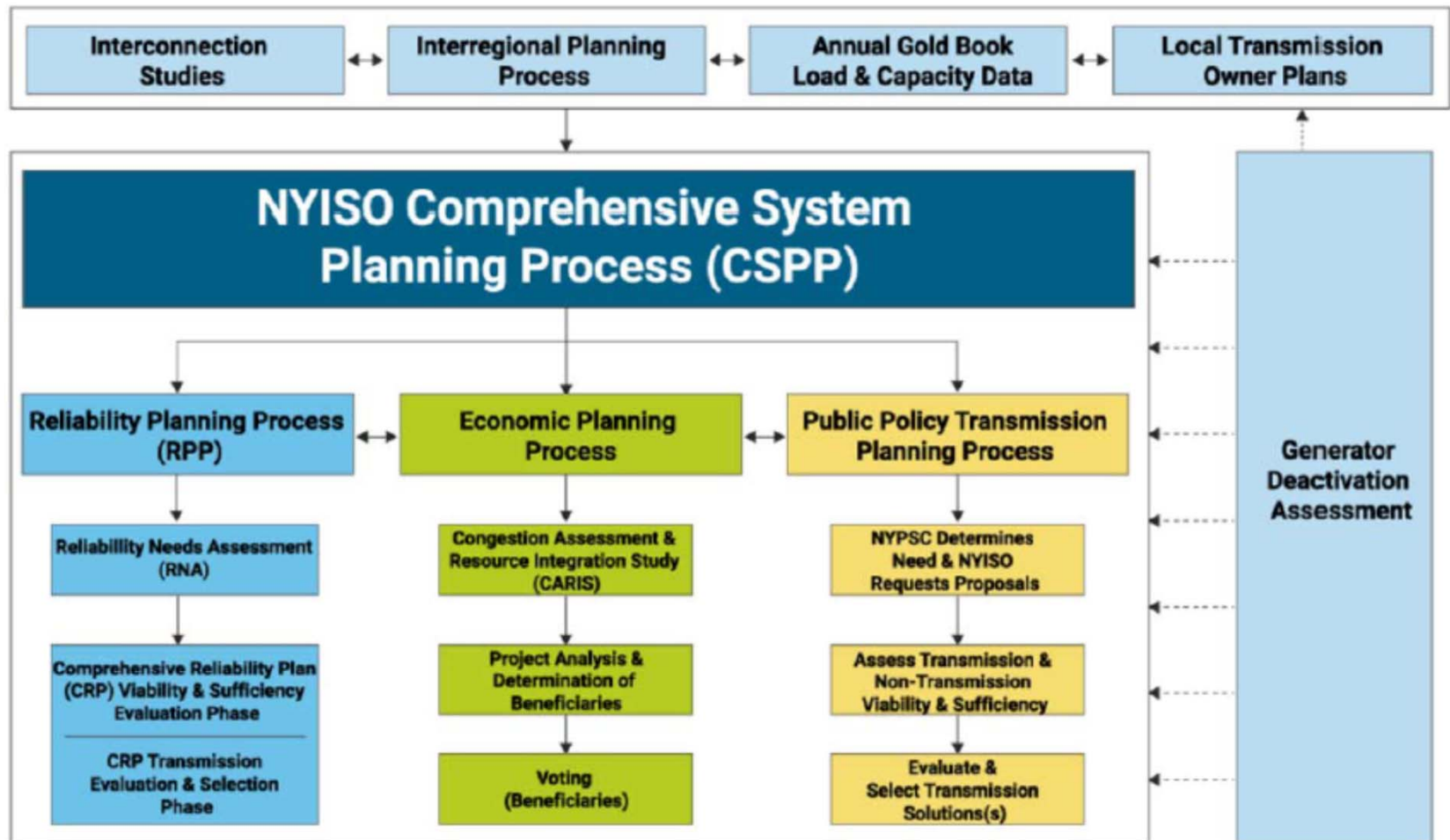
TransWest Express



<http://www.transwestexpress.net/>

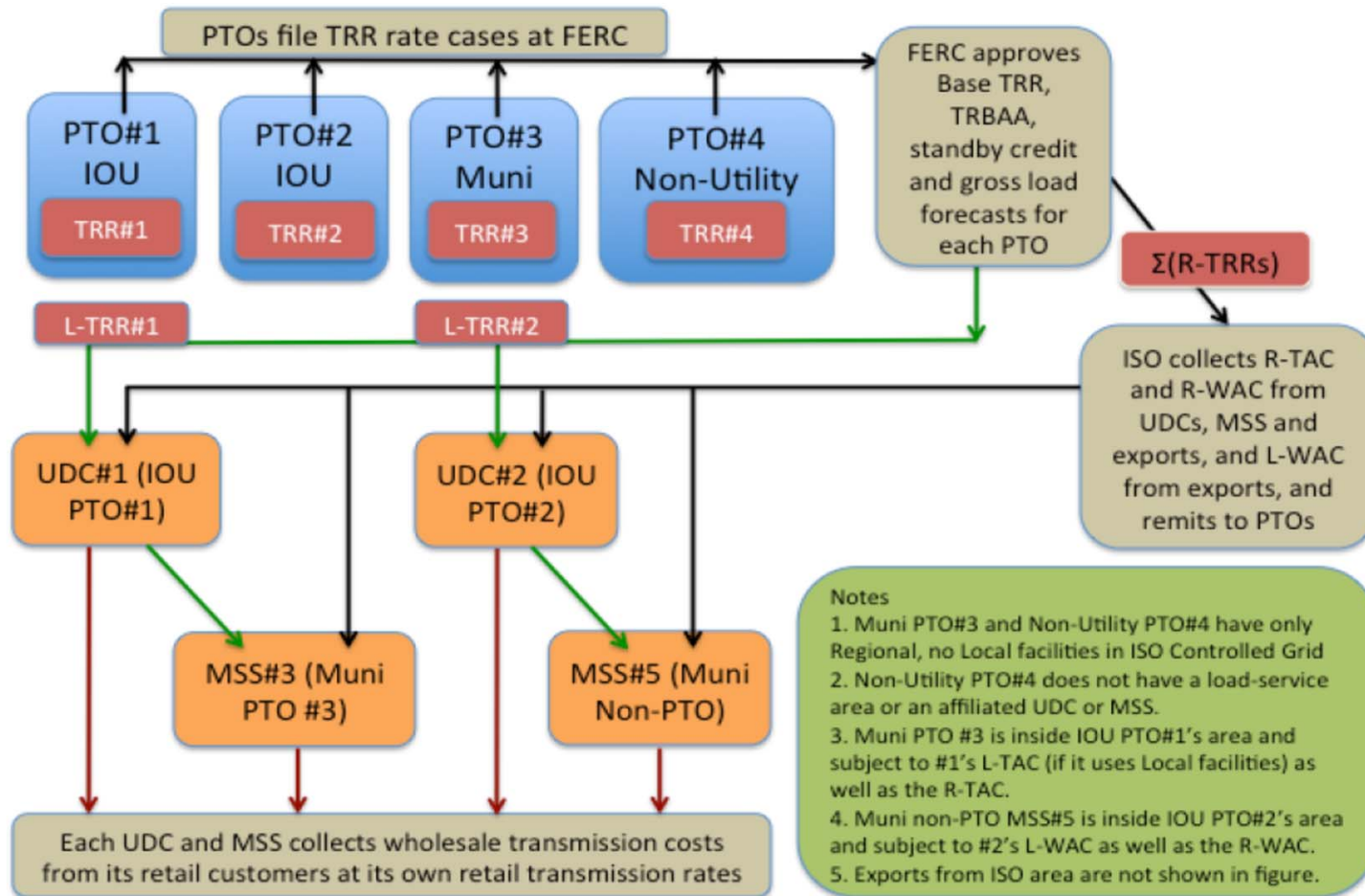
FERC TRANSMISSION INVESTMENT INCENTIVES (2006, 2012)

- Formula rates (no regulatory lag)
- Premium ROE
- Full recovery of CWIP
- Full recovery of costs of abandoned facilities
- Accelerated depreciation
- Additional premium ROE for members of RTO/ISO and other transmission organizations
- Hypothetical capital structure
- Recovery only for “prudent” costs
- But no visible process for reviewing prudence
- No “performance based incentives”
- Not what I had in mind when Energy Policy Act of 2005 was enacted
- FERC NOI to review incentives now in process



(/documents/20142/2251271/CSPPProcessFlow040419.png/65b7f3b4-f5d3-b8eb-7f18-8d1b33da866f?t=1554396338495)

CAISO TRANSMISSION COST ALLOCATION



Competitive Bidding for Transmission

- A substitute or complement to performance based incentive regulation
- ISO issues RFP for a specific project or to resolve a defined transmission need
 - Apply transparent multi-attribute evaluation
 - Cost estimates, cost containment and performance incentives included
- Not a new idea: Latin America, India, Australia, UK
- Slow to catch on in the U.S. and Canada
 - Resistance from incumbents
 - Reliance on classical merchant model has been a deterrent
- Provides comparative cost estimates for consideration
- Cost containment and related performance incentive provisions enforce commitments
 - Cost savings estimated at ~25-30% by Brattle Group (April 2019)
- Creative solutions to identified transmission needs
- Terms and conditions for winning bidder folded into FERC cost recovery, cost allocation, cost containment and tariff rules
- So, it's competition for a regulated cost-based contract
- Adoption of competitive procurement post-order 1000 has been limited
 - No consistency across ISOs

TABLE 1

CALIFORNIA ISO COMPETITIVE TRANSMISSION PROJECTS¹

<u>Project Name</u>	<u>Date Approved</u>	<u>ISO Planning Cost Estimate</u>	<u>Number of Bidders</u>	<u>Winning Bidder</u>	<u>Cost Containment</u>
Imperial Valley Policy Element	July 11, 2013	\$25 million	2	Incumbent ²	Yes
Gates-Greg	November 6, 2013	\$115-\$145 million	5	Incumbent	No ³
Sycamore-Penasquitos	March 4, 2014	\$111-\$221 million	4	Incumbent	No
Miguel 500kV	May 1, 2014	\$30-\$40 million	1	Incumbent	No
Suncrest	January 6, 2015	\$50-\$75 million	2	Non-incumbent	Yes
Estrella	March 11, 2015	\$35-\$45 million	4	Non-incumbent	Yes
Wheeler Ridge Junction	March 11, 2015	\$90-\$140 million	4	Incumbent	No
Spring	March 11, 2015	\$35-\$45 million	3	Incumbent	No
Delaney-Colorado River ⁴	July 10, 2015	\$300 million	5	Non-incumbent	Yes
Henry-Allen To Eldorado	January 11, 2016	\$144 million	3	Non-incumbent	Yes

¹ Developed from project solicitation evaluation reports. <http://www.caiso.com/planning/Pages/TransmissionPlanning/2013-2014TransmissionPlanningProcess.aspx>

² Project adjacent to selected proposer's territory but this territory is outside CAISO.

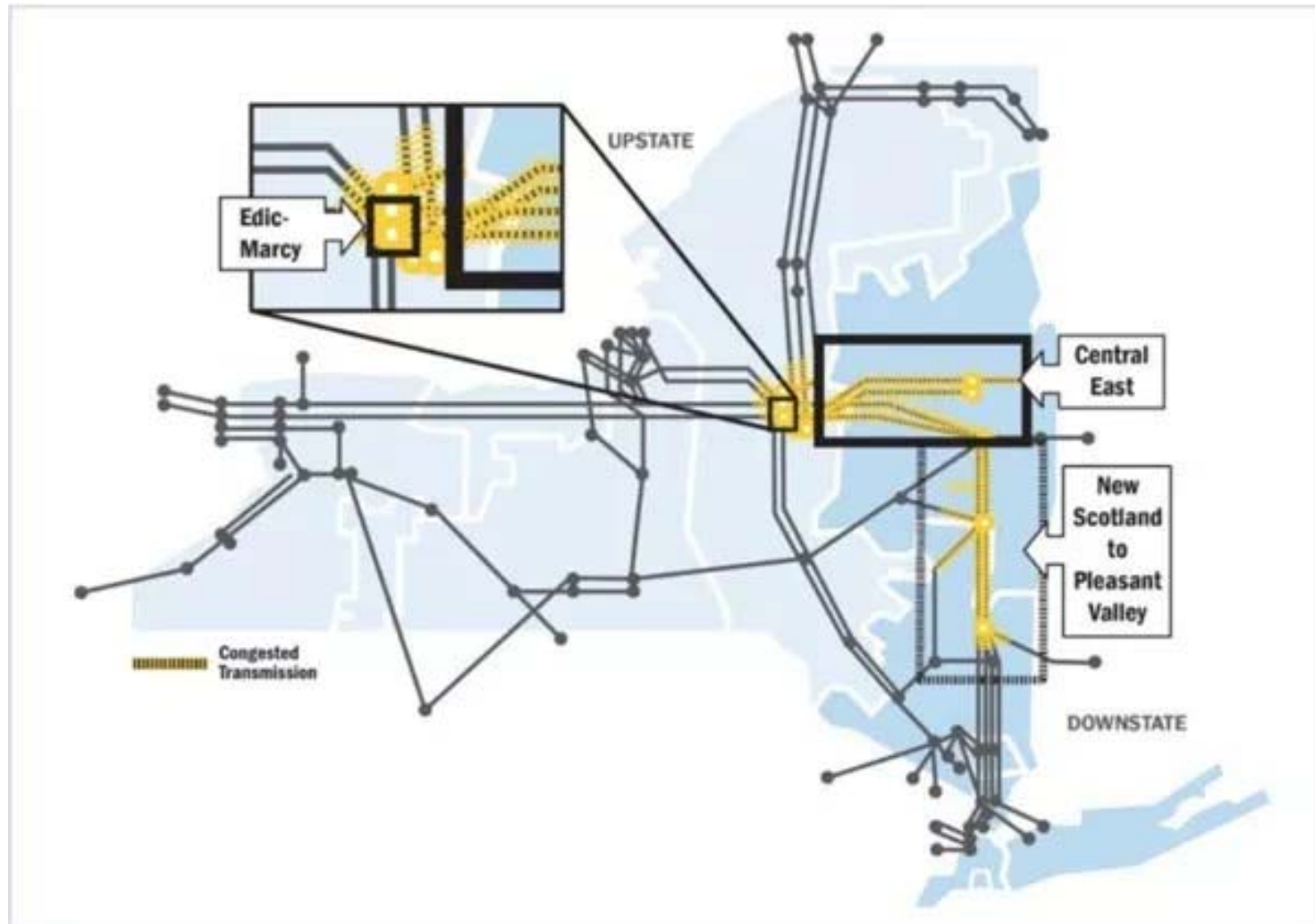
³ Agreed only not to apply for FERC incentive rate of return on equity

⁴ First "economic" or "market efficiency" project

NEW YORK

- Two major “public policy” multi-segment transmission projects put out for competitive bids
- A different model from CAISO, MISO, SPP, ISO-NE
 - Specific project vs. specific network problem
- “Western New York Public Policy Need” (2014)
 - 12 proposals (7 unique bidders)
 - Estimated construction cost: \$157- \$487 million
 - Winning bidder (non-incumbent): Estimated cost \$181 million. Approved 2017
 - Agrees to cost containment/incentive provisions
 - NYPSC questions whether incentive provisions consistent with OATT and FERC regulation
 - Expected in-service date 2022

NY AC Public Policy Transmission Need



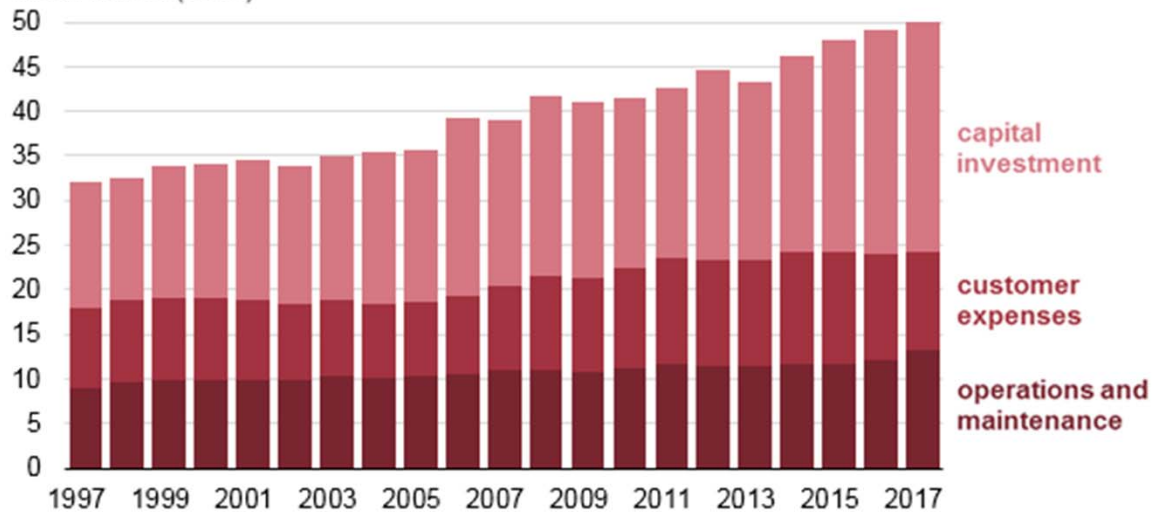
New York

- “AC Public Policy Transmission Need” (2014)
- Sought competitive bids (RFP 2016)
 - Segment A and B could be awarded separately
 - 15 proposals (5 unique sponsors)
 - 7 proposals segment A
 - 6 proposals segment B
 - 2 proposals both segments
 - Variations in cost estimates
 - Segment A: \$375 - \$659 million
 - Segment B: \$275 - \$380 million
- Winning bids (4/2019):
 - Segment A (non-incumbent): \$556 million
 - Segment B: (incumbent): \$341 million
- Cost containment commitments

DISTRIBUTION

- Regulatory capabilities and practices vary widely by state
- Most U.S. states continue to rely on COS/ROR regulation
 - Revenue Requirement
 - Tariff Design
- Oversight of distribution investment planning and cost recovery appears to be limited in most states but has not been studied in detail
 - Historical vs. future rate base
 - Performance-based incentive regulation much more common in Europe and Latin America and has been studied (Pollitt)
- Proposals to restructure distribution to facilitate competition (Burger et. al. Energy Journal 2019)
 - Separate ownership from operations
 - Facilitate competition for DER and distribution investment
 - Ownership of DER, storage, micro-grids

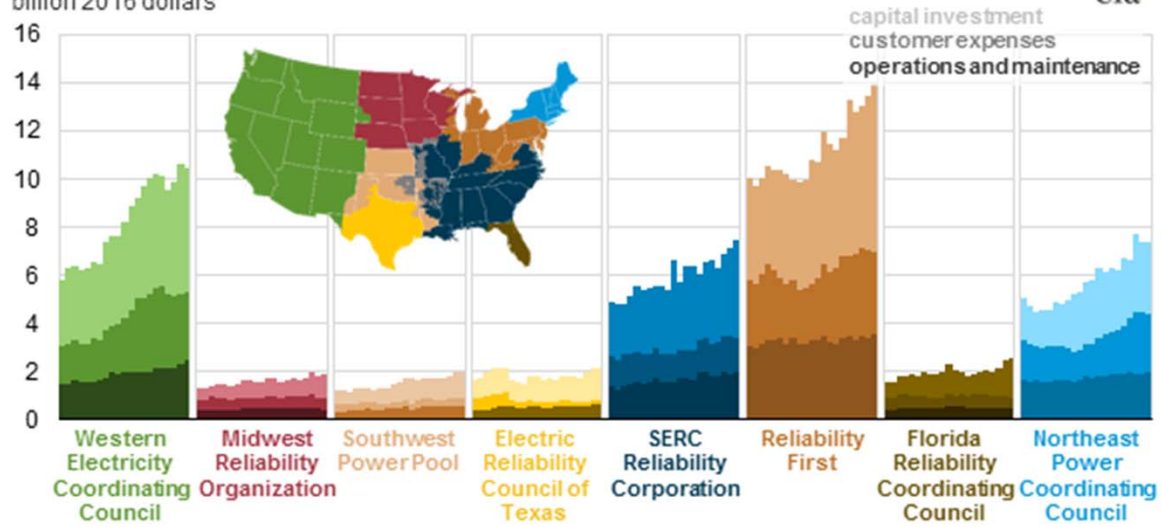
Annual electric distribution system costs for major U.S. utilities
billion dollars (2017)



EIA

Major utility distribution system investment by NERC region (1996-2016)

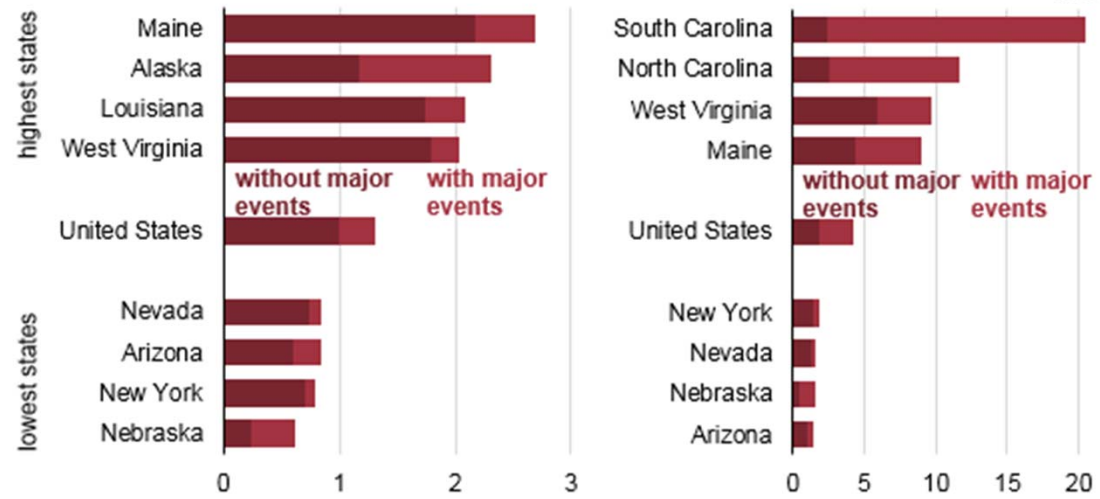
billion 2016 dollars



Average electric power service interruptions per customer in selected states, 2016

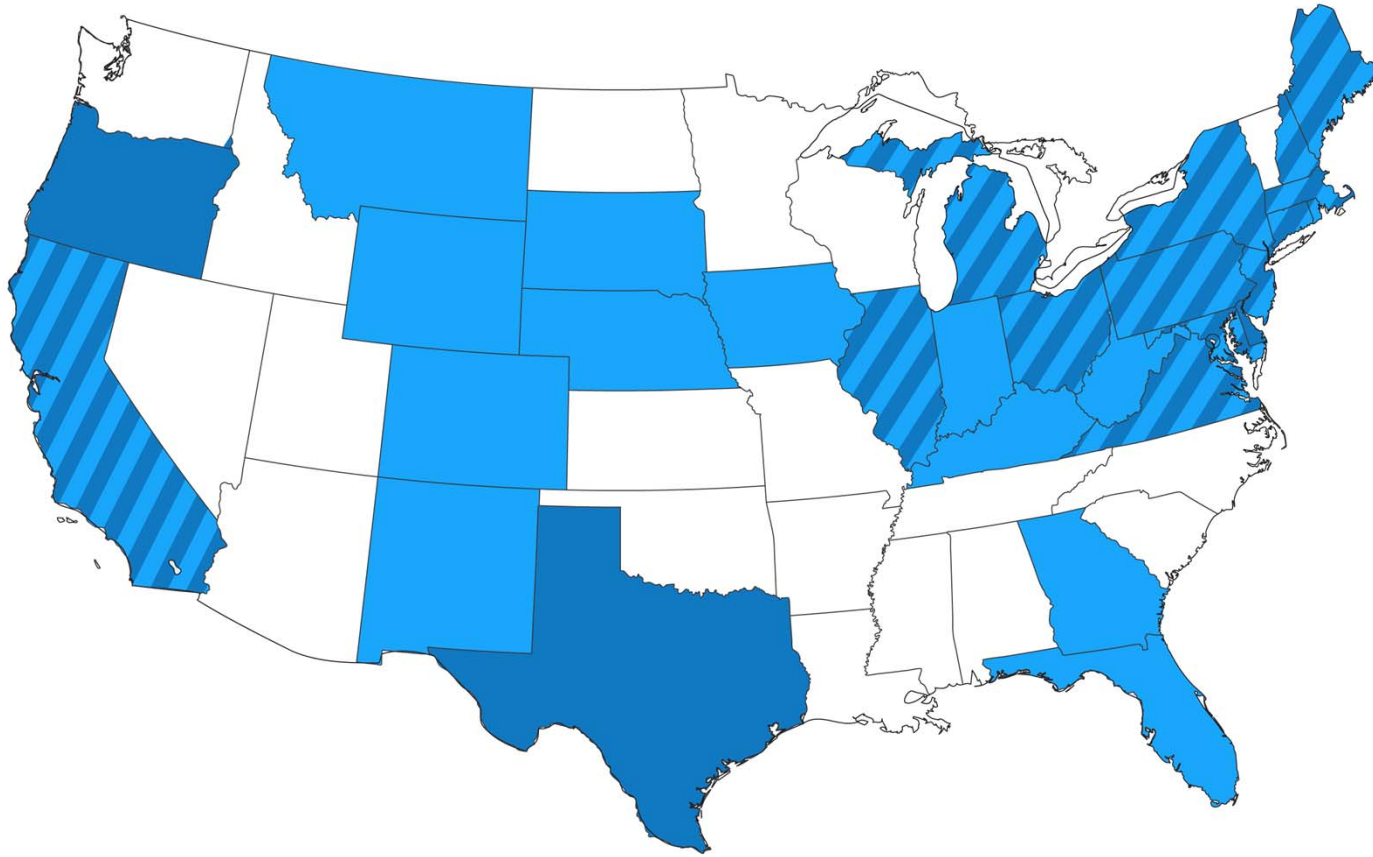
frequency (number of instances)

total duration (hours)



EIA

Retail Competition



<https://www.electricchoice.com/map-deregulated-energy-markets/>

DATA

- Transmission
 - ISO web sites
 - FERC formula rate filings
 - FERC Form 1
 - EIA
 - Transmission owner web sites
 - SEC 10-K
 - FERC orders
- Distribution
 - State PUCs
 - FERC Form 1
 - SEC 10-K
- Retail competition
 - State PUCs and AGs
 - EIA