# The Role of FTR's as Congestion Hedges and FTR Auction Values

Scott Harvey

EUCI FTR Conference

Washington DC

January 30, 2020

# TOPICS

- The Role of FTRs as Congestion Hedges
- Valuation of Financial Transmission Rights
- Empirical Analysis of FTR Auction Valuation
- Valuation of FTRs as Risky Financial Instruments

# The Role of FTRs as Congestion Hedges

# ROLE OF FTRS

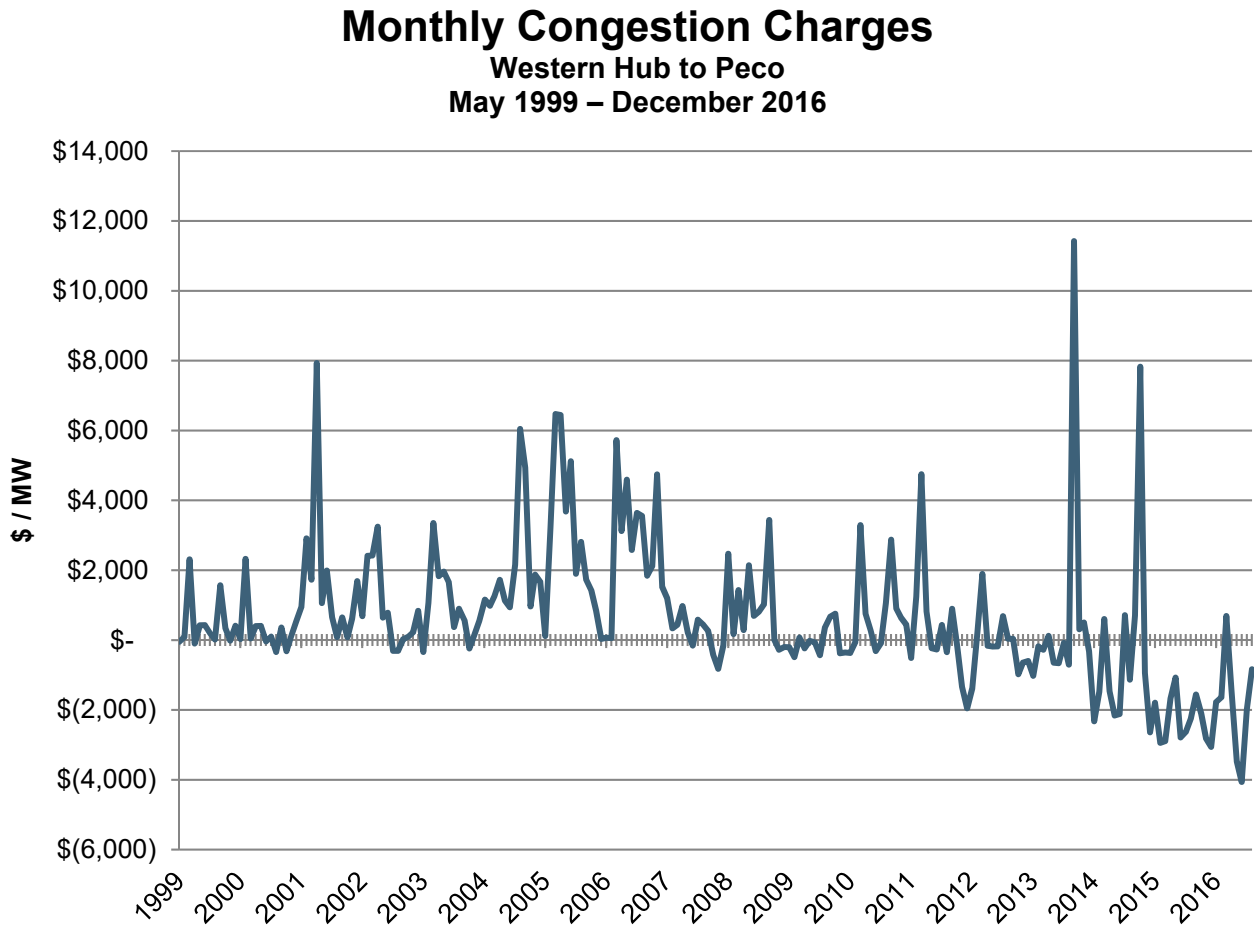
Financial Transmission Rights, Transmission Capacity Rights, and Transmission Congestion Contracts, were developed by Bill Hogan as a mechanism to allow load serving entities, generators and traders to hedge the congestion charges associated with the delivery of power from remote generation owned by a load serving entity or from remote generation selling power to a load serving entity under a long-term contract. [1]

- The congestion charges incurred in meeting load at B with generation at A are not hedged by an entitlement to receive a specified share of all congestion charges collected by the system operator.
- The congestion charges incurred in meeting load at B with generation at A are specific to that source sink pair and are hedged by a FTR that is specific to that source sink pair.

1. See William Hogan, Transmission Capacity Rights for the Congested Highway: A Contract Network Proposal, FERC Docket PL91-1-000 June 8, 1991.

# ROLE OF FTRS

Historical PJM data illustrate the variability of day-ahead market congestion charges. This variability is the reason that load serving entities seeking to hedge their cost of meeting load often want to hold congestion hedges.






FTI CONSULTING

# ROLE OF FTRS

The allocation of financial transmission rights to market participants through an auction design is fundamental to achieving open, non-discriminatory access to the transmission grid, to meet the needs of all types of load serving entities.

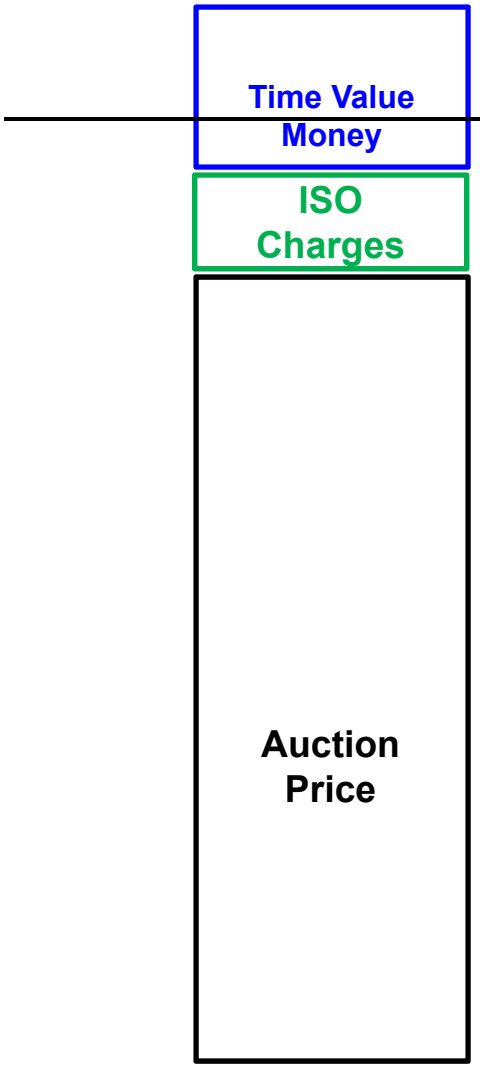
- FTRs could be allocated from the generation of the incumbent utility to load, but that would not allow power consumers to hedge congestion when contracting to purchase power from an entity other than the incumbent utility.
- FTRs could be allocated from generation owned by or under contract to a power consumer or load serving entity to their load, but that would discriminate against power consumers or small load serving entities that would find it less costly to contract for power with a trader at a trading hub, rather than contracting for the output of a specific generation resource.

# Valuation of Financial Transmission Rights

# VALUATION OF FTRS

If positively priced financial transmission rights are held at the margin by load serving entities, generators or traders that use the financial transmission rights to hedge congestion charges they could incur in covering forward financial contracts, or in covering physical or financial load serving obligations, then we should expect financial transmission rights auction prices to exceed by at least a little the expected payment to the financial transmission right holder, taking account of time value of money costs and other costs imposed on financial transmission right holders.

# VALUATION OF FTRS




**Expected Payout**

**FTRs valued as a hedge against risk**

If FTRs are priced as hedges, they should be priced at a premium to the expected payout, taking account of the time value of money and ISO charges.

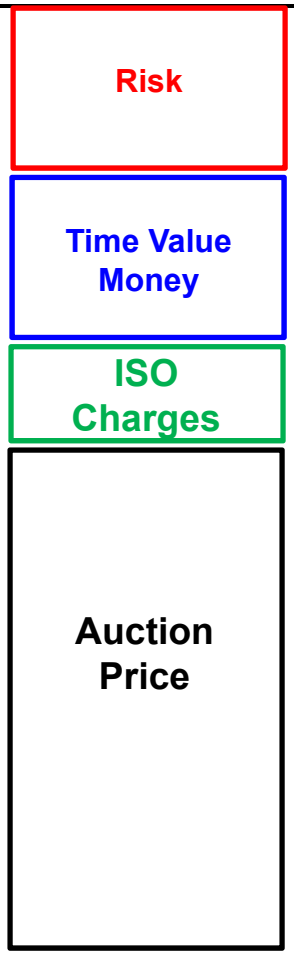


FTI CONSULTING

# VALUATION OF FTRS

Conversely, if positively priced financial transmission rights are held at the margin by financial market participants that do not acquire them in order to hedge other positions, the financial transmission rights will be valued to provide a return to holding them, i.e. as risky financial instruments, and the auction price will reflect a discount to the expected day-ahead market pay out.

# VALUATION OF FTRS




**Expected Payout**

**FTRS valued as a risky Financial Instrument**

A return for risk is a competitive market outcome if FTRs are valued as risky financial instruments, rather than as risk hedges.
The fact that FTRs are competitively priced would not change the fact that they would be sold at a discount to their expected value.



FTI CONSULTING

# VALUATION OF FTRS

In order for market participants to be willing to hold negatively priced, counter flow financial transmission rights, those financial transmission rights must be priced such that the auction price, taking account of the time value of money and other charges imposed on financial transmission right holders, exceeds the expected day-ahead market congestion charges.

- This is an efficient outcome and consistent with a risk shifting role for financial transmission rights, as long as the entities holding the negatively priced financial transmission rights have sufficient financial resources to cover their potential liabilities. [1]

1. The purpose of financial transmission right collateral policies is to ensure that potentially negatively valued financial transmission rights are held by entities that have sufficiently financial resources to cover their potential liabilities. Excessive collateral policies will, however, reduce auction prices on positively priced financial transmission rights requiring collateral and could raise the prices of some negatively priced financial transmission rights.

# Empirical Analysis of FTR Auction Valuation

# EMPIRICAL ANALYSIS

Assessing whether positively priced financial transmission rights are being valued in auctions as risky financial instruments rather than as hedges is not straight forward.

- We do not observe the expected payment to financial transmission right holders, we observe the actual payment, which reflects the impact of uncertainty.
  - Day-ahead market payouts on a given financial transmission right can vary radically from month to month, reflecting the highly variable congestion they hedge.
  - Day-ahead market payouts are also unpredictable, so that the relationship between the auction price and day-ahead market payout can vary greatly from month to month.
- In addition, depending on ISO payment terms and charges for financial transmission rights, there may be time value of money costs and other charges to take into account in making such comparisons.

# EMPIRICAL ANALYSIS

Because FTR prices are set by auction constraint shadow prices, all possible FTR source sink pairs are priced in every auction.

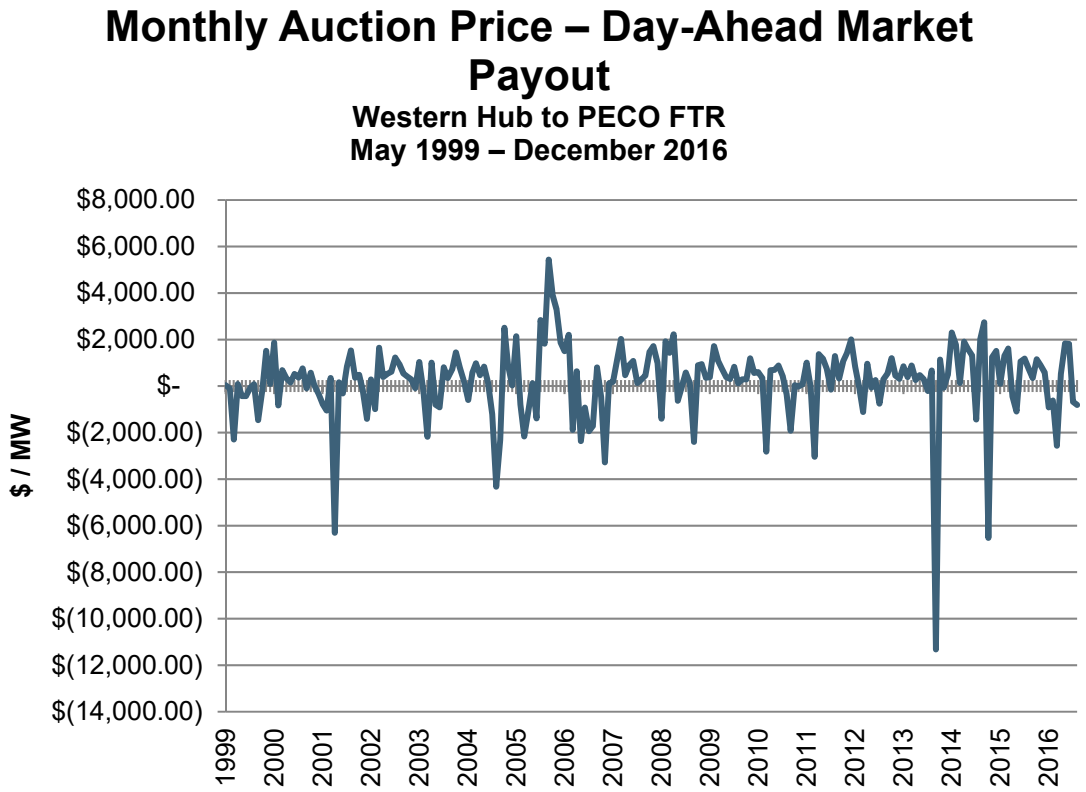
- Hence, even if no one purchases a FTR between a particular source and sink in a particular auction, its price is determined in the auction based on its flow impact on binding constraints, so one can calculate a historical time series of auction prices for any hypothetical FTR source and sink.

- One can also calculate the historical day-ahead market payout to any hypothetical FTR source sink pair.

- This allows one to calculate a time series of auction prices and payouts for any hypothetical FTR source sink pair.

# EMPIRICAL ANALYSIS

Historical PJM data illustrate the unpredictability of day-ahead market payments. The monthly auction price can turn out to be much higher or lower than the actual day-ahead market payout.

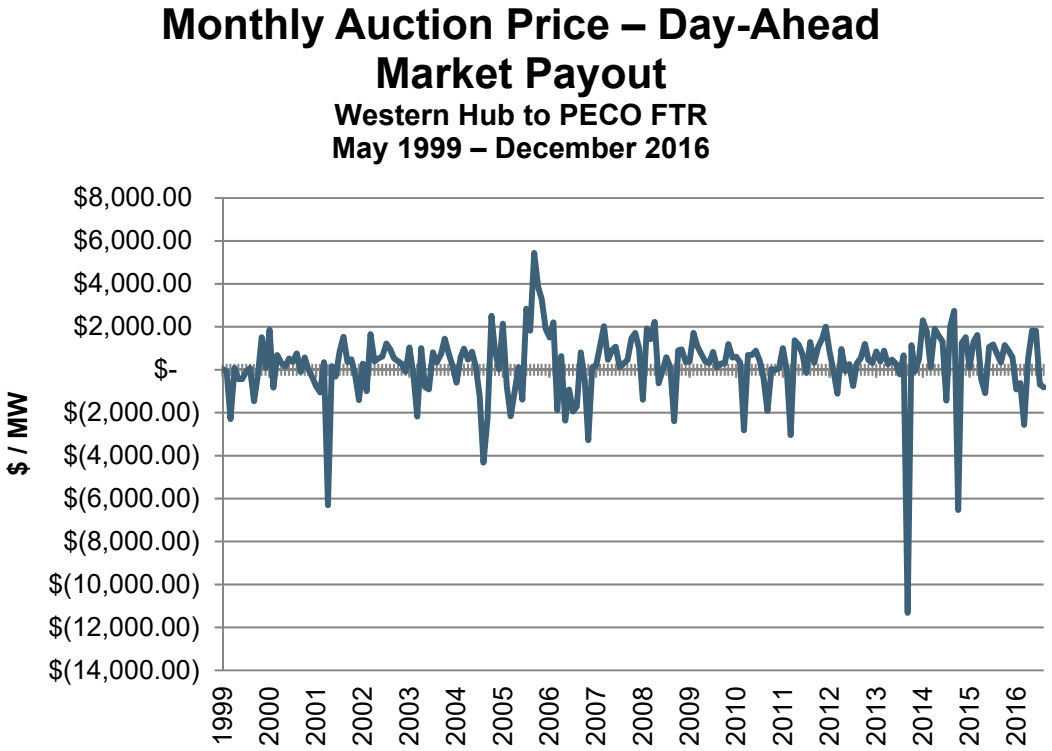





FTI CONSULTING

# EMPIRICAL ANALYSIS

In light of the unpredictable variability of congestion charges, comparisons of past auction revenues and day-ahead market payouts need to be carried out over a sufficiently long period of time to allow valid conclusions to be drawn regarding the underlying relationship, given the historic variability in auction prices and day-ahead market payouts.






FTI CONSULTING

# EMPIRICAL ANALYSIS

I have from time to time updated a time series of auction prices and day-ahead market payouts for benchmark FTRs in New York ISO and PJM.

- The monthly auction price of a New York ISO Zone G to Zone J TCC has averaged 112.64% of the day-ahead market payout over the period June 2000 through December 2019.
- The monthly auction price of a New York ISO Niagara to Zone G TCC has averaged 107.09% of the day-ahead market payout over the period June 2000 through December 2019.
- The monthly auction price of a PJM western hub to PECO FTR averaged 137% of the day-ahead market target payout over the period May 1999 through December 2016.
- The monthly auction price of a PJM western hub to PECO FTR averaged 143% of the day-ahead market prorated payout over the period January 2005 through December 2016.

These valuations are consistent with these particular TCCs and FTRs being valued as hedges, priced at a premium to the expected payout, even without accounting for charges imposed on FTR and TCC holders.

# EMPIRICAL ANALYSIS

The sign of Western Hub to PECO congestion has reversed in recent years, so summing the auction prices and payouts over the more recent period would tend to overstate the price premium.

- A similar calculation for a Western Hub to BG&E FTR shows that the purchase price averaged 102.7% of the target payout over the period April 2006 through December 2012; 104.28% over the period January 2013 through December 2019, and 103.45% over the period April 2006 through December 2019. [1] The auction price would have been somewhat higher relative to the actual payment accounting for proration of FTR payouts.

These valuations do not imply that all TCCs and FTRs are being valued as hedges in auctions, but they provide clear evidence that some TCCs and FTRs are being valued as hedges.

1. The BG&E calculations start in 2006 because we did not compile the BG&E data when we first started tracking FTR prices and we cannot locate these data back to 1999 on the current PJM website.

# EMPIRICAL ANALYSIS

These kinds of historical tabulations of auction prices and day-ahead market payouts for financial transmission rights between significant trading and load serving locations provide insight into the auction valuation of particular financial transmission rights that are likely to be used for hedging.

They do not assess the overall relationship between auction values and day-ahead market payouts.

# EMPIRICAL ANALYSIS

The impact of the variability and unpredictability of day-ahead makret payouts on the observed relationship between auction prices and day-ahead market payouts can be reduced by examining the relationship over a sufficiently long period of time that the actual returns should converge around the expected return.

Thus, we can post the question:  Are the FTRs sold by ISOs in monthly, seasonal and annual auctions in aggregate sold at prices that include a risk premium that would be consistent with their use by load serving entities, generators and traders to hedge risk or do FTR auction prices in aggregate reflect a risk discount, implying that at the margin many FTR buyers require a return to hold the FTRs?

# EMPIRICAL ANALYSIS

CAISO data for December 2016 shows a substantial degree of FTR revenue inadequacy and show a low overall auction valuation of FTRs relative to the actual payout.

**Table 20: Summary of CRR performance for December 2016**

| Metric | Amount |
|---|---|
| DA Congestion Rents | $15,066,599 |
| Perfect Hedge | -$1,100,593 |
| CRR Clawback | $84,822 |
| CRR Payments [Auction + Allocation] | -$31,400,209 |
| CRR Payments to Auction CRRs | -$14,511,510 |
| CRR Payments to Monthly Auction CRRs | - $8,459,523 |
| CRR Payments to Annual Auction CRRs | -$6,051,987 |
| CRR Payments to Allocation CRRs | -$16,888,698 |
| CRR Auction Revenue Monthly | $6,048,734 |
| CRR Auction Revenue Annual | $2,754,467 |
| Revenue Adequacy | -$17,349,381 |
| Revenue Adequacy with Auction Revenues | -$8,546,180 |
| Net payment to auction CRRs | -$5,708,310 |

Source: California ISO, CRR Auction Analysis Report, November 21, 2017 p. 135

# EMPIRICAL ANALYSIS

The low valuation of FTRs sold in CAISO auctions relative to the average payout is not unique to December 2016. Data compiled by the CAISO shows that this pattern persisted on average over the entire period studied, August 2016-April 2017.

**California ISO Congestion Rents and CRR Payouts**

| | 2016 | | | | | 2017 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | August | September | October | November | December | January | February | March | April | Total |
| **Day-Ahead Congestion Rents** | 10,432,605 | 14,025,706 | 31,233,392 | 35,317,671 | 15,066,599 | 11,265,612 | 13,909,669 | 20,755,467 | 30,341,196 | 182,347,917 |
| **Payments to Auction CRRs** | 5,983,425 | 5,254,466 | 12,716,717 | 18,117,875 | 14,511,510 | 11,093,405 | 9,749,790 | 10,427,145 | 13,506,767 | 101,361,100 |
| **Payments to Allocated CRRs** | 7,833,133 | 3,061,390 | 27,304,120 | 28,347,476 | 16,888,698 | 10,046,111 | 10,157,220 | 15,039,715 | 20,147,092 | 138,824,955 |
| **CRR Auction Revenue** | 8,947,756 | 6,500,166 | 5,414,798 | 6,031,045 | 8,803,201 | 6,539,363 | 5,634,934 | 6,798,434 | 5,806,755 | 60,476,452 |
| **Auction Value/Payout** | 1.495423775 | 1.237074519 | 0.4258016 | 0.3328782 | 0.6066358 | 0.589482 | 0.5779544 | 0.6519938 | 0.4299145 | 0.596643604 |
| **Congestion Rents/total payout** | 0.755079883 | 1.686622039 | 0.7804283 | 0.7600862 | 0.4798248 | 0.5329172 | 0.6987322 | 0.8149991 | 0.9015666 | 0.759194438 |
| **Payout to Allocated/Total Payout** | 0.56693809 | 0.36813889 | 0.6822476 | 0.6100777 | 0.5378531 | 0.475229 | 0.5102333 | 0.5905602 | 0.5986562 | 0.577989238 |

Source: California ISO, CRR Auction Analysis Report, November 21, 2017, pp. 89, 101, 113, 124, 135, 146, 157, 168 and 178

# EMPIRICAL ANALYSIS

We have a few observations regarding these calculations:

- The 60% ratio of auction price to payout is far too low to be accounted for by the time value of money.

- It is remarkable that the CRRs allocated to load serving entities only received 58% of the CRR aggregate payout over this period (and 54.6% over the longer period January 2015 through May 2017). If there were CRRs that were feasible and yielding such high payouts, one would expect load serving entities to nominate them in the allocation process, rather than leaving them to be purchased in the auction.

- The finding that congestion rents are only sufficient to fund 75% of the payout to CRRs is also remarkable since there are limits on how much of the transmission grid is allocated and auctioned.

# EMPIRICAL ANALYSIS

The independent market monitors for the NYISO, MISO and PJM have also compared net auction revenues to FTR payouts.

- The MISO and PJM comparisons should not be materially impacted by the time value of money because FTRs are paid for in the same time frame in which day-ahead market FTR payouts are received.
- There is a somewhat material time value of money cost for most NYISO FTRs which are paid for several months prior to time period in which payouts are received.
- NYISO FTRs overall were sold over 2017-2018 at prices reflecting slightly over 84% of the average payout, without accounting for the time value of money or charges imposed by the NYISO on FTR holders. [1]
- Day-ahead market congestion rents funded 86% of the FTR payout. [2]

1. Potomac Economics, 2018 State of the Market Report for the New York ISO Markets, May 2019 Table 10 p. 39
2. Potomac Economics, 2018 State of the Market Report for the New York ISO Markets, May 2019 Figure 8 p. 30

# Valuation of FTRs as Risky Financial Instruments

# FTR VALUATION ISSUES

Why might many FTRs be purchased at prices indicating that the FTRs are valued as risky financial instruments rather than as hedges?

- Lack of hedging demand for some or all FTRs sold in the auctions?
- Lack of competition in hedging demand for FTRs sold in auctions?
- Auction modeling issues?
- FTR settlement rules?

# FTR VALUATION ISSUES

In April 2018, I pointed out that if FTRs are auctioned based on one grid model and settled based on another grid model, expected differences in grid configuration between the auction model and the day-ahead market could incent the purchase of FTRs that would likely be valued at a large discount to the expected payout because they were extremely risky and had no value as congestion hedges, yet would at times receive large payouts that would magnify congestion rent shortfalls.

See Scott Harvey, CRR Revenue Adequacy, Auction Values and Settlement Rules," Market Surveillance Committee Meeting, April 4, 2018.

http://www.caiso.com/Documents/Presentation-CongestionRevenueRightsAuctionEfficiency-HarveyApr52018.pdf

# FTR VALUATION ISSUES

Revenue adequacy and auction valuation are distinct concepts, however they are not necessarily completely independent.

- There may be features of FTR auctions and settlements that contribute both to high FTR payouts relative to auction revenues and to FTR revenue inadequacy.

- In particular, settling FTRs based on day-ahead market shift factors while pricing FTRs in the auction based on auction shift factors, may enable non-hedgers to buy FTRs that entitle them to FTR payouts at a fraction of the price paid by hedgers for the same payout.

- The fundamental issue is that an FTR auction participant can buy FTRs in the auction that will have low flows over a given constraint in the auction model and hence sell at a low price, but will have much larger flows on the constraint on days when a particular outage is modeled in the day-ahead market.

# FTR VALUATION ISSUES

The rather stunning historical level of FTR revenue inadequacy in CAISO FTR markets could be a result of purchases of a material numbers of FTRs that do not serve as hedges but are expected to generate payouts when transmission outages that were not reflected in the annual or monthly auction model are modeled in the day-ahead market.

- The high degree of revenue inadequacy could be a result of FTR bids that are designed to create flows on constraints that bind in the day-ahead market, based on day-ahead market shift factors, while creating much lower flows on constraints that bind in the auction.
- FTRs whose payout depends on differences between the transmission model used in the FTR auction and the day-ahead market may sell at a particularly large discount to the expected payout because they are very complex to value and have little or no value in hedging forward contracts.
- These inflated payments due to differences between day-ahead market and auction shift factors could also be the reason for the low proportion of FTR payouts going to allocated FTRs.

# FTR VALUATION ISSUES

The April 2018 presentation focused on the pricing of prevailing flow FTRs but there can be similar issues with the pricing of counterflow FTRs.

Is the purchase of counterflow FTRs that enable the sale of more prevailing flow FTRs an efficient auction outcome that should be accommodated in the auction rules?

- Yes, if the additional prevailing flow FTRs are simultaneously feasible on both the auction grid and the day-ahead market grid.
- No, if the additional prevailing flow FTRs are simultaneously feasible on the auction grid but are infeasible on the day-ahead market grid.

The purchase of counterflow FTRs that enable the sale of more prevailing flow FTRs on the auction grid but that are infeasible on the day-ahead market grid, may be profitable for the buyer but the payments to the prevailing flow FTRs just increase congestion rent shortfalls.

# FTR VALUATION ISSUES

FTRs purchased as hedges are typically sourced from generator locations, trading hubs or interties to trading hubs, load zones or interties.

- FTRs purchased as hedges will create flows on many constraints, both those that bind in the auction and others that may bind in the day-ahead market as a result of transmission outages.

- FTRs purchased as financial instruments on the other hand, could have sources and sinks that are selected to create:
  - prevailing flows on constraints that will bind in the day-ahead market but not on constraints that will bind in the auction, thereby receiving large payouts while paying little or nothing for the FTRs;
  - counter flows on constraints that will bind in the auction but not on constraints that will bind in the day-ahead market, thereby receiving auction payouts without being required to make commensurate day-ahead market payments.

# FTR VALUATION ISSUES

The extent to which this is happening in ISO markets can be examined for prevailing flow FTRs by:

- Identifying constraints with low or zero shadow prices in the auction but high payouts in the day-ahead market;
- Identifying FTRs that have more than a specified threshold per megawatt flow on such a constraint and calculating the FTR auction prices and FTR payout
- Examining whether there is a pattern of hedgers buying these FTRs at prices that are roughly in line with the payout, while other entities are buying prevailing flow FTRs at very low prices relative to the payout.

These data would provide indicators of whether high payouts are a result of financial participants structuring their FTR purchases in a manner that does not contribute to auction efficiency, but are made profitable by differences between auction and day-ahead market shift factors.

# FTR VALUATION ISSUES

The extent to which this is happening in ISO markets can be examined for counter flow FTRs by:

- Identifying constraints with high shadow prices in the auction but low payouts in the day-ahead market;
- Identifying FTRs that have more than a specified threshold per megawatt flow on such a constraint and calculating the FTR auction prices and FTR payout
- Examining whether there is a pattern of hedgers buying these FTRs at prices that are roughly in line with the payout, while other entities are buying counter flow FTRs at very high prices relative to the payout.

These data would provide indicators of whether high payouts are a result of financial participants structuring their FTR purchases in a manner that does not contribute to auction efficiency, but are made profitable by differences between auction and day-ahead market shift factors.

# FTR VALUATION ISSUES

While defining FTRs as perfect hedges by settling them based on day-ahead market shift factors (and load zone weights) instead of auction shift factors and load zone weights, makes them a more perfect congestion hedge for load serving entities, these design elements:

- Make them a better congestion hedge than they actually are, leading to congestion rent shortfalls;
- Create the opportunity for auction participants to acquire FTR positions that do not hedge risk, nor take on risk, but magnify congestion rent shortfalls.

It is possible that congestion hedging on grids subject to loopflows, outages and other factors is so complex that some FTRs will inevitably sell at a discount to the expected payout, but the auction design should not create opportunities for profitable trading strategies that are profitable because they inflate congestion rent shortfalls.

# COMPASS LEXECON-FTI CONSULTING-ELECTRICITY

| | | |
|---|---|---|
| Bert Conly | bert.conly@fticonsulting.com | 214-397-1604 |
| Scott Harvey | scott.harvey@fticonsulting.com | 617-747-1864 |
| William Hogan | William_Hogan@Harvard.edu | 617-495-1317 |
| Joseph Kalt | jkalt@compasslexecon.com | 617-520-0200 |
| Susan Pope | susan.pope@fticonsulting.com | 617-747-1860 |
| Ellen Smith | ellen.smith@fticonsulting.com | 617-747-1871 |
| Jeffrey Tranen | jtranen@compasslexecon.com | 212-249-6569 |
| Kevin Wellenius | kevin.wellenius@fticonsulting.com | 207-495-2999 |
| | See papers@ http://lmpmarketdesign.com | |



FTI CONSULTING