Credit Issues in Organized Electricity Markets

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INTRODUCTION

Credit issues have recently come to the forefront of the financial markets, and the organized electricity markets are no exception. In the second half of 2007, at the same time that the world was facing a credit crisis, so too was the oldest of the ISO-administered electricity markets, an issue of magnitude not observed since the collapse of Enron and the California market in 2001. At issue were the financial transmission rights (FTRs[1]) portfolios held by two market participants in PJM. The performance of these two portfolios had deviated strongly from expectations drawn from historical observations. The resulting default of almost $60MM (early estimates of which ranged as high as $85MM) led to emergency actions to address the apparent failure of the credit policy, not just in PJM, but across all of the ISOs[2] with (or in the process of developing) nodal markets. Despite extensive efforts from the ISOs and market participants to institute myriad rule changes in an to attempt to bolster the credit policy around FTRs, to date these changes have not addressed the issues directly and have left the market both with artificially high collateral requirements in some places and significant risk exposures that are uncollateralized in others.

In examining credit issues in the organized electricity markets, this paper focuses on the FTR markets and the extraordinary nature of risks associated with them.[3] We start with a brief review of the importance of credit and risk management and a tutorial on transmission congestion and the critical need for FTRs as a risk management tool, while also highlighting the inherent riskiness in this hedging instrument. We then delve into the specific events surrounding the recent PJM defaults, and critique the reaction both at PJM as well as at the other ISOs. We conclude with a set of recommendations for (and describe limitations inherent in) constructing a robust credit policy.

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[1] For simplicity the general term financial transmission right (FTR) will be used throughout to describe all like instruments, e.g., congestion revenue rights (CRRs) in ERCOT and CAISO, transmission congestion contracts (TCCs) in NYISO, etc.
[2] Also for simplicity, the general term independent system operator (ISO) will also be used to describe regional transmission organizations (RTOs).
[3] Clearly there are many credit issues in organized electricity markets beyond the FTR markets; we focus on FTR markets because recent events have made them the focal point for credit discussions across the ISOs. Many, if not all, of the conclusions have general applicability to credit issues in organized electricity markets.

Central to this discussion is the fundamental need to balance minimizing the exposure to uncollectible loss (i.e., participant default) with encouraging significant activity in the markets from a diverse set of participants (e.g., load, generation, physical, financial). Robust participation in markets leads to the best price discovery, which in turn is central to providing both affordable insurance to market participants as well as appropriate and fair compensation for the product or service being sold. To this end, though onerous credit requirements may appear to make the market less risky, they can be as detrimental as a default to the health and viability of the market by skewing pricing and depressing liquidity.

THE ROLE OF CREDIT AND RISK MANAGEMENT IN MARKETS

Fundamental to the concept of a futures market is the premise that every aspect of the transaction aside from the future value of the contract is known with absolute certainty. This assurance that the contracts will be binding encourages buyers and sellers to transact, thereby bringing about liquidity and robust pricing in the marketplace. Among the most critical of these aspects is the creditworthiness of the counterparty.

Before examining the comparatively new organized electricity markets, let's look at markets in general. The most basic market is a bilateral or over-the-counter (OTC) market. In bilateral agreements, an entity takes on the risk of the counterparty not performing and may hold an amount of the counterparty's cash as collateral to offset that potential risk. This is inefficient as each counterparty must be scrutinized with respect to each transaction; inevitably price becomes intertwined with credit. A great improvement on the bilateral market is the cleared exchange. Collateral is also held to mitigate these risks, but instead of matching counterparties, a single entity, the clearinghouse, acts as the counterparty to every transaction. This creates substantial efficiencies as offsetting transactions can be netted to eliminate credit risk and cash requirements. To further enhance the risk mitigation for traders, the risk in traditional cleared exchanges is shared among a set of general clearing members (GCMs), who aggregate individual trading entities and cover the risks of their respective clients. The efficiency of a common counterparty remains, but the competition among several GCMs keeps clearing costs in check. If a trader defaults, the loss is the responsibility of the GCM. If the GCM defaults on its traders' obligations (an extremely rare occurrence), the clearinghouse and the other GCMs are responsible for the loss through default funds and insurance. In practice, the traders are almost completely isolated from any defaults.[4]

Though there are clear parallels between the ISO-administered markets and cleared exchange markets, there is a critical difference. In both there is a common counterparty; in the ISO markets it is the ISO itself effectively functioning as the clearinghouse. However, there are no GCMs to shoulder the risk on individual participant default. In the event of default, the ISO has no capital available other that that of its members to cover the loss. The defaults are directly allocated across the market participants; each participant bears in some degree default risk for the whole market. This puts considerable responsibility on the ISO to minimize defaults. However,

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[4] The non-defaulting traders' positions (and money if in non-segregated accounts) at the GCM of a defaulting trader can be at risk if the GCM itself defaults.

because they have almost no financial stake in the outcome and each has a monopoly on their market today, there is limited direct incentive to perfect the balance described above between market liquidity and risk mitigation.

The Role of Financial Transmission Rights and Their Risks

Financial transmission rights markets play a critical role in nodal electricity markets. They are the primary means of hedging basis risk and provide a long-term price signal for congestion, highlighting specific weaknesses in the transmission grid and creating incentives for investment (e.g., new generation, transmission upgrades, demand response). It is because of their sensitivity to the grid dynamics that FTRs also carry risks that are unique and, at times, extraordinary. To understand the nature of this risk, we need to understand where they derive their value.

The modern transmission grid is very complex and suffers from three fundamental limitations. First, the elements of the grid have impedance (resistance). They heat up under the strain of power flow; at some point, this heat becomes so extreme that elements reach their operating limit, beyond which physics take over, the conductor expands, and the transmission lines sag to the extent that they short circuit into the trees or ground below. Second, the grid is, to a great extent, passive. Power flows according to the laws of physics and not according to the wishes of grid operators, with only a handful of exceptions (e.g., direct current (DC) interties, phase angle regulators (PARs), special protection schemes (SPSs), etc.). Only on this small subset of elements can operators intervene to alter the flows by altering the characteristics of the grid itself. This creates further limitations – while an increase in power flow on one line may be tolerable, it may create an overload upstream or downstream. Finally, the alternating current (AC) nature of the system has inherent stability issues relative to a DC system, in that in addition to managing the real power flows, there is a reactive power flow component associated with the oscillating voltage levels in the system. Maintaining this voltage stability requires many elements to be operated below the thermal limit described above; these elements are deemed voltage-limited.

The management of the grid to maintain reliable power delivery is accomplished primarily through the re-dispatch of generation resources, i.e., reducing the output of generators that exacerbate the power flow across the limiting element while increasing the output of generators that relieve the power flow across the limiting element. Although management of the grid could also be accomplished by reducing demand in constrained areas (as well as increasing demand in unconstrained areas, although this is a less natural response), the pricing mechanisms and resources required for demand response are still nascent.

All of these issues have existed since the first transmission grids were developed; none of them are unique to nodal markets. In traditional transmission grids, just as in nodal market grids, the system operators manage congestion by directing specific generators to increase their output and others to reduce. However, in traditional grids, the costs associated with compensating these generators are socialized across all users of the grid. In nodal markets, the result of congestion management is different prices across various locations on the grid. These differing congestion costs reflect the marginal cost of delivering power to each location based on the limitations of the grid and the availability of economic generation. Prices will be higher in locations where cheap power sources are scarce and the ability to deliver cheap power from elsewhere is limited. On the other hand, locations with an abundance of cheap power will see relatively lower prices.

Nodal markets are great at providing specific instantaneous price signals at each of a vast set of granular locations; when ERCOT implements its nodal market, every five minutes each of the roughly 700 commercial nodes will receive a potentially different price signal. However, by their nature, the necessary operational swings associated with grid management are revealed via spot prices that can be in extreme conditions very volatile and, therefore, risky. Forward markets enable participants to hedge against this volatility and create long-term price signals to better manage their business. A participant could simply buy or sell power outright at their location, however, there is an extremely limited long-term forward market today to do so. Alternatively, one could buy or sell power at a liquid traded hub and assume the congestion (basis) risk from their location to or from the hub. FTR markets allow for the congestion risk inherent to power transport to be managed on a forward basis. A participant can pay a fixed amount to close out the forward basis risk.

In nodal markets, the ISO generally collects excess revenue when there is congestion. These congestion rents represent the cost of marginal transmission capacity on the constrained elements of the grid and are charged to all users of the available capacity of these elements. The congestion rents are redistributed to market via FTRs. In general, FTRs are obligations that grant the holder the congestion rents accrued to the power flow between two locations in the grid. The location at which the power is injected onto the grid is termed the source, and the location at which it is withdrawn is termed the sink; from this perspective, power flows from source to sink. Specifically, the FTR grants the holder the price differential designated by the sink price minus the source price, which is equal and opposite to the cost of congestion in flowing power from the source to the sink. Note that the standard FTR is an obligation not an option[5]; positive price differentials (i.e., sink price > source price) yield payments to the FTR holder whereas negative price differentials (i.e., source price > sink price) demand payments from the FTR holder. Recall that congestion occurs when cheap power cannot be delivered to a location, thereby driving up prices at the constrained location. The negative price differential represents power flowing from the constrained location against the direction of the constrained net power flow. This is called counterflow. It is the primary source of risk in the FTR markets. Most importantly, it is a risk that cannot be altogether avoided in any FTR. Because congestion is directional in nature, it is always possible that the conditions of the grid could change in such a way that elements can become congested in either direction.

One way to eliminate the catastrophic risk of counterflow is to use FTR options instead of obligations. Although this may sound appealing given the risks of counterflow it is far from optimal for several reasons. First, it is very inefficient for the market to allocate transmission capacity via options. FTRs are allocated in a manner such that they are simultaneously feasible, i.e., the sum total of the transmission capacity consumed by the awarded FTRs does not exceed the physical limits of the grid. This is done to ensure revenue neutrality since congestion rents are collected from power flows on the grid, which are limited by the physical properties of the

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[5] FTR options are (or will be) available in some ISOs, e.g., PJM, ERCOT.

grid. When an option is awarded, it not only consumes capacity where the FTR path flows in the direction of prevailing flow, but it cannot provide any relief or counterflow where the FTR path goes against the prevailing flow. This restricted use of the transmission capacity limits the set of available FTRs and prevents market participants from acquiring positions to match actual physical flows. This leads to the second problem with options; it is not a clean hedge of basis risk for any real physical flow. By definition, hedges are not meant to necessarily make money; they are meant to provide certainty around an uncertain element. Although one could buy an option as a hedge and it would avoid any of the net negative congestion values, it should not be viewed as necessarily superior to the cleaner hedge of an obligation because the option will, by definition, cost more than the obligation. Finally, because of the asymmetry in how options consume transmission capacity, the computational power required for clearing auctions with options is much greater than for auctions with obligations only. This limits the ability to have more frequent auctions with greater temporal granularity. Further evidence that options are not a panacea come from looking at PJM, the only market currently auctioning FTR options alongside FTR obligations, where volumes have decreased substantially on the option product from about 15% of total awarded FTR volume when they were introduced in 2003 to less than 5% today.

Two additional factors that further exacerbate FTR market risk are the relatively long settlement period and the limited liquidity in the markets. FTRs settle over a time period that can range from one month to one year.[6] Given that the drivers of congestion can be sudden, extreme and persistent (e.g., major line outage or transformer de-rate), the value of an FTR can change quickly and dramatically. This value change can then persist through the full term of the FTR, with limited to no ability to manage the position. The lack of liquidity is driven more by a dearth of markets than a scarcity of market participants. In fact, there is strong evidence to suggest that there is significant interest to participate more frequently and in more venues. The standard auction cycle comprises an annual auction (which may be split into seasons, e.g., MISO) prior to the beginning of the "planning year" followed by 12 monthly auctions, each held prior to the beginning of each month that solely focuses on the prompt month. Therefore, there are essentially only two opportunities to buy an FTR and one opportunity to sell for any given month. NYISO expands on this slightly by conducting long-term auctions every six months that comprise FTRs settling over an annual period as well as the first six months of the annual period. PJM has greatly expanded on this with a balance of planning period (BOPP) auction that uses each monthly auction to not only transact FTRs for the prompt month but the remaining periods of the planning year. This provides many more opportunities to reconfigure an FTR portfolio well in advance of the settlement period. It also provides opportunities to mark FTR portfolios to current market prices, assess risk and even liquidate portfolios. The demand for increased hedging options is apparent in PJM, where average monthly auction volumes have almost doubled since the BOPP auctions were introduced in PJM in June 2006.[7]

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[6] By FERC mandate, long-term transmission rights (LTTRs) will be will extend this to as much as five years in certain ISOs.
[7] Based on a comparison of non-prompt month BOPP award volume and increased prompt month award volume across the planning year compared to prompt month award volume prior to the introduction of BOPP.

THE DEFAULT CRISIS AT PJM

PJM 2007-08 Annual FTR Auction

In April 2007, the results of the second round of the PJM annual FTR auction shocked market participants. A new market participant, Exel Power Sources, had acquired 34 TWh of FTRs for an investment of negative $73.9MM. Contrast this to the total market investment of $448MM. Exel's net negative investment in that round was six times larger than the next market participant. Most surprising was that the collateral required to hold this portfolio was $0. Despite being paid to hold the FTRs, by definition a sign that the market believed the portfolio contained substantial counterflow, PJM's rules did not require any collateral to hold that portfolio. In other words, based on the credit policy in effect at the time, this portfolio appeared to have no risk.

Table 1. Investment by Market Participant. Top 20 Investors by Absolute Net Investment.[8] PJM 2007-08 Annual FTR Auction, Round 2.

Company	Net Investment ($MM)	Collateral Requirement ($MM)
Exel Power Sources	($73.9)	$0.0
Morgan Stanley	$61.8	$18.5
Constellation	$29.8	$9.8
Deutsche Bank	$18.8	$5.9
Citadel	$15.3	$12.4
DTE	$13.9	$5.8
PowerEdge	($11.8)	$2.0
330 Fund	$11.4	$2.8
Edison Mission	$11.4	$7.4
BP	$10.2	$3.0
Akula Energy	($8.8)	$2.2
Susquehanna	($6.5)	$5.4
DC Energy	($4.5)	$4.0
JP Morgan	($4.0)	$2.6
Sempra	$4.0	$1.3
Barclays	$3.2	$1.3
Shell	($2.4)	$0.1
Franklin Power	($2.2)	$0.2
Credit Suisse	$2.0	$3.1
Old Lane	$1.5	$0.5

[8] Excludes market participants whose FTR holdings are primarily derived from self-scheduling auction revenue rights (ARRs). ARRs are allocated to load-serving entities (LSEs) and grant the holder the auction clearing price for the associated FTR. Self-scheduling is the process in which an LSE effectively converts their ARR into the FTR; they can do so at any clearing price because they will receive the exact money required to buy the FTR via the ARR. Because of their price insensitivity, these entities are excluded.

PJM's response to the Exel portfolio

Initially PJM did not publicly seem to be concerned by the massive uncollateralized investment from the new thinly-capitalized entity Exel. They publicly stated that they were concerned not from the perspective of the portfolio losing money in the end (in fact, they expected it to make money!), but in the working capital demands of the likely negative cash flows in the first few months of the planning year, which in PJM coincides with summer. To support these working capital requirements, PJM demanded, outside of its standard FTR credit rules, approximately $15MM in collateral from Exel. As Exel was extremely capital constrained, this put them in default unless they could find another entity to take on their portfolio.

PowerEdge doubles down with the Exel portfolio

In mid-May, after PJM become pro-active in attempting to prevent a default, PowerEdge negotiated with Exel to purchase Exel's annual FTR portfolio. Note that PowerEdge had already acquired a sizable portfolio in the annual auction. Their aggregate portfolio stood at 78 TWh and a net investment of negative $120MM. The collateral requirement was $9.5MM. With this initial crisis seemingly behind them, PJM proceeded to focus on establishing more robust credit rules.

Exel enters the market again and defaults

Having rid itself of its massive counterflow portfolio from the annual auction and effectively cured its default, Exel participated in the July 2008 auction. They bought FTRs that settled throughout the planning year. Although the portfolio was profitable during the summer, it was hit with substantial losses of ($2.5MM) in September 2007 and Exel defaulted on their payment to PJM in October 2007. The Exel portfolio ultimately accrued ($5MM) in defaulted losses.

PowerEdge defaults

As expected, the PowerEdge portfolio suffered losses in the summer months of 2007, which continued into September with unusually hot weather. Through September, the losses stood at ($15MM). In October, performance improved and the portfolio was profitable, although still underwater from the summer losses. Then in November, the portfolio soured dramatically as a result of transmission outages in New Jersey. December was a disaster as PowerEdge lost $18MM and defaulted. The total default was $52MM.

THE EVOLUTION OF PJM'S FTR CREDIT POLICY SINCE THE DEFAULTS

Each ISO has developed its own credit policy for its FTR market. Clearly there are similarities among them given that the underlying risks are similar, however, there are surprising differences in approach. In this section, we will describe the general issues to be addressed by an FTR credit policy and then describe specifics of PJM's FTR credit policy and how it evolved during and after the Exel and PowerEdge defaults.

Fundamentals of FTR risk

There are two types of risk for FTRs:

> *Auction risk*: The risk that a market participant cannot afford the purchase price of FTRs awarded. This is only a risk at the time of bidding as it becomes a known fixed exposure after the auction clears. Even at the time of bidding it is a risk with a finite cap equivalent to the maximum possible investment consistent with the bid portfolio.
>
> *Settlement risk*: The risk that a market participant cannot afford to pay the negative congestion value. Settlement risk arises solely from counterflow, i.e., power flow from FTR source to FTR sink goes against direction of constrained power flow, resulting in negative congestion values. Settlement risk is theoretically unbounded.[9]

Auction risk is more straightforward to manage because it is bounded and quantifiable. Settlement risk is challenging to manage because of its potential unbounded value; it is this more elusive risk element that we focus on in this paper.

PJM FTR Credit Policy: Going into the 2007-08 Annual Auction

PJM's credit policy revolves around the concept of a reference price, which is meant to reflect a reasonable expected future value and is based on a weighted-average of the actual congestion values over the past three years. Specifically, the weights are 50% for the most recent calendar year, 30% for the second calendar year and 20% for the third calendar year.

For every MW bid into the auction, the market participant must collateralize the difference, if positive, of the bid price less an adjusted reference price. If the reference price is positive, the adjustment was simply a 30% discount off of the reference price. If the reference price is negative (i.e., suggestive of counterflow), there was no adjustment. The differential treatment was designed to require some collateral for prevailing flow positions while not allowing counterflow positions to benefit from a similar discount.

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[9] The marginal plant will always be set a price at or below the offer cap, but the other locations in the grid may have prices in excess of the cap depending on how power to and from that location flows on the grid.

PJM's first attempt to close the credit loophole

On June 14, 2007 PJM filed revisions to its FTR credit policy in a targeted attempt to address specifically the loophole that enabled Exel to purchase significant counterflow without collateral support.[10] In the calculation of the adjusted reference prices for negative-valued FTRs, the adjustment was moved from zero to a minimum 30% premium (matching the 30% discount for positive-valued FTRs) and a 100% premium for the "summer" months of June through September. For the annual auction, PJM contorted the equation for negative-valued FTRs further by making the collateral requirement equal to 25% of the FTR price less 55% of the reference price. This equation yielded an identical result to the monthly calculation when the clearing price was identical to the reference price, but enabled the reference price to have more leverage over the clearing price when they diverged, resulting in higher collateral requirements for apparent net counterflow FTRs.

FERC was unconvinced of the need for emergency action, especially as the summer period had passed without a problem. Without any evidence from PJM that there was substantial future risk for the current planning year and with clear evidence that the proposal was not necessarily matching increased collateral requirements with increased risks, FERC rejected the proposed changes on October 26, 2007, coincidentally just as Exel defaulted on its obligations in PJM.

PJM's second attempt to close the credit loophole

On December 21, 2007, in light of the actual defaults of Exel and PowerEdge, PJM filed the first of two sets of revisions to its FTR credit policy[11]. PJM continued to work with the concept of a reference price derived from historical values, but with a more refined approach than the previous proposal. Now the reference price would be calculated monthly (instead of annually) to capture the seasonal volatility. In addition, the collateral requirements in one month could not offset those of another month; this was critical for an annual position, without which the collateral requirements would not be any different from the original calculation methodology. To moderate the collateral increase, PJM changed the adjustment to be a simple 10% discount for positive-valued FTRs and a 10% premium for negative-valued FTRs. Although the adjustment factor was smaller, the use of monthly values instead of annual ones offset this reduction.

PJM targets counterflow, but only to a limited extent

On January 31, 2008, PJM filed the second set of revisions to its FTR credit policy[12]. These revisions focused solely on the risk of counterflow as defined by FTR portfolios with net negative investments. Despite the fact that all FTRs, regardless of their clearing price, are exposed to potential counterflow to an extent, portfolios with net positive investments, even those comprising a significant number of FTRs with negative clearing prices, were completely

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[10] FERC Docket No. ER07-1036-000
[11] FERC Docket No. ER08-376-000
[12] FERC Docket No. ER08-520-000

unaffected. Of course, the rationale was simple. The majority of FTR portfolios have a net positive investment and the two defaulted portfolios did have net negative investments.

Two concepts were defined to describe the extent of counterflow risk held in a portfolio. The first, *flow undiversified*, was a measure of whether a portfolio was net counterflow and to what extent. A portfolio was deemed *flow undiversified* if it had a net negative investment. PJM would require portfolios that were *flow undiversified* to post *additional* collateral equal to two times the net investment. The second, *geographic undiversified*, was a sub-categorization of a *flow undiversified* portfolio (portfolios with net positive investments were not examined) being adversely exposed to potential outage scenarios. PJM required portfolios that were *geographic undiversified* to post a total *additional* collateral equal to three times the net investment, a 50% increase to the adder for being just *flow undiversified*.

This proposal was riddled with flaws. First, although the focus on counterflow risk was appropriate, PJM defined counterflow risk as merely arising from FTR portfolios with negative net investments. This definition completely ignored the counterflow risk arising from individual FTRs with negative clearing prices that resided in portfolios with overwhelming investment derived from FTRs with positive clearing prices. It also completely ignored the counterflow risk inherent in FTRs with positive clearing prices. Positive clearing prices are only indicative of the market perceiving the value of prevailing flow to overwhelm potential counterflow, and, in fact, the market may not perceive any value to the counterflow despite the potential for it existing in every FTR. For example, one of the major contributors to PowerEdge's default was an FTR[13] with a modest positive clearing price of $1,655/MW-year that ultimately settled for ($83,072)/MW-year. If PowerEdge had only invested in FTRs like this one, they would not have been subject to these proposed credit policy changes, but still would have likely defaulted. Second, for *flow undiversified* portfolios, the adder based on net investment was not a clear measure of counterflow risk, but instead the market value for counterflow. A simple example describes the inherent flaw. Let's say Trader X buys a 1 MW path A-B in Round 1 of the annual auction for ($1,000)/MW-year and Trader Y buys a 1 MW path A-B in Round 2 of the annual auction for ($2,000)/MW-year. Although both entities have the exact same portfolios, and in fact, Trader Y received a more attractive price, it turns out that Trader Y would have to post $2,000 more collateral than Trader X. Finally, the concept of *geographic undiversified* meant no such thing. To test if a portfolio was *geographic undiversified*, PJM would forecast portfolio values based on a series of outage scenarios. If the forecasted value went down (even by $1) from the base case of no outages, then the portfolio was deemed *geographic undiversified*. Of course, this test is simply checking to see if a portfolio is adversely exposed to the impact of any one of many outages. In fact, a well-diversified portfolio with broad counterflow exposure would certainly fail the *geographic undiversified* test as it would almost certainly be adversely impacted by at least one of the outages. And, of course, most problematic was the fact that only *flow undiversified* portfolios would be subject to this test. Counterflow exposure lurking in portfolios with positive net investments was unaffected.

[13] ATLANTIC 230 KV REACTR to TRENTON 138 KV TDEC. PowerEdge purchased 50MW in Round 4 of the 2007-08 annual auction.

Despite the flawed logic, the market participants were eager to see higher collateral requirements for suspicious entities, especially if it was at no cost to the majority, whose traditional portfolios with positive net investments would not be subject to the rules. FERC approved these rules on March 25, 2008.

PJM revisits credit risk anew

Since the new rules were put in place, PJM has undertaken a thorough review of credit policy through its newly formed Credit Risk Management Steering Committee (CRMSC) formed in early 2008. An independent consultant, Market Reform, tasked with leading this review considered several possible enhancements[14]:

> *Minimum tangible net worth for members*. Establish measurable threshold for investing based on CFTC guidelines for Eligible Commercial Entities. Ensure investor sophistication and avoid the "trader's option".
> *Cash collateral*. Eliminate the use of unsecured credit. Reduce exposure to ephemeral measures of creditworthiness.
> *Accelerated settlements*. Increase billing frequency from monthly to weekly to reduce exposure to receivables from market participants.
> *Independent clearinghouse*. Use traditional exchange model to manage risk.
> *Mark-to-market*. Use market prices to assess portfolio riskiness and incremental margin calls.
> *Mark-to-model*. Use simulations to assess portfolio riskiness and incremental margin calls.
> *Default fund or insurance*. Avoid socialization of defaults to members.
> *Liquidation rights*. Grant ISO authority to terminate and liquidate defaulted portfolios.

The only changes to gain member support were accelerated settlements, liquidation rights, a shortened default cure period and several minor miscellaneous issues. The PJM membership seems only to have sought the simplest of changes with the least impact to their bottom line. To be fair, this is a reasonable response, but it also highlights the need for a balanced fair approach to policy that avoids undue discrimination. The outcome in this case has been that despite risks existing across every participants' portfolios, the policy changes have focused on arbitrary definitions that do not focus on the actual risks, but on portfolio characteristics that look like those that have defaulted in the past. A more balanced approach would subject every participant to similar scrutiny and would appropriately call into question the need to cover all possible defaults.

To highlight this point, PJM reviewed the efficacy of the recent changes to the credit policy on the FTR portfolios from the 2008-09 annual auction. Based on a simulation of worst case scenarios (analogous to the mark-to-model methodology), it was determined that the counterflow portfolios (defined simply as net negative investment or *flow undiversified*) were overcollateralized by \$0.5B (i.e., the worst simulated case was 59% less than the collateral

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[14] PJM CRMSC Summary of Recommendations, Report to Member's Committee. August 7, 2008.

required) where as the prevailing flow portfolios were severely undercollateralized by $2B (i.e., the worst simulated case was 235% more than the collateral required). Not surprisingly, the response from PJM and the members was one of curious surprise, but it certainly did not lead to a call for $2B of additional collateral from the majority (nor a relief of $0.5B from others).

THE RESPONSE FROM OTHER ISOS

The shocks of the defaults in PJM have been felt at all of the ISOs in the United States. As expected, the approaches and responses have been quite variable by market. The following is a brief review of a few of the highlights from each of the ISOs.

New England (ISO-NE)

ISO-NE has taken the most thoughtful and thorough approach of any of the ISOs. Working from a position of relative stability (the magnitude and volatility of congestion is much less in ISO-NE than in other ISOs) and a robust FTR credit policy, the choice was made to review all of the issues, but not rush to make changes. Many of the issues that have been discussed in the recent PJM review appeared in the ISO-NE discussions as well.

Training requirements for participants.
Minimum tangible net worth for members.
Eliminate unsecured credit.
Liquidation rights and process.
More frequent auctions (e.g., BOPP). Enable mark-to-market margining and provide forum for liquidation.
Default fund or insurance.
Independent clearinghouse.
Mark-to-model.

While most of the issues are moving forward consistent with commodity market predecessors, the revolutionary change being discussed in depth at ISO-NE (and also being examined in PJM) is the concept of mark-to-model. Given the absence of a liquid market, the traditional concept of mark-to-market is challenged as there are often no valid market prices to mark against. In contrast to the PJM FTR market with its BOPP auction that allows an annual portfolio to be marked monthly through the year, the ISO-NE FTR market lacks this venue, meaning that FTRs in ISO-NE are inherently less liquid than in PJM. It is also clear from the PJM experience (and any examination of congestion trends) that historical congestion values are not always a good indicator of risk. To cover potential risks, the ISO has proposed to forecast congestion scenarios and require collateral to cover the downside scenarios. This proposal is deeply concerning for many reasons that will be discussed below in our recommendations.

Midwest (MISO)

In contrast to the measured response at ISO-NE, there was significant anxiety at MISO in the aftermath of the PJM defaults. The primary cause for concern was that the existing FTR credit policy required no collateral to bid on negative-priced FTRs, opening up the possibility that a market participant could bid for and win a massive counterflow portfolio. Although their FTR credit policy might require collateral to hold this portfolio to settlement, there was concern that an entity could bid on a portfolio it could not afford to own under the current policy. In addition, there was concern that the collateral requirements for holding the portfolio would be insufficient to cover risks of the magnitude observed in PJM.

MISO split their approach into two immediate action phases to effect change prior to the 2008-09 annual auction followed by a more thoughtful comprehensive review that is ongoing. In the first phase, MISO sought to close the loophole for bidding on negative-priced FTRs. Borrowing from the NYISO TCC credit policy, MISO sought to institute a minimum collateral requirement per unit volume bid. After significant discussion with market participants, it was agreed to collateralize bids with prices at or below $0 differentially more than those that were bid at a positive price. The asymmetry was clearly imperfect (e.g., a $0.01 bid for 1MW in the summer season requires $100 whereas a $0 bid requires $375), but it was clearly an improvement on a significant loophole in the original policy. On February 29, 2008, MISO filed revisions to the bidding portion of their FTR credit policy.[15]

In the second phase, MISO focused on enhancing the requirements for holding an FTR portfolio. The original policy required one to post collateral equivalent to the difference between the median values of the prior year's actual congestion values of the FTR's sink node and the FTR's source node. There were two major concerns. First, the use of the median value was clearly not targeting risk, which is derived not from expected values, but rather on the unusual outcomes, those at the edges of the distribution. Second, the value was the difference between the two medians, not the median difference, which can be quite different because of temporal correlations between the two sets of nodal prices. In other words, the median price of the source node might be from a completely different time of year than the median price of the sink node. Since FTRs settle on the difference in congestion values between the two nodes, it is critical to look at the distribution of the differences, not just the distribution of the congestion at the nodes themselves. Unfortunately, this expanded the scale of the problem by a power of two (n source nodes x n sink nodes = n^2) and was not computationally feasible prior to the 2008-09 annual auction. Instead, in a stated effort to be "conservative", MISO proceeded with the independent nodal perspective and proposed that the greater requirement of the difference in median nodal values or difference in 75th percentile nodal congestion values be used. In reality, this was like picking the greater of two random numbers. On March 31, 2008, MISO filed revisions to the award portion of their FTR credit policy.[16] FERC approved the two sets revisions in May 2008, but ordered MISO to continue to review its FTR credit policy, in particular the issues laid out above regarding nodal correlations.

Since then, MISO has begun a more thoughtful review of its FTR credit policy, although the focus has been much more narrow in scope than that of PJM and ISO-NE, primarily focusing on how to improve the collateral requirements based on historical values (e.g., distribution of FTR values instead of nodal values).

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[15] FERC Docket No. ER08-622-000.
[16] FERC Docket No. ER08-622-001.

New York (NYISO)

Prior to the PJM defaults, NYISO had recently undergone a significant review and had instituted a set of changes to better collateralize its TCC markets. In particular, NYISO's original credit policy had a similar loophole to MISO with respect to negative-bid TCCs in that there was no credit required to bid. Through an analysis of historical prices and settlement values, they established a minimum collateral requirement per unit volume bid as well as a more sophisticated formulation of the collateral required to hold a TCC based on its clearing price. The effect was to reduce the collateral requirements for positive-priced TCCs while increasing it for low-priced and negative-priced TCCs. After a brief review following the PJM defaults, no further changes were made.

ERCOT READIES ITS CREDIT POLICY FOR A NODAL MARKET

ERCOT has had the luxury of being able to observe the maturation of the nodal markets in the Northeast and Midwest US without burden of an active market to exert pressure. That said, with nodal market implementation imminent, the pressure is mounting.

ERCOT's current CRR policy has two components. To own a CRR with a clearing price at or below $15/MWh, the collateral requirement is a universal $10/MWh. For CRRs above this price, the collateral requirement decreases, asymptotically approaching zero at higher prices. The second component relates to the awarded portfolio and is a mark-to-settlement/mark-to-market hybrid that takes an amalgamation of recent congestion values (spanning periods of the most recent day, most recent 5 days, most recent month) as well as the relevant auction clearing price and extrapolates this value to the remaining time to maturity of the portfolio. This is designed to be responsive to the latest information (e.g., most recent day's congestion value and auction price) without relying entirely on it to project future values.

ERCOT has been re-examining its CRR credit policy in light of the PJM defaults; contrary to efforts in the other ISOs, the efforts to date in ERCOT have focused on ensuring that the collateral requirements are not overly stringent and harmful to market liquidity. In particular, they are looking at the value for the minimum collateral requirements, currently set at $10/MWh. This value is extremely high; to bid for any 1MW CRR in an annual auction would require an astounding $87,600. Contrast the $10/MWh floor to NYISO, which ranges from $0.17/MWh for annual TCCs to $0.82/MWh for monthly TCCs[17] and to MISO, which is as high as $0.34/MWh.[18] Also contrast this to the amount that would have been required to cover the PowerEdge and Exel defaults. PowerEdge had a 78 TWh portfolio and a $52MM default so $0.67/MWh would have covered the entire default; Exel had a smaller 2.3 TWh portfolio and a $5MM default, requiring $2.20/MWh to cover the entire default. Again it is important to remember that the objective of a robust credit policy is not simply to avoid all defaults, but to

[17] $600/MW, $2,000/MW and $1,500/MW for a monthly (730 hours), six-month (4,380 hours) or annual (8,760 hours) position, respectively.

[18] $375/MW for summer (~1,095 hours)

balance the cost of avoiding defaults against the cost of the defaults themselves. The current $10/MWh floor is excessively high and will have adverse implications for market liquidity and pricing.

RECOMMENDATIONS FOR ROBUST RISK MANAGEMENT

In this final section we outline key guiding principles for the ISOs and suggest practices for sound risk management.

Like any market, the ISO is required to manage the delicate balance between market efficiency (e.g., low costs, broad participation, etc.) and market security (e.g., contract certainty, default risks) to bring about liquidity and robust price formation. That said, while the market needs to be open to foster competition, this does not imply allowing everyone to participate, especially if they may do harm to themselves or the market itself. In addition, it is critical to set an attainable standard for market security. A secure market is not one that does not have any defaults, but one in which defaults are infrequent, and when they do occur, not overly disruptive to the market. The cost to the whole market of ensuring no defaults is far higher than the costs of weathering the occasional default. To strike the right balance it is critical to examine carefully the underlying drivers of risk to match against collateral requirements. It is also essential to avoid potential loopholes that might entice unusual behavior as well as cross-subsidizations among market participants that may create an unfair advantage within the market. It is with these principles in mind that we arrive at our recommendations.[19]

Member requirements

FERC has stated time and again that one of its guiding principles is creating a competitive marketplace by maintaining low barriers to entry. Unfortunately, low barrier seems to be defined as little or no barrier. At more than one ISO, the minimum requirement is that an entity be formed as a limited liability company (LLC) or similar corporate entity, hardly the most stringent of requirements. Contrast this with the regulations around trading in other commodities, futures and equities, which are in place to protect naïve investors from entering into markets or investments with significant complexity and volatility. The Commodity Exchange Act (1936), which governs many other commodity markets, defines an Eligible Commercial Entity (ECE) based on tangible net worth and sets minimum thresholds for companies of $10MM for non-commercial (speculative) investors and $1MM for commercial (hedging) investors[20]. The Securities Act (1933) defines accredited investors based on net worth and sets a minimum threshold of $1MM[21]; furthermore the Investment Company Act (1940) defines a qualified purchaser, who can participate in a broader array of private investments, based on a threshold of investable assets of $5MM. [22]

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[19] We do not claim these recommendations as solely our own, but do believe that together they provide a sound framework for developing a robust credit policy.
[20] 7 U.S.C. §1a(11-12)
[21] 17 C.F.R. §230.501 et seq
[22] 15 U.S.C. Section 80a-2(a)(51)

Not only do minimum requirements provide a level of protection to the investor, but they also protect that market by reducing the risk that a naïve investor wreaks havoc on the market at the same time. It also protects the market from savvy investors exercising the "trader's option"; essentially, without a significant capital requirement, an entity can leverage the use of many thinly-capitalized independent entities to make large risky bets, knowing that they face limited liability if the bets don't pay off, and can potentially collect large upsides if they do.

As expected, this suggestion of tightening member requirements has been met with fierce opposition by current members, namely those who would be prevented from participating. For reference, in PJM, 15% of the members would fail to meet the $1MM tangible net worth threshold and 21% would fail to meet the $10MM threshold.[23]

Margining

Margin requirements are the dynamic mechanism for ensuring market security across all market participants' positions. Margin requirements typically comprise two components – initial and variation (or maintenance) margin. Initial margin is financial support to cover market price movements between settlement periods (i.e., cash flow events); variation margin is the financial support to true up the cash position to match that of the market value of the position after each settlement period.

Initial Margin

For traditional exchanges, initial margin is designed to cover an extreme move from one trading day to the next as all market participant accounts are settled every trading day. The sizing of initial margins is specific to the contract and is derived from distributions of historical price movements. On commodity exchanges like ICE and NYMEX, the initial margin is based on a three-standard deviation (99.7%) move over two days. In rolling up the portfolio, the total initial margins are the sum of the contract-specific initial margins discounted by a factor to account for correlations between contracts, which provide real diversification benefit to the portfolio over the individual investments. This discounting is termed offsetting.

The current collateral requirements of FTR markets are analogous to the initial margin concept. The challenge for FTR markets is that the initial margin needs to cover not only the period between two settlement periods (typically a week, but potentially as long as one month), but also the potential exposure of open positions held into the future that cannot be liquidated. Although accelerated settlements (e.g., weekly instead of monthly) can mitigate risk from recent losses, it does not help to mitigate future expected losses. This complicates the process of calculating initial margins and exerts upward pressure on the sizing of initial margins.

The ISOs use a variety of calculation methodologies based on historical congestion values or actual clearing prices to size initial margins (see Appendix for details by ISO). One key challenge is that there is a limited history of congestion values (e.g., PJM is the oldest with 10 years of data), especially in light of the shortest FTR tenor being a single month. Compounding

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[23] PJM CRMSC 7-14-08 Draft of Recommendations to the PJM Members Committee

this challenge is the ever-changing congestion environment, which limits the relevance of historical data for future projections. That said, we strongly believe in the transparency provided from looking at actual data as opposed to forecasted distributions driven by models with their myriad assumptions. To frame this problem for MISO, we recently proposed the following segmentation of the problem.[24]

Path-Based Risk Measurement Parameters

– Menu of Options–

Timeframe	Dataset	Sampling Frequency	Percentile	Temporal Extrapolation
All-Time *Most data, but old data is stale*	**All Potential Paths** *Most comprehensive, but computationally intensive*	**Hourly** *Most granular data; potential extrapolation issues*	**99%** **97%** **95%** *Common risk benchmarks*	$\times N$ *Settlements are repeated throughout tenor – too conservative*
Last X Year(s)	**Distinctly Priced** *Similarly comprehensive, less computationally intensive*	**Daily** *Decent granularity; more manageable dataset; still potential extrapolation issues*	**75%** *Current MISO standard (in addition to median)*	$\times N^x \quad 0.5 \le x \le 1$ *Settlements have some memory; best representation of reality, but x value is arbitrary*
Seasonal (Past X Years) *Less data, but most relevant period*	**Bid Only** *Informational, but not comprehensive*	**Monthly** *Less data, but less extrapolation issues (none in monthly FTRs)*	**Mean** **Median** *Related to expected value; not appropriate for risk measurement*	$\times\sqrt{N}$ *Random walk – settlements are uncorrelated over time*

Indicates suggested methodology

N is number of units in FTR settlement period, e.g., 360 on-peak hours in an month

We advocate for an approach that looks at the unusual hours or days in the historical distribution and extrapolates those values out to longer tenors (e.g., month, year) in an appropriate manner to capture the reasonable edge of the distribution, but not necessarily the very end of the distribution. Currently, only ISO-NE uses a historical monthly distribution to determine collateral requirements.[25]

The current FTR markets employ only basic offsetting techniques. These consist of allowing the historical value of one FTR offset that of another via a strict addition of values from contemporaneous time periods. This is reasonable where FTRs are truly anti-correlated, but can be misleading when correlations are merely coincidental. It also ignores the inherent benefit that a portfolio derives from aggregating uncorrelated risks. Although challenging to appropriately account for correlations, we believe that discounts on initial margins should scale with diversification as opposed to adding premiums for perceived concentrations (e.g., PJM's adders for *flow undiversified* and *geographic undiversified* portfolios). In this way, the initial margin of a single FTR represents the risk of that FTR without further adjustment.

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[24] DC Energy comments, MISO FTR Credit Policy Working Group, July 22, 2008.
[25] CAISO will also use a historical hourly distribution and extrapolate via random walk in their CRR market when MRTU goes live.

A further complication of sizing initial margins in FTR markets is the auction process and the uncertainty that is inherent between bidding for an FTR and its subsequent award. Because the award is unknown at the time of bidding, it is impossible to calculate any potential offsets that might exist. It is also typically the case that a market participant will bid on far more FTRs than they will be awarded (overall award rates are <10%). The only certain way to ensure that an entity has sufficient collateral is to require them to post collateral to cover the possibility of winning every bid at the bid price.[26] The central implication being that a portfolio as bid is almost certain to be overcollateralized relative to the awarded portfolio. It should be noted that ERCOT has an innovative solution for its CRR market that incorporates a market participant's collateral amount as a constraint into the clearing solution; a market participant need only hold enough collateral to cover their awarded portfolio.

Variation Margin

Traditional exchanges determine variation margin requirements based on mark-to-market, the change in market prices from one trading day to the next. Effectively, as the market price of the position changes, each participant is required to support the implied market value change, which may be a credit or debit to their account. The underlying concept is that every entity effectively closes out its entire position at the day's market prices. Although the positions are not actually closed out, assuming the market prices would be robust enough to withstand the liquidation (i.e., prices would not move), it is a measure of an entity's ability to manage its position and it prevents financial support from getting too far out of line with the held position.

As noted above, mark-to-market requires robust pricing; it must be up-to-date and backed by the liquidity of the market. The current FTR markets suffer from infrequent auctions. Although every day yields a new congestion value for the next day derived from the day-ahead prices, this new information provides little to no information about the balance of the settlement period, which may extend weeks or months into the future. With the advent of FERC-mandated LTTRs, this period increases, in some ISOs, to five years.

All ISOs today ensure that each market participant has the financial support at the ISO to cover their current liabilities, however, there is limited protection against future losses. NYISO uses a *mark-to-settlement* calculation methodology that extrapolates the recent 90-day congestion values to cover the remaining settlement period; if this value exceeds the initial margin requirement, it becomes the collateral requirement for the portfolio. ERCOT has proposed an analogous methodology that takes a weighted average of the four different values: the most recent day's settlement, the past five days' settlements, the past month's settlement and the auction clearing price. This is designed to move quickly with sudden changes in congestion landscape without overreacting purely to the most recent settlement. These methodologies provide some measure of protection against future settlements, but only to the extent that the future is simply the past repeating itself.

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[26] Multiple bids on an identical FTR can be treated conditionally as they can only be awarded at one price. For example, let's take the following pair of bids on the same FTR: a bid for 1MW at $100 and a bid for 2MW at $50. The first bid cannot clear at simultaneously at $100 with the second bid at $50. If the second bid is awarded, the first bid must be awarded also at $50 (or less). So the exposure is not $200 ($100 x 1 + $50 x 2), but $150 ($50 x 3).

As discussed above, ISO-NE and PJM are proposing a *mark-to-model* approach to get around the challenge inherent in margining a relatively illiquid market. Although attractive in principle in that it is forward-looking, it is at the same time a significant liability for the ISO to have the singular burden and responsibility of determining the magnitude of the tail of the distribution of potential outcomes looking into the future. On the one hand it chances missing a key risk either because of a modeling error or, as is always the case when forecasting the future, an assumption, while valid at the time it is made, may turn out to be wrong or missing altogether. This is especially difficult because the objective is to model the tail of the distribution as opposed to the expected value, a region that is by definition likely to be poorly understood. On the other hand, it also risks a drastic overstatement of the risk for the same reasons. Since the ISO is the sole purveyor of the risk forecast and the credit management, the market participants are captive to the ISO's view. At the very least, the market participants should have transparency into the forecast process, however, this can also compromise the market as it centers the market around the view of one entity, the ISO. The efficacy of such an approach would be highly dependent on the actual implementation; a worst case scenario would be that poor modeling leads to useless and/or capricious overcollateralization that reduce market liquidity while not actually reducing credit risk.

The mark-to-market approach is superior. It reflects the collective market's view on future value and provides a direct market price at which a defaulted portfolio could be liquidated. PJM has taken a significant step forward with the institution of the balance of planning period (BOPP) auction. Although still only monthly, it creates a market each month for one to trade around their entire FTR position.[27] MISO is planning to start implementation work for a BOPP auction at the end of 2008, and ISO-NE is considering similar upgrades. Finally, on the horizon is a new marketplace for nodal power trading, Nodal Exchange.[28] Starting in early 2009, this cleared exchange will offer cleared contracts with nodal granularity across all of the nodal markets. Auctions will be held daily enabling near continuous trading and mark-to-market margining.

Default events and liquidation procedures

The ultimate objective of the excess capital held as collateral is to provide the necessary capital to liquidate the position. In the event of a default, i.e., a market participant cannot meet its payment obligations or continue to support increasing collateral requirements, it is critical that the portfolio can be closed out with minimal disruption to the rest of the market.

The recent defaults have highlighted a general weakness across the ISOs; none have clear rights to assume portfolios in default nor do they have a clear methodology for liquidating these portfolios and eliminating exposure. Stronger rights are now being put in place to give liquidation authority to the ISOs, but the question still remains as to how to liquidate. In general, the ISOs lack spare transmission capacity to liquidate a portfolio, having allocated or auctioned almost all of the available transmission capacity through FTRs. In fact, most ISOs award the majority of capacity in the long-term auctions, leaving only residual capacity and capacity traded

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[27] With the advent of long-term FTRs in late 2008, this will only be true for the current planning year as the long-term FTRs will only be available in the long-term FTR auctions, which will be held twice a year.
[28] In the interest of full disclosure, an affiliate of DC Energy is the founding investor in Nodal Exchange.

between market participants for the shorter-term auctions. Thus, the market participants must play a direct role in the liquidation process, just as they do in other exchange markets. As discussed above, the critical issue is the relative infrequency of auctions, especially for settlement periods beyond the prompt month. The ISO could hold a special liquidation auction; unfortunately, this would hold the ISO and the defaulted market participant captive to a market that knows there is a desperate buyer. To combat this, the ISO could try to implement a more savvy close-out strategy with price-sensitive bids, but then it risks not liquidating a defaulted portfolio in a timely fashion and potentially creating even greater losses. A better approach is to increase the frequency of auctions; ideally daily, but even weekly auctions should enable reasonably smooth liquidation.

Independent clearinghouse – moving credit and risk management out of the ISO and away from the market participants

Although not essential, a positive step for risk management would be to move towards the practices of traditional exchanges and separate the functions of market operation and clearing, in turn making clearing a competitive process. The ISO would still hold the responsibility for administering the FTR market; it would run the auction and determine settlement prices, but it would transfer the positions to a clearinghouse and its associated GCMs. As in traditional exchanges, the clearinghouse would then establish initial margin minimums and manage the cash flows for variation margin and settlement. The GCMs would manage the risk of their individual clients, in this case, the FTR auction participants. In this way, a GCM could decide to ask a client for additional margin beyond clearinghouse minimums for cases in which it perceived additional risk, but it could not do so capriciously for fear of losing business to another GCM. On the other hand, the GCM could decide to grant the client unsecured credit if it was comfortable with their balance sheet and strategy, but unlike the current ISO practice of granting unsecured credit to entities, that credit would not be backed by the rest of the membership, but by that GCM. Perhaps most advantageous to this approach is that the entities responsible for gauging necessary margins are directly affected by their decisions, either through the loss of business or exposure to client defaults. Contrast this with the ISO as a quasi-clearinghouse; all market participants share in the risk, but there is no direct consequence to the ISO of margining at inappropriate levels. In addition, moving to an independent clearinghouse will remove a layer of inefficiency because those that bear the risk currently (other ISO members) make irrational decisions on market rules and collateral requirements (tendency to overcollateralize the minority) because of the risk they bear.

CONCLUSIONS

Financial transmission rights are a critical component of nodal markets. Nodal markets are exceptional at providing instantaneous price signals across a granular set of locations on the grid; they highlight precisely where the grid is under strain and create incentives for investment in physical assets. FTRs are critical for aggregating these price signals across time; they serve both to provide hedges against spot price volatility, but also to monetize the cost to the grid of chronic hot spots to enable direct comparison to various investment opportunities (e.g., new generation, transmission upgrades, demand response) to alleviate these weak points.

That said, FTRs have inherent volatility and associated risk. Their value is quite sensitive to subtle (and not so subtle) changes in the grid. Therefore, a robust FTR market needs to carefully consider the risks and the associated credit issues. There is a critical balance to strike between mitigating risk and creating liquidity; too much mitigation through onerous collateral requirements and too little mitigation along with significant defaults are both harmful to the health of a market.

To get this balance right requires everyone to have an objective balanced view of the problem. Risks should be examined at their core underlying drivers and basic granular observables, not via simplistic aggregate metrics (e.g., net portfolio investment) that skew the view. Finally, we should look to other commodity exchange markets and borrow from their model with its successful long history of healthy liquid markets.