



Spot-Market Clearing

Solving the electricity credit malaise.

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“TCE, a [qualified scheduling entity] QSE in the ERCOT region, filed for bankruptcy protection in March 2003 ... the outstanding principal amount owed to market participants at Jan. 1, 2005 is \$13,692,188.37. ... ERCOT intends to begin the process of uplifting to QSEs representing LSEs the principal amount remaining on TCE’s payment obligation to ERCOT. ... On Jan. 18, 2005, ERCOT will send invoices totaling \$2.5 million to QSEs representing LSEs. ... After this initial invoice, ERCOT will continue to uplift \$2.5 million per month until it uplifts all remaining outstanding principal.”²¹

Such was the news that greeted ERCOT participants the morning of Jan. 18. This situation is not unique, with many electricity spot markets² around the world experiencing similar defaults in recent years—often in the millions of dollars.

In most electricity spot markets, the spot-market operator (SMO)³ serves as the central counter-party to all trading, with any defaults socialized to the pool of all participants. Because participants do not have any knowledge of other parties’ spot exposures and no way to manage these risks bilaterally, potential losses are both unpredictable and unhedgeable. As a result, participants are totally dependent upon the credit practices adopted by the SMO.

These credit practices, however, remain rudimentary in many spot markets. In the United States, most markets continue to operate on a monthly billing cycle, resulting in exposures of up to 60 days’ settlement. Little collateral secures these exposures, with unsecured credit dispensed liberally. The likelihood of participant default—and the potential loss arising from such an event—is significant.

A better solution is required. Spot-market clearing provides the answer, using the sophisticated clearinghouse infrastructure that futures markets have evolved over many years, and extending it to the domain of spot electricity. Under this model the clearinghouse replaces the spot-market operator as the counter-party to all trades, and, more importantly, acts as guarantor, assuming all risk of counter-party default.

The Problem With the Status Quo

Most electricity spot markets transact via a multi-lateral auction, in which the supply offers of all sellers and demand bids of all buyers are matched in aggregate. Because it is not possible to uniquely associate a single buyer with a single seller, this trading mechanism necessitates the use of a “central counter-party,” which acts as the *de facto* buyer to all sellers, and seller to all buyers. In most spot markets this role is performed by the SMO.

In the event of a default, the central counter-party is expected to ensure financial performance of all obligations of the defaulting party. In practice, however, the SMO does not have the balance sheet to carry this risk itself. As a result, most

markets’ rules call for any default amounts, in excess of the collateral being held, to be socialized to the remaining participants according to a pre-determined formula, often unique to that market. Because participants do not have insight into each other’s spot-market exposures, these socialized amounts are both unpredictable and unhedgeable.

This would all be moot if the magnitude and probability of default were both sufficiently small that they could be ignored. The reality, however, is far from this. On a monthly billing cycle, credit exposures can be up to 60 days’ settlement (see *Figure 1*), and even under weekly billing can exceed 18-plus days. For many spot-market participants these exposures are secured by little or no collateral, with all unsecured amounts at risk.

Under the *status quo*, the likelihood of participant default and the potential losses arising from such an event is significant. These events can occur regardless of whether the market is otherwise successful. For example, in 2001, PJM experienced payment defaults totalling \$4.5 million⁴ related to the failure of Utility.com and Utilimax.⁵ A number of other markets around the world have experienced similar defaults in the millions of dollars. If sufficiently severe, such events have the potential to affect the ongoing viability of the entire market, along with the market operator—as demonstrated by the California Power Exchange, which collapsed after its markets suffered payment defaults totaling \$2.9 billion.⁶

For participants, the potential to receive large socialized charges resulting from the default of someone else—charges that they cannot anticipate, hedge against, or in any other way manage independently—should be an issue of serious management concern. For spot-market operators, who are entrusted with managing this risk on behalf of participants, the challenge is to find a better solution.

A New Application for Proven Infrastructure

For an answer, we need look no further than futures markets, and the sophisticated clearinghouse infrastructure they have evolved over many years. The clearinghouse model is used by almost all of the world’s futures markets, including major energy marketplaces such as the New York Mercantile Exchange (NYMEX). The disciplines inherent in this model have allowed these markets to maintain their integrity through both normal circumstances and extraordinary events, such as the collapse of Enron, the energy industry credit meltdown, and various natural disasters, wars, and other causes of price volatility.

Spot-market clearing is an innovation upon this proven solution—extending the clearinghouse concept to provide similar protections to spot markets in electricity. Under this model, the clearinghouse replaces the SMO as the counter-

party to all trades. More importantly, it acts as guarantor, assuming the risk of counter-party default—thus removing this risk from the socialized pool of all participants.

However, without the right credit risk-management processes and structures in place, a third-party guarantee is a hollow promise.

It is not enough for a central counter-party to pledge it will take on all default risk; a guarantee is only as good as the organization providing it, and the market must be confident that the counter-party won't itself fail—the California Power Exchange providing a salutary example. As stated more eloquently by Mark Twain in Pudd'n'head Wilson, "The wise man saith, 'Put all your eggs in the one basket and—watch that basket!'"

Protections and Safeguards

Clearinghouses preserve their financial integrity through a system of rigorous processes and robust guarantees. Spot-market clearing uses these same safeguards, modified as appropriate to fit the unique characteristics of electricity spot markets.

Full Collateralization

All positions held at the clearinghouse must be secured by collateral—specifically liquid redeemable instruments such as cash, treasury instruments and letters of credit—in accordance with the risk they present. Unsecured credit is not accepted, be it based on balance sheet, parent guarantee or IOU.⁷

Credit risk is determined based upon a probabilistic assessment of potential credit exposure. This is the total exposure which a participant might incur by the time a default is detected and resolved, calculated to a given statistical likelihood. Due to the inherent volatility of electricity spot markets the calculation of potential exposure, as with futures markets, must be performed on a daily basis. The method of calculation, however, differs significantly between these two types of markets.

In futures markets, potential exposure is usually based upon the worst one-day move, within the chosen statistical bounds (e.g., 99 percent), this being the exposure that can be incurred between when risk is assessed and when the position can be

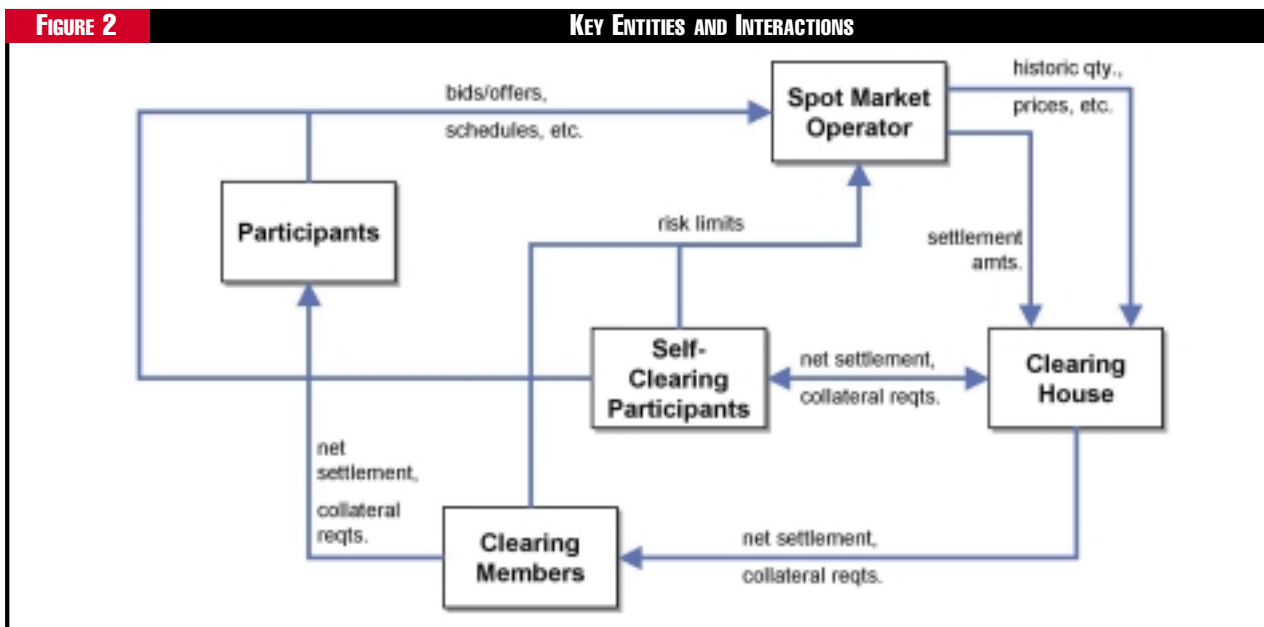
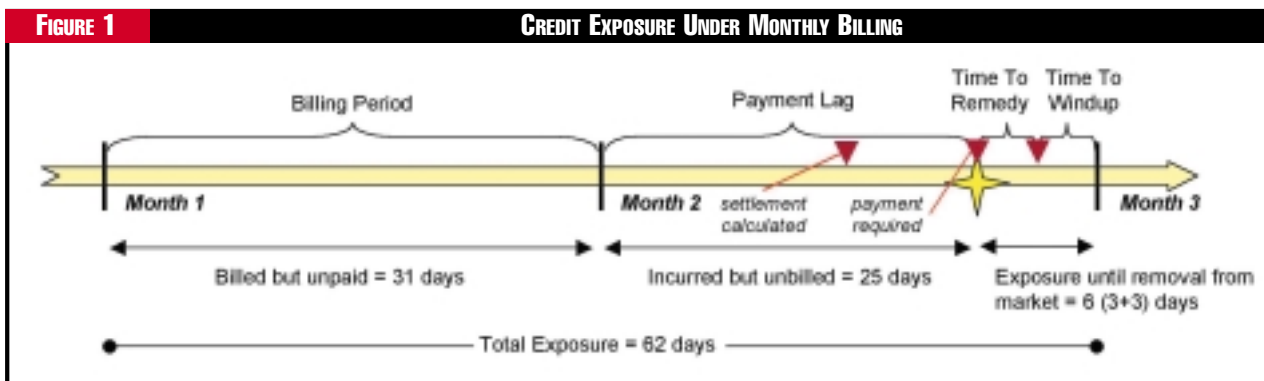
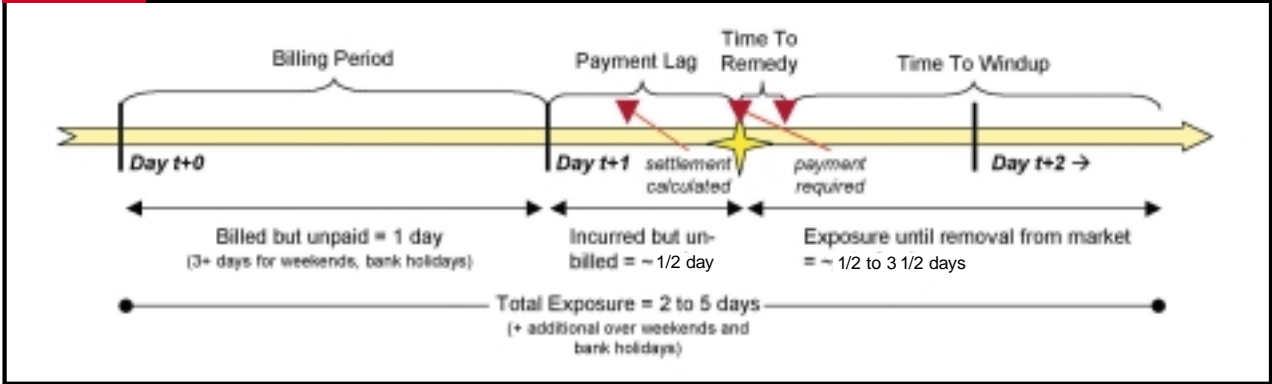


FIGURE 3

CREDIT EXPOSURE UNDER SPOT-MARKET CLEARING

Source: The authors



liquidated in the event of default. In electricity spot markets there usually is no position to liquidate, as the power has been, or is being, consumed by the time a default can be detected. Instead, potential exposure is determined based upon the (statistically determined) settlement liability that might be incurred between assessment and detection—or resolution.⁸

The authors have undertaken significant work with NYMEX to identify methods for calculating and managing spot-market exposures, not just for real-time and day-ahead electricity, but the broad range of charges and payments associated with most electricity spot markets (*e.g.*, ancillary services, capacity, etc.).

One of the more attractive features of the clearinghouse collateralization model is the ability to perform portfolio margining. Many organizations are active in multiple electricity spot markets and the futures market, often with collateral assessed and posted separately for each. Consolidating all of these positions at the same clearinghouse allows credit exposure, and hence collateral, to be determined on a portfolio basis, with the potential to generate significant offsets between positions with correlated risk. Potential markets against which collateral offsets can be provided include:

- Positions in other electricity spot markets;
- Electricity future;
- Contracts for major fuel sources, such as natural gas, coal and fuel oil; and
- Other commodities with a significant linkage to electricity, such as weather and emissions credits.

To effectively provide these benefits, however, the clearinghouse must have a material standing in the markets in question. This makes the provision of collateral offsets between spot and forward markets a far more realistic proposition for organizations already clearing energy futures, such as NYMEX.

Daily Settlement

Posting full collateral under current billing arrangements, with

potential exposures of approximately 60 days' settlement, would represent a significant imposition for many participants.⁹ However, by accelerating settlement time frames the quantum of any potential default, and associated collateral requirements, can be reduced significantly. Under spot-market clearing, settlement will occur on a daily, or "T+1," basis, with the following characteristics:

- Settlement amounts are calculated by the spot-market operator, immediately following the end of the trading day.
- On business days, settlement and funds transfer will occur later the same morning. Because fund transfer networks do not operate on weekends and bank holidays, amounts calculated on these days will be settled the next business day (*e.g.*, trades for Friday, Saturday, and Sunday will all be settled on Monday morning).¹⁰
- Any failure to pay results in a margin call, which must be promptly satisfied (generally within an hour or so) to avoid default.

This process not only substantially reduces potential exposures (*as shown in Figure 3*), but it is consistent with the mark-to-market process in the futures market. This facilitates the netting of spot-market settlement cash-flows with mark-to-market settlement of futures positions, as well as settlement cash-flows from other spot markets being cleared. This results in a single net movement of cash across all trading activity cleared at the same clearinghouse.

But from where will the data required for settlement come? One apparent complication with T+1 settlement is that some required input data, in particular metering data, may not be available immediately. This situation, however, represents a classic tradeoff between timeliness and accuracy—where it is preferable to use data of "reasonable" accuracy on an interim basis, with later true-up once more accurate data becomes available. This satisfies (most, if not all of) the settlement liability sooner, allowing collateral requirements to be substan-

tially reduced (by contrast, if settlement waited until final measurement data became available, it would be necessary to hold collateral for the entire intervening period). Alternate sources of data include SCADA and State Estimator¹¹ results, demand forecasts, and dispatch instructions. In most markets this data exists now, without any additional need for data collection.

Risk Limits

Risk limits may be applied to some spot-market products, to ensure that a participant's position stays within acceptable risk boundaries. This is most relevant for those products where historical performance is not necessarily an indicator of future performance, such as day-ahead electricity. Limits ensure that

a participant cannot dramatically lift its trading activity, and hence exposure, without prior authorization.

Efficient Banking

Ensuring the timely movement and accurate tracking of funds is important in maintaining the integrity of any settlement or credit process. Clearinghouses maintain an extensive network of relationships with money-market banks for the efficient daily and intra-day movement of funds—both cash and other assets. These mechanisms are generally integrated with national and inter-national funds transfer networks, such as Fedwire. Clearinghouse banking processes are significantly more robust and effective than the banking processes currently employed by any electricity spot market.

CLEARING: DEFINING THE NUMERICAL BENEFITS

Detailed cost-benefit analyses of spot-market clearing were performed by Accenture and NYMEX, in conjunction with a number of North American spot-market operators. Summary results from one such analysis are presented below. All numbers have been proportionally scaled from the actual to preserve anonymity. For the analyzed market, with (scaled) annual consumption of approximately 220 TWh, both average and 99th percentile potential losses were examined:

- **Average losses:** The amount that the spot market should, on the balance of probabilities, expect to lose through default during the year. Participants should budget for their socialized share of this loss.
- **99th percentile (P99) potential losses:** Represents the level of losses which, to 99 percent likelihood, the actual losses will be less than. Stated differently, the statistical likelihood of losses exceeding the P99 loss is 1

percent. It is standard risk-management practice to hold sufficient risk capital to cover the P99 loss. This capital, cannot be deployed for other purposes.

Results for the example market are summarized in Table 1 below. These represent losses in excess of collateral held. Provisioning for this risk has a cost to participants, also shown. Spot-market clearing eliminates these risks, and their associated costs.

Spot-market clearing also leads to significant market-wide reductions in cash requirements, summarized in Table 2. These are driven by:

- **Reduction in required collateral postings:** Although spot-market clearing requires all participants to post collateral, the acceleration of settlement time frame results in lower potential exposures, and hence lower collateral postings than many participants are currently required to make.
- **Change in float:** The acceleration of settlement time frame results in a reduced period of float for net purchasers. As, at the time of analysis, the cost of money for net producers was on average higher than that for net purchasers, an overall cash benefit resulted.

As one would anticipate, the cash benefits of spot-market clearing do not flow uniformly to all participants. That would be an unrealistic panacea. However, the negative cash impact to some must be weighed against the credit risk benefit they receive, as well as the overall credit risk and cash benefits to the market as a whole.—*TWB, FXS*

TABLE 1 MARKET-WIDE CREDIT RISK BENEFIT

	Losses (\$'000)	Cost of Covering (\$'000)	Covered By
Average Losses	2,432	2,432	Setting aside reserve
P99 Potential Losses	36,334	3,691	Holding risk capital
Total Credit Risk		6,123	
Reduction Benefit			

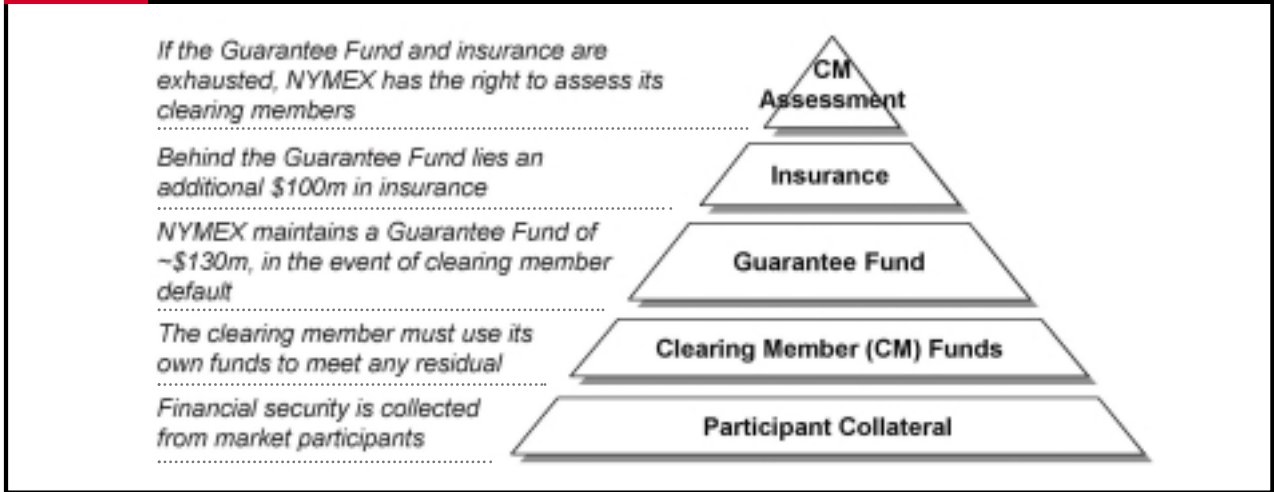
TABLE 2 CASH IMPACT OF SPOT MARKET CLEARING

	Collateral (\$'000)	Cost (\$'000)
Collateral Change		
Old Collateral Amount	100,000	(14,169)
New Collateral Amount	29,684	(1,882)
Cash Impact of Collateral Change		12,287
Cash Impact of Changed Float		3,656
Clearing House/Clearing Member Fees		(4,154)
Cash Benefit Total		11,789

FIGURE 4

THE GUARANTEE PYRAMID FOR NYMEX

Source: The authors.



Financial and Market Surveillance

Surveillance is an essential clearinghouse function, performed to ensure the integrity of its members, customers, and markets. Financial surveillance ensures the financial integrity of the clearinghouse, through monitoring of customers and clearing members. Market surveillance ensures that the markets are operating in an orderly fashion, and free from distortion or manipulation.

The Guarantee Pyramid

As discussed previously, a guarantee is only as good as the organization providing it. Clearinghouses use an escalating series of trade guarantees to protect market participants from the default of any individual participant. Figure 4 provides an example of the guarantee structure for NYMEX.

Importantly, this structure does not rely upon variables outside its control, such as the availability of credit default swaps, or the performance of the third parties providing such products. Additionally, despite the existence of many levels of guarantee, the upper levels are rarely called upon. NYMEX, for example, has never needed to call upon its guarantee fund or any higher levels of protection.

A Call to Action

As stated recently by Bob Ludlow, the CFO of ISO New England, “ISO New England views clearing as the logical next step in materially reducing the credit risk of the markets.” The time has come for electricity spot markets to institute comprehensive reform in the way they manage credit risk. ■

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Endnotes

1. Quoted from ERCOT, “Market Notification re TCE Payment Default (2005-01-17).”
2. For the purpose of this paper, the term “spot market” is used in the broad sense, and refers to near-term cash markets in electric energy (real-time, day-ahead, hourly), as well as markets in related products (ancillary services, unforced capacity, etc.).
3. This can include independent system operators (ISOs), regional transmission organizations (RTOs), power exchanges (PXs), or any other entity responsible for operation of the electricity spot market.
4. Source: Moody’s Investors Service, Special Comment on PJM Interconnection, December 2004.
5. Around \$1 million was later recovered in bankruptcy proceedings.
6. Estimate by the Reorganized California Power Exchange, in L.A. Superior Court, Docket # CR308007.
7. This is a feature common to all proper clearinghouses, and helps ensure that the rapid collapse of a participant, even one previously rated highly (e.g., Enron), does not compromise the integrity of the market as a whole.
8. Because of the “obligation to serve,” it may not be possible for a default to be resolved until some days after it is detected.
9. Monthly billing would represent a substantial risk to the clearinghouse if a default exceeding the defined statistical boundaries for collateral (e.g., 99th percentile) were to occur *i.e.*, a 1-in-1,000 event given five days of exposure is less problematic than such an event given 60+ days of exposure.
10. Additional collateral must be collected on a Friday to cover this extended period.
11. Supervisory Control and Data Acquisition (SCADA) and State Estimator are related systems commonly used by system operators as part of their overall energy management system (EMS).