



Managing Basis Risk in ISO/LMP Wholesale Markets

How Consumers and Physical Market Participants Benefit from Financial Transmission Rights (FTRs)

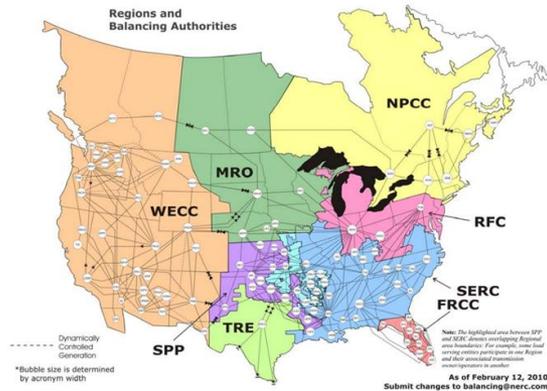
Abram W Klein

7 October 2025

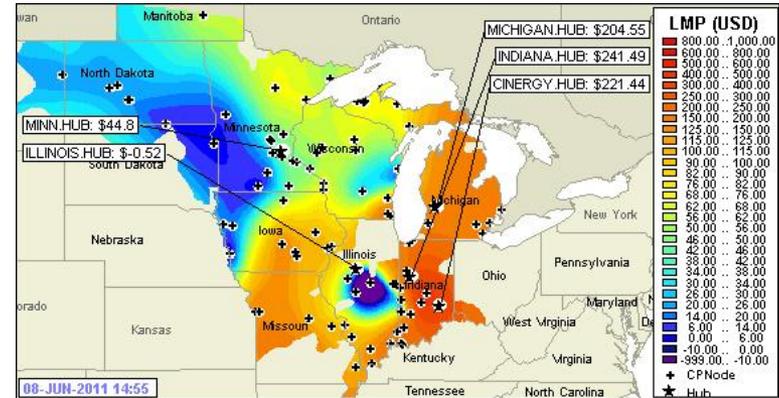
For the Future of Power Markets Forum

Bilateral Market vs. ISO/LMP Market

What happens When We Use ECONOMICS Instead of Physical Rights to Allocate Transmission Usage?



- Scarce transmission capacity is rationed based on “physical” rights reservations (legacy/first-come first-serve; “use-or-lose”)
- “Contract Path Fiction” – inconsistent with physics of the grid
- Requires conservative ATC; results in uneconomic dispatch and uneconomic curtailment
- Lack of transparency regarding what transmission and generation investment should be made

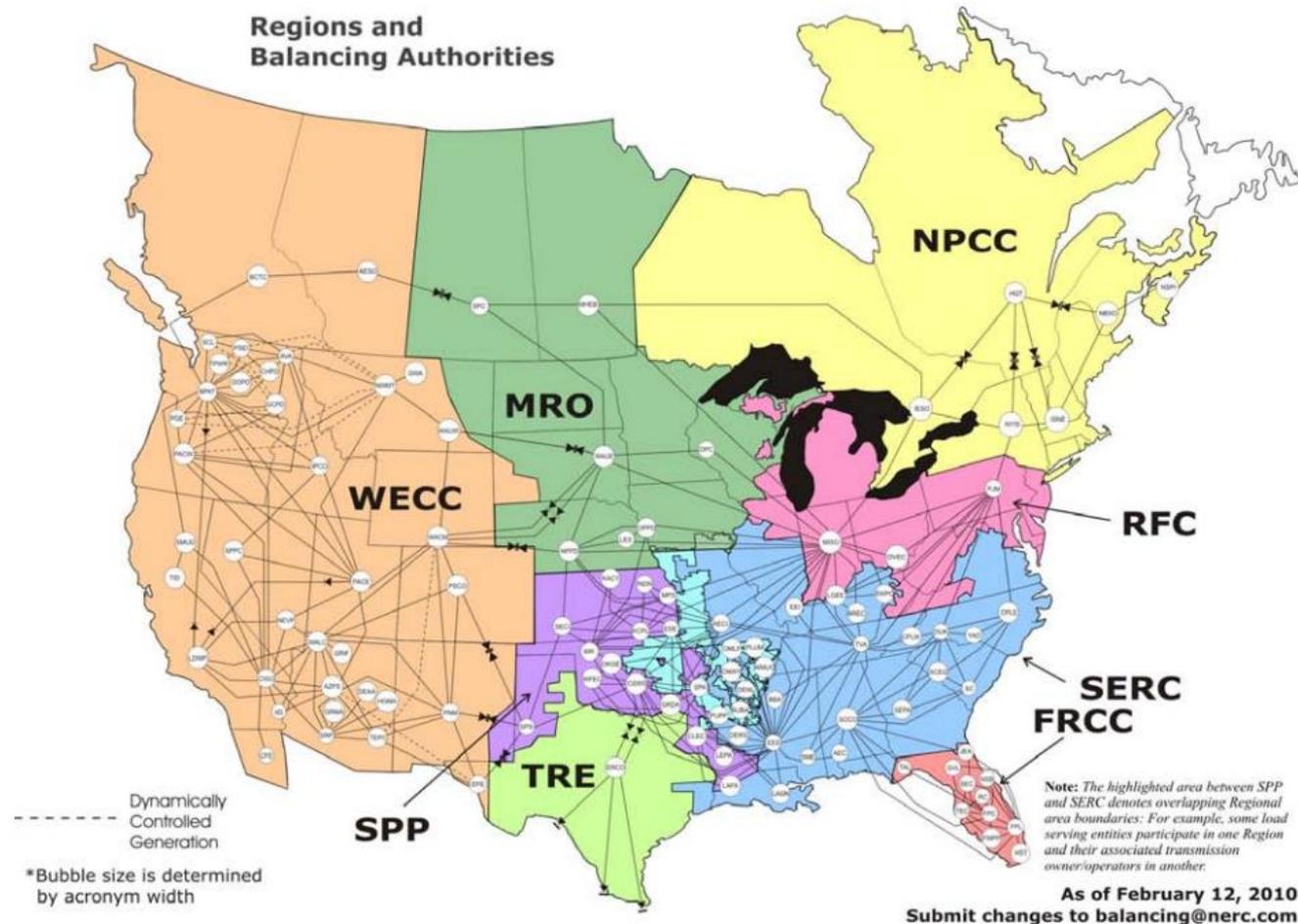


- Scarce transmission usage optimized based on **economics!**
- Market system consistent with physics of the grid; prices support least-cost dispatch and optimal transmission usage
- LMP Dispatch signal
- Proper long-term entry/exit incentives for gen, load, transmission investment and demand response



"Physical" Rights and the Contract Path Fiction

"Physical Rights" Do Not Match The Physics of Powerflow



Wholesale Electricity Markets

What happens When We Use ECONOMICS Instead of Physical Rights to Allocate Transmission Usage?

AEP System Flows: Before vs. After Dispatch Integration

Scott Miller, WPTF

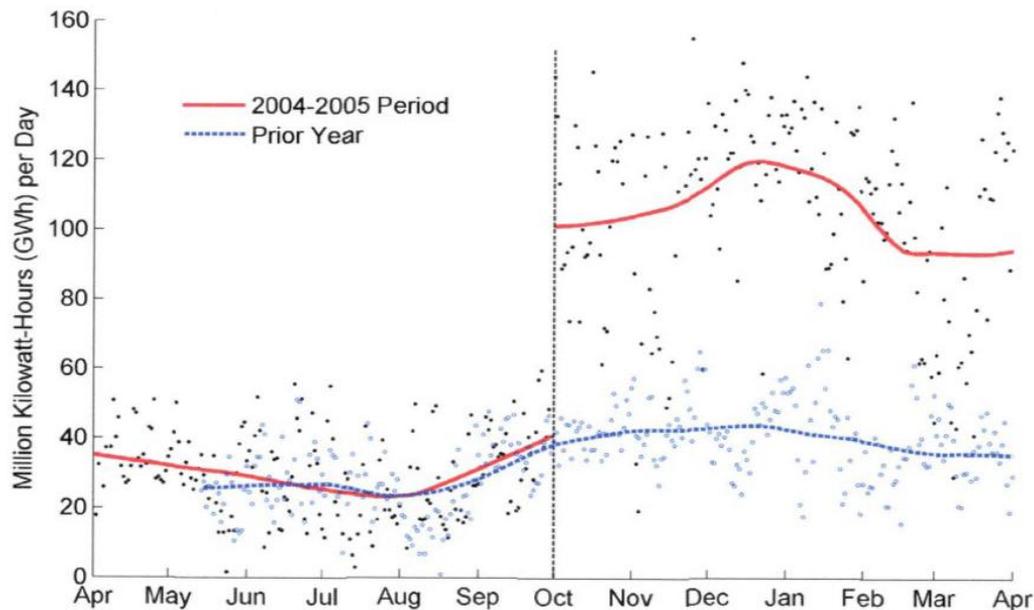


Figure 2: Day-Ahead Net Exports from Midwest to East (PJM)

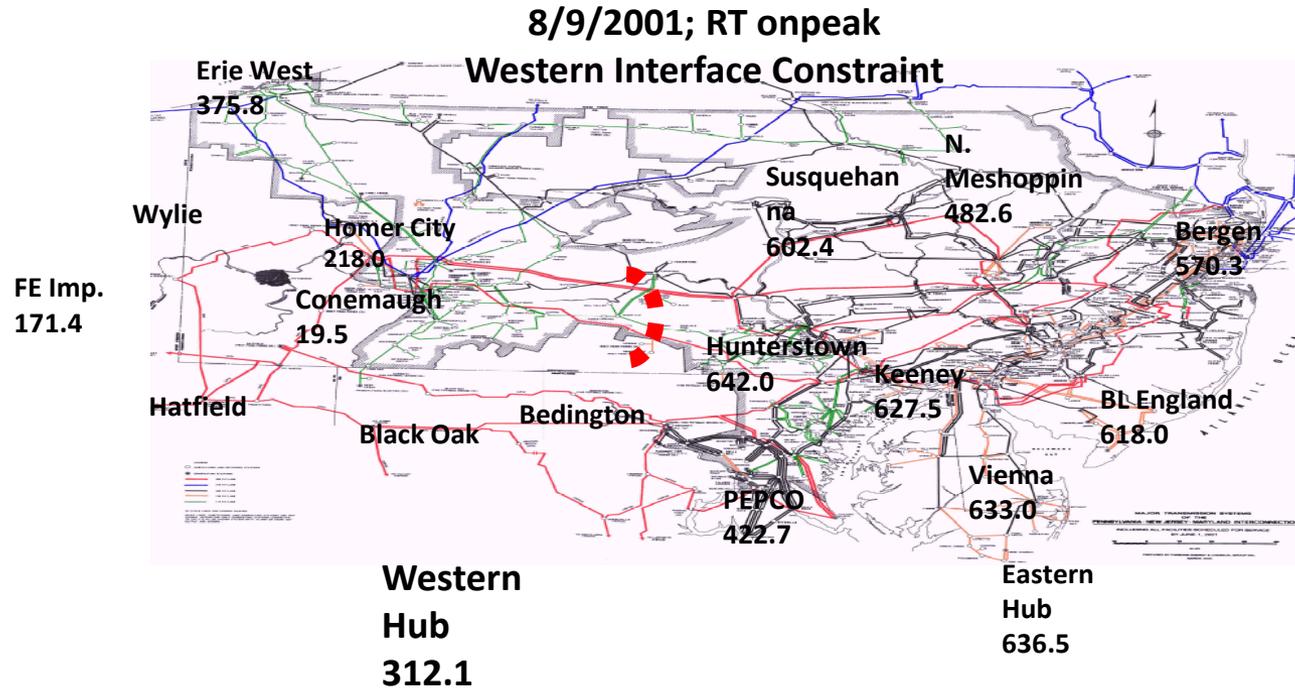
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The system of “physical rights” (without LMP) leads significant underestimation of actual available transmission capacity



The 1990s Market Design Debate: Nodal vs. Zonal vs. Uniform Pricing

Nodal "Too Complex" For Supporting Liquidity in Long-term Contracting? Some Viewed the LMP System as a Barrier to Liquidity and Trading. FTRs provide the Answer



LMPs are set to the marginal cost of meeting load at each location, accounting for grid network externalities/loop flows/congestion. When congestion occurs, prices can be vastly different at each location. Market participants need a mechanism to hedge price and congestion exposure



Wholesale Electricity Markets

Two Purposes of The Electricity Market

- The LMP spot market accounts for a unique aspect of electricity: power flows according to the laws of physics, not contract paths. A spot market in electricity has two principal functions:
 - **Maintain Efficient Short-Term Operations and Dispatch** – Least-cost and reliable dispatch to meet load given available resources in the hour/day; efficient usage of transmission capacity; largely independent of longer-term contract arrangements
 - **Facilitate Longer-Term Contracting and Efficient Entry/Exit** – Spot market reduces the risks of contracting; Allows contracting parties to sell “overs and unders” to meet their obligations at least cost/highest profits, facilitates entry by undiversified competitors, each of which can compete in the specific activity it does best without needing to be a self-contained, full-service producer; sends price signals regarding when and where new generation or transmission is needed
- Market design needs to get the first one right, not only in terms of efficient, least-cost dispatch and transmission usage, but also in creating the right signals to support the second function

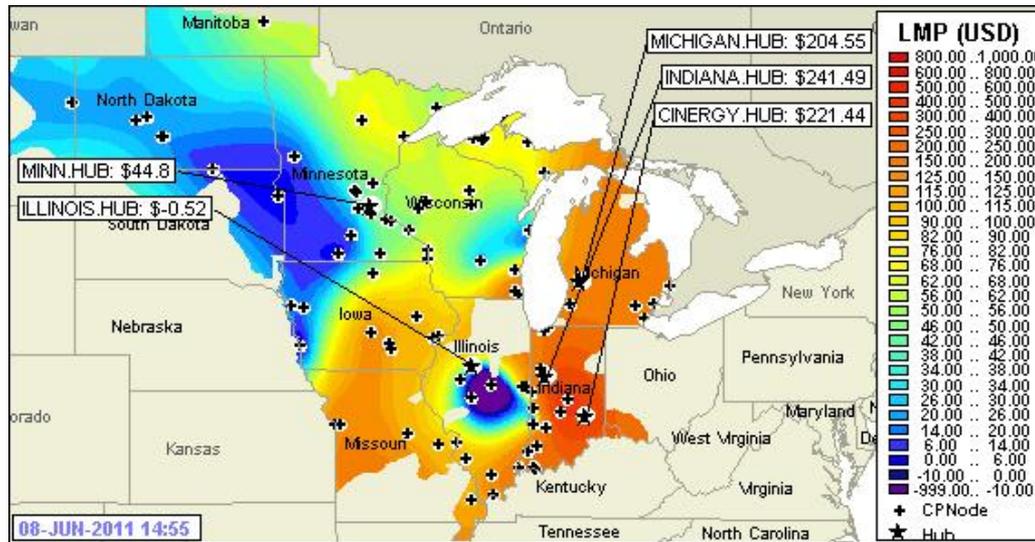
ISO markets provide low transaction cost access to the spot market, efficient dispatch and efficient use of transmission. Transparent, reliable spot pricing creates a straightforward index against which to settle futures and contracts for differences



Nodal vs. Zonal/Uniform Pricing

Nodal "Too Complex" For Supporting Liquidity in Long-term Contracting?

FTRs provide the answer



- The LMP system creates a challenge regarding the physical hedging of generation and load
- PJM's white paper on FTRs: PJM has an "obligation to ensure the development and operation of market mechanisms to manage congestion" (FTRs)
- When there is congestion in the LMP system, prices can be different at every location on the grid.
- Entities participating in the ISO market need a system for managing congestion.



ARR Allocation, FTR Auctions and Congestion Hedging

Application of Economics' Coase Theorem to Power Markets

- In the ISO/LMP market, physical rights are replaced by financial rights

ARR Allocation

- Total ARRs allocated (and FTRs auctioned) based on system network capacity
- "Physical" rights holders can have their point-to-point rights converted to ARRs
- ARRs are also allocated to entities that pay for the grid
- ARR holders may:
 - ✓ Convert their ARRs to FTRs
 - ✓ Convert ARRs to certain \$\$
 - ✓ Use ARR \$\$ to fund purchase of a different set of FTRs that better meet their business and risk needs
 - ✓ Provide ARRs to financial intermediaries who manage the financial risk of serving load for them

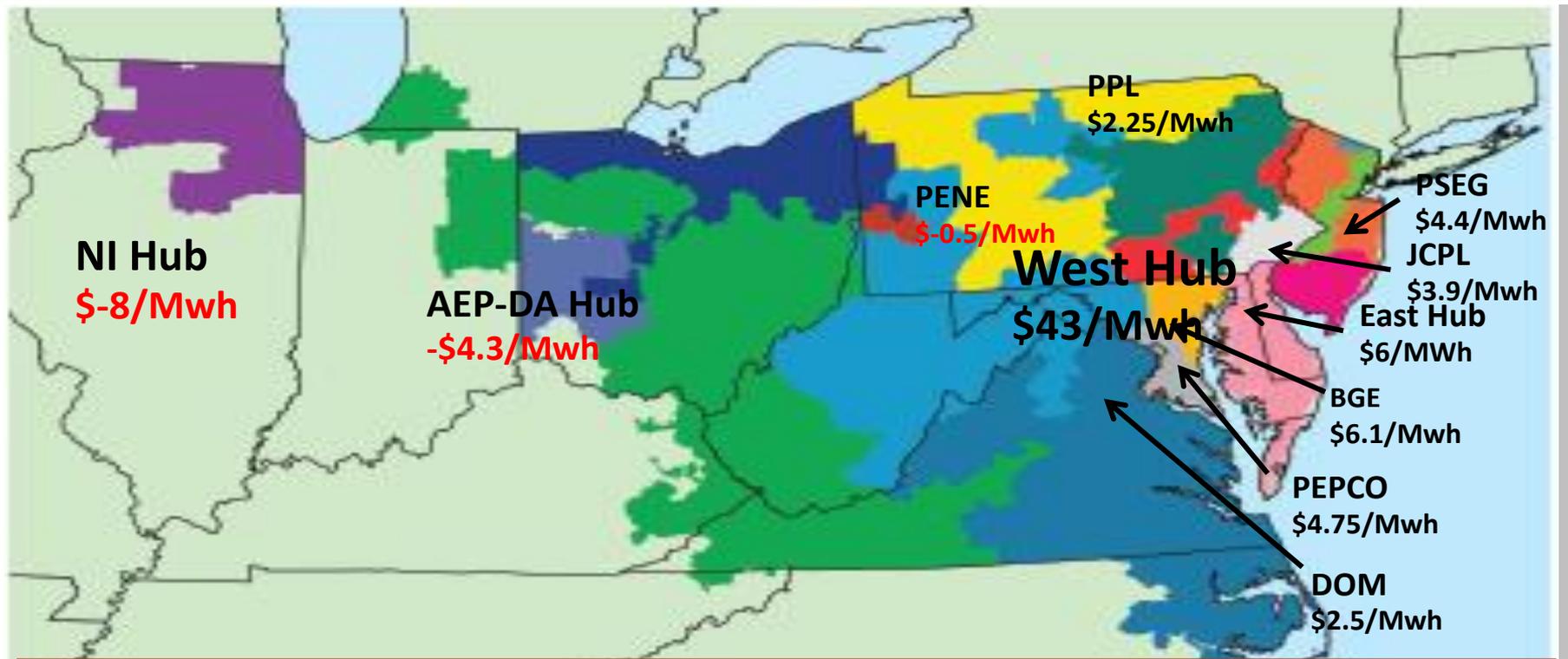
FTR Auction

- The ISO runs the FTR auction, allowing eligible market participants to bid to purchase any FTRs from and to eligible nodes
- The ISO clears the FTR auction by maximizing ARR revenues subject to system constraints
- FTR prices can be positive or negative depending on the source to sink clearing price
- Generators (or financial intermediaries that trade with them) manage congestion risk by:
 - ✓ Buying FTRs to a trading hub
 - ✓ Buying FTRs to a load zone
 - ✓ Buying FTRs to different locations outside their gen pocket but not all the way to a load zone or hub
 - ✓ Buying a portfolio of FTRs correlated with their congestion risk while avoiding FTR exposures correlated with outages
 - ✓ Choosing to "wear the basis risk"



Nodal Complexity Simplified With Traded Hubs & Zones; Augmented by FTR Auction Markets

The FTR market provides a "contestable market" for bilateral futures, enhancing competition, and reducing cost to consumers in wholesale markets



Nodal spot prices drive market expectations for FTR markets, and forward trading at zones and hubs. These forward prices become the basis for pricing in contracting and forward hedging. With high transparency, and increasing sophistication, customers who serve load become comfortable using FTR markets and the futures markets, in combination, to manage basis risk.



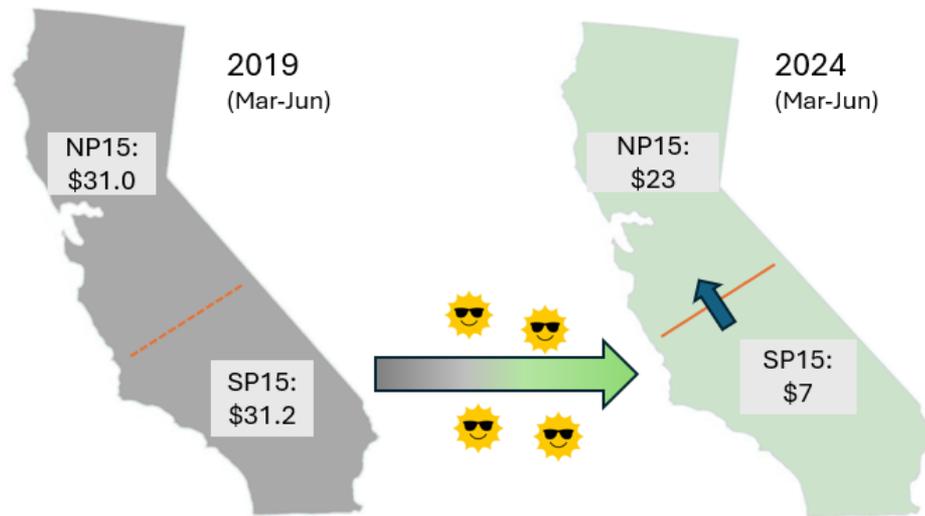
FTR Property Rights in Context

Do Transmission Ratepayers Experience "Losses" from the FTR Auction?

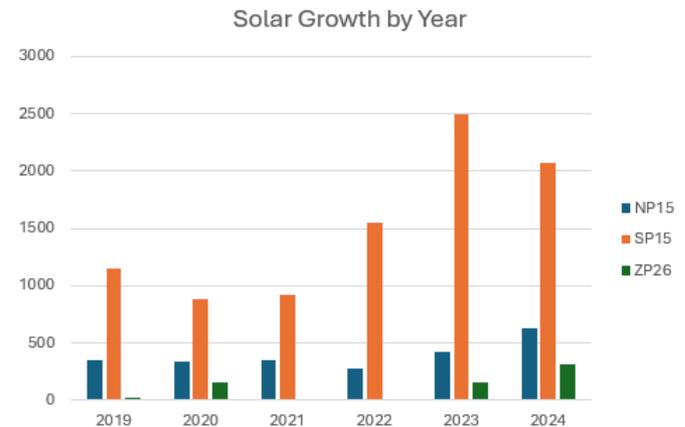
Misconception: "Load pays the congestion and therefore load is entitled to ALL the congestion rent"

Counterpoint: When there is congestion, it's not possible to say whether load is paying "more," or suppliers are being paid "less"

Context: CAISO renewable growth has led to lower spot prices for load (i.e. suppliers being paid less) and highlights the importance of access to congestion hedges to manage delivery risk for IPPs, LSEs that contract for remote generation, and the financial intermediaries that transact with each of them



Average on-peak RTDP price for March-June of 2019 vs 2024
IFM prices were \$26.6 and \$26.5 in 2019, and \$23.1 and \$7.9 in 2024



The FTR Market and the ISO/LMP System are Inextricably Linked

FTRs serve as the financial equivalent of firm transmission under Order 888

- FERC:

- *Consistent with Commission precedent, we reiterate that “[t]he purpose of FTRs to serve as a congestion hedge has been well established.” FTRs were designed to serve as the financial equivalent of firm transmission service and play a key role in ensuring open access to firm transmission service by providing a congestion-hedging function.*

- Commissioners Glick, Danly, Clements, Christie and Phillips, ER22-797, 3/11/22

- The FTR/ARR Market Design is Part of a Larger Market Design Context:

- “Now all organized wholesale markets in the United States are built around the essential elements of bid-based, security-constrained, economic dispatch with locational prices and **financial transmission rights**. The success and wide adoption of this market design reflects the basics of the underlying electricity system and the requirements of open markets. In short, this successful market design is the only way to organize a short-term electricity market that adheres to the principles of open access and nondiscrimination. [For the Commission,] the most important thing to remember is the critical role of this fundamental market design. There is no other way to organize system operations and adhere to the Commission’s mandate. Furthermore, the broad policy objectives of the green energy agenda only serve to reinforce this conclusion. **The penetration of intermittent resources, such as solar and wind, often located far from load, increases the need for real-time coordination of dispatch across larger regions.**”

- Comments of William W. Hogan, Docket No. AD17-11



Congestion is a Small Part of Larger Electricity Market Structure, but FTRs are a Crucial Piece

- Congestion is a small part of the overall energy market
- Nevertheless, “getting the prices right” is essential for sending efficient market signals to both the spot and longer-term markets
- The ISO model with nodal pricing is the ONLY market design that accomplishes this and FTRs are a crucial aspect of this model

2023 CAISO Energy Market Size (\$MM)

