Substituting Outrage for Thought: The Enron “Smoking Gun” Memos

Far from distorting the market, the majority of Enron’s strategies actually corrected potential distortions in complicated interrelated markets. To the extent that some of these strategies exploited market flaws to bring some of these markets out of alignment, there were obvious corrections available that policymakers should focus on rather than the futile, or at least unproductive, search for scapegoats.

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With the publication of law firm Stoel Rives’ memo summarizing Enron’s trading strategies in California, we have witnessed a cascade of outrage and a widening of a search for culprits (Enron being judgment-proof) to recover money allegedly stolen from California’s consumers in the summer of 2000 and the winter of 2001. What is clear is that those who have leapt to argue that this memo proves “market manipulation” have either not read it or not understood it. Understanding it, however, requires some knowledge of the California energy markets and economic markets in general. As I will make clear, the invective that has accompanied the publication of this memo is almost entirely unwarranted. I stress the almost, however, because some of the Enron strategies clearly took advantage of market rules that...
created incentives to act in ways which did not advance social welfare. Normally, of course, we would not chaste those who followed their economic incentives but would instead focus on what was wrong with the rules. But these are not normal circumstances.

Worse still, of the 10 trading strategies cited by the memo, at least 6 increased market efficiency. There is no hint in any of the political invective that consumers and producers are clearly better off for the existence of the strategies named "Fat Boy" and "Get Shorty." Other strategies, e.g., "Death Star," had no impact on market efficiency at all. On balance, there is no evidence that Enron's activities in California had any deleterious impact on electricity markets.

It will require large amounts of data and sophisticated analysis to calculate a net effect of all of these strategies, but the assumption of a net adverse effect through a combination of outrage and succumbing to the public relations effect of the names of strategies is unworthy of serious consideration in the making of public policy.

I. A Basic Sketch of the Argument

Society suffers when the same product is sold at different prices. Suppliers who sell in a low-priced market may have been willing to produce and sell more in the higher-priced market. Consumers who bought in a high-priced market might have been willing to buy more in the low-priced market. These potential trades, beneficial to both sides of the transaction, which were lost through price divergence are lost welfare to society. In addition, some of the production which was sold in the high-priced market might have cost more to make than the value a consumer placed on it in the low-priced market. These transactions which were enabled by price divergence also lower social welfare.

Given this social cost, it generally improves social welfare to take actions which cause divergent prices to at least partially converge. As I will demonstrate, most of the Enron trading strategies had the feature that they caused prices for highly similar electric products to converge. This was not their intention, which was profit. But as Adam Smith pointed out in his most famous quote of 1776, this is not of concern.

The gains from these strategies flow directly from the infirmities of the price formation process in the various electric market institutions of California. Market institutions are intended to facilitate the gains which arise from trade. No market mechanism is perfect, however, and then California market structure was more imperfect than most. There were surely alternative market institutions which would have eliminated the need for these strategies. But we should never confuse opportunistic behavior with socially detrimental behavior.

In order to demonstrate how Enron's actions caused prices to converge, I must describe the prices at issue. First I will describe electricity markets in general and follow that with a highly simplified description of the California market institutions created to facilitate a competitive electric generation market. Next I will describe the role which pure trading firms have in such a system. With these preliminaries, we will have the background necessary to explore the 10 specific Enron strategies outlined in the Stoel Rives memo.

II. A Brief Introduction to Electricity Markets

Electricity markets are, in one sense, like any other economic market: willing buyers and sellers agree on a price. Economists focus on what they call equilibrium price,
which has two properties: (1) no individual seller has unused capacity which he is willing to sell at that price; and (2) no individual buyer has a desire to consume more at that price. If the price is not at the equilibrium, there is scope for trading. Some seller who has more to sell should be willing to accept a slightly lower price to sell more output. Some buyer should be willing to offer a slightly higher price to get his desired quantity to consume. In this give-and-take, we expect the equilibrium price to emerge as the only sensible stopping place.

The primary way in which electricity markets are different from other markets is that the cost conditions for the provision of electric supply vary from minute to minute. There are two reasons for this. First, the demand for electricity varies from minute to minute; so that the optimal set of generating units to supply that electricity vary from minute to minute. These units have a wide range of costs to provide power, so that the marginal generator, i.e., the last generator called on to provide power, will be different, and so have very different costs, at night than on a hot summer’s afternoon. Second, generating units are complicated mechanical equipment which often drop out of service, changing the identity of the marginal unit.

Why isn’t this true in other markets? Well, it is, but the ability to store output mutes the effect. The demand for apples may change from minute to minute, and the ability of apple orchards to produce apples certainly changes from day to day, but the ability to maintain a stockpile of apples means that we don’t have to find an apple producer to produce an apple at the exact moment that I decide I want to eat one. Electricity operates at the speed of light: any time I flick on a light switch, either some generator has to produce more power or the voltage on the system drops. The aggregate effect of everyone’s decision to produce and consume power creates a need for a system operator, someone who can issue demands to turn on, turn off, increase, or decrease the output of specific generating capacity and have their commands followed without questioning. Without such a system operator, blackouts would be commonplace.

Before electricity restructuring, the system operator’s job was the occupation of those in a room at a particular utility. They had direct control over the generators in their service territory, to whom they issued orders to increase or decrease output and maintained communications with neighboring utilities, arranging for specific quantities of electric flow at the borders between service territories.

This system worked quite well. The desire to restructure electric systems came from questions over whether the specific generating units that the utilities built were the cheapest way to meet customers’ demands and whether the risks of bad construction decisions were properly allocated. But once we decide to shift the responsibility of new plant construction to the market, we must find a way to keep the system operator function working as efficiently as it did before regulation. In particular, the system operator should choose the right set of units to operate at any given moment, even though he no longer owns those units, and the units themselves have to have the proper incentives to follow instructions without worrying about what they will be paid.

To do this, restructured electric systems have turned: (1) to independent system operators (ISO’s, of which the California ISO was one) who have no stake in the financial performance of any generating unit; and (2) to bid-based systems to give the ISO the information it needs to decide which units run at any given moment. To help ensure that the bids properly reflect costs, the bids are de-linked from the price.
paid to the generator for power, but prices are guaranteed to equal or exceed his bid if he is asked to generate and to fall below his bid if he is asked to reduce power (or not generate at all). Thus, the generator always has the incentive to follow orders. To the extent that bids reflect costs, knowing the bids allows the ISO to select the proper set of generators at any moment.

System operators have a lot to do and they have to do it in real time. To simplify their task, it is generally regarded as desirable to prearrange most of the load and supply the day before. This creates, in most jurisdictions, a so-called day-ahead market. With any luck, the bulk of transactions will be scheduled (and a price set) on the day before, leaving the system operator to deal largely with changes that were not anticipated on the day before. However, as is clear from the description of the system operator’s role, he will establish a real-time price. No matter how little electricity actually transacts at that price, sellers will realize, if the real-time price is higher than the day-ahead price, that they have sacrificed profits by not waiting to sell their electricity in real time. If real-time prices are lower than day-ahead prices, consumers will realize that they would have been better off waiting to commit to consume power. Thus, the existence of the real-time market will strongly affect the equilibrium price paid in the day-ahead market.

III. California’s System

Each jurisdiction that has implemented electricity restructuring has done it in a slightly different way. California’s system, often described as flawed, had, for political and historical reasons that need not concern us here, a particularly bizarre structure. My basic intention is to describe the process of formation of a number of prices which, had to be bid into the PX, although others could bid there as well. In addition, California allowed anyone other than the IOUs to form their own markets. Each of these markets was called a scheduling coordinator (SC). SCs had to submit to the ISO, day-ahead, for each hour of the day, a balanced schedule, i.e., equivalent amounts of supply and load. Thus, if a generator wanted to become an SC, it had to find customers to take its output. Similarly, if a load wanted to become an SC, it had to have a specific generator who had agreed to supply its load. Finally, a marketer had to locate both a source of generation and a source of supply before it could become an SC. Enron was one SC.

Thus, the existence of the real-time market will strongly affect the equilibrium price paid in the day-ahead market.

in a broad sense, all represent prices for electricity. To do so requires a detour through a number of specific institutional details.

A. The PX and other day-ahead scheduling coordinators

Rather than create a single day-ahead market, they created many day-ahead markets. The most significant of these markets was called the Power Exchange (PX). The demands (traditionally called loads in the electric industry) and supplies of the investor-owned utilities (IOUs)

B. Congestion management

Each of the SCs, including the PX, submitted a balanced schedule. Since each schedule was balanced, the aggregate supply and demand was balanced. But the electricity system depends on a transmission system that follows the laws of physics in deciding which electrons flow where. Not all balanced patterns of supply and demand are feasible. The ISO examined the submitted pattern of supplies and demands and determined the physical feasibility of the resulting flows of electricity. If the flows were infeasible, the ISO implemented a complicated set of protocols to create a feasible flow. They did so in a very inefficient fashion that was highly
and demand. If the feasible balanced supply schedules submitted by the SCs had been followed this would have involved doing precisely nothing. However, demands on the system are only estimates, unanticipated transmission bottlenecks can arise suddenly, and generators can break suddenly. To manage the system, real-time imbalances resulted in payments.

This quite complicated “inc” and “dec” scheme was only made necessary by the requirement for balanced schedules.

C. Imbalance pricing

The ISO was required at all times to balance supply and demand. If the feasible balanced supply schedules submitted by the SCs had been followed this would have involved doing precisely nothing. However, demands on the system are only estimates, unanticipated transmission bottlenecks can arise suddenly, and generators can break suddenly. To manage the system, real-time imbalances resulted in payments.

D. Ancillary services

To do its job, the ISO needs to have a supply of units ready to increase or decrease load. Some plants can do so quickly; others can only respond with more time. To create the list of potential suppliers, the ISO purchases ancillary services from generators. Ancillary services (in this case) are nothing more than promises to deliver (or retract) a given amount of power in a given time frame from immediately to 30 min. These ancillary services were purchased in another set of auctions from those whose capacity was not already committed to the market for energy. It should be pointed out that this is also a system that makes it almost
impossible to efficiently dispatch generators. Better-functioning systems like the New York ISO purchase energy and ancillary services simultaneously rather than sequentially, but that inefficiency will not be important here.

E. Price caps

The ISO market would not accept a bid from a generator for more than $250/MWh. However, California recognized that it was possible that demand would exceed supply at that price, so it allowed the ISO to solicit so-called out-of-market bids whose price was whatever bilateral negotiations between the ISO and the supplier reached. The cost of these bids was averaged across all demand in a so-called uplift payment."

F. A summary of California pricing

Within this scheme, it is quite clear that there are various prices being established through quite complicated mechanisms for what are at best minor variants of the same thing. This raises a problem for a participant in a market: if I have a megawatt-hour of electricity to sell, where and how should I sell it? It could be sold to a trader months in advance of the market. It could be sold day-ahead. It could be sold hour-ahead. It could be sold in the real-time market. It could be sold as ancillary services, saving me the fuel cost unless the unit is called on in real-time. It could be sold outside of California to a utility that might need it more than California does. It could be sold into any zone in California. Every one of these choices had a different price associated it. How does this hypothetical seller decide what to do? As the next section makes clear, the existence of traders described above: generators generate power and consumers consume it. Why is there any need for traders? There are two traditional reasons for traders: first, traders provide liquidity. If I want to sell 100 shares of a company, there may be no one at the instant I want to sell it who will buy it. Traders fill this gap by purchasing from me with the intent to sell to a buyer. For this service they extract a fee known as the spread. In practice, they charge buyers slightly more than the sellers receive from them. This traditional function of trading has no analogue in electric markets that are operated as clearinghouse markets in which all demands and supplies are bid simultaneously.

Second, however, traders arbitrage between markets. Suppose a stock was selling on the New York Stock Exchange for $100 and was being offered somewhere else, say an ECN, for $95. The trader who spots this price differential can simultaneously purchase the stock for $95 on the ECN and sell it on the NYSE for $100, pocketing the $5 differential. Of course it is impossible to execute the trades precisely simultaneously, so the trader takes the risk that prices will fall too quickly on the NYSE to make a profit. Through the monitoring of expected prices in various market, the arbitraging trader lowers price in high-priced markets and increases price in low-priced markets, creating an equilibrium price and augmenting the efficiency of these markets.

IV. Generators, Consumers and Traders

Generators and consumers have clear functions in the system simplifies the decision immensely: with a robust, aggressive set of traders who have no stake in the market at all, the expected returns to our hypothetical seller will converge in all markets. It will not matter in which market he sells. This property of markets makes it possible for small sellers to avoid making huge investments in market intelligence, allowing them to follow a simple rule: sell anywhere you want to.
by ensuring that no consumer pays more than he or she needs to and no producers receives less than he or she needs to. It is important to see that although arbitragers make a profit in the process of equalizing prices between markets, both consumers and producers benefit in aggregate.

The function these traders perform is to allow anyone to participate in a market with minimal knowledge about that market. In equilibrium, one cannot sell one’s output too cheaply in a market, since traders will compete among themselves to buy the output in that market and sell it in another higher-priced market. Similarly, one cannot, in equilibrium, pay too much in one market without traders purchasing in some cheaper market and selling the supplies thus established at the higher price.

Thus, the job of traders is to find disequilibria and attempt to convert them to equilibria. They may not be able to do so perfectly, but that is their goal. To do so, a trader must be able to spot disequilibria and figure out a way to buy and sell so as to exploit this disequilibrium. With this in mind, we can turn our attention to the specific strategies mentioned in the Stoel Rives memo.

V. Enron’s Strategies Explained

The Stoel Rives memo lays out 10 different strategies used by Enron traders. I will set out the strategies here and discuss their effect on the efficiency of the California market as described above.

A. “Fat Boy” aka incing load into the real-time market

In the California market, there was no way to supply generation to the real-time market without claiming a corresponding load. There is no logical reason for this requirement and no other market uses it. Apple sellers do not have to identify their customers in order to be allowed to sell apples. Competitive apple sellers simply dump their supplies on the market and receive the competitive price. Enron created a synthetic method of selling naked generation into the market by contracting for the generation it wished to sell in real time and simply stating that it had matching load. In real time of course, the load that Enron claimed would not be there and the excess generation that remained would be treated as an "uninstructed deviation" for which it was paid the market price.

When did Enron pursue this strategy? They did so whenever traders were “able to anticipate when the dec price will be favorable by comparing the ISO’s forecasts with their own.” (p. 2). This is an efficiency-improving arbitrage strategy, clearly defined. Enron was betting that more load would need to be served than the ISO was anticipating. If Enron was correct, they would receive a high price for the power; if they were incorrect, they would achieve a lower price for this power than they would have gotten by waiting for the ISO to request the power directly through an inc. This action simply arbitrages the inc and dec prices for power, increasing efficiency in the ISO market. Thus, incing the market was a strategy that deserved to be emulated by other traders and, indeed, implemented by the market.

B. Export of California power

The point of this strategy is to find the market where price is the highest. Since the ISO would not accept bids greater than $250, whenever Enron anticipated that the true clearing price of power would exceed $250, they sold the power to someone outside of California who agreed to sell it back to them for a small fee. Then, when the ISO needed the power, they negotiated to
pay the market price rather than the artificially constrained cap price.

Again, this is a simple arbitrage strategy. When prices outside California are above $250/MWh, there is no reason to sell the power inside California for less. So Enron took the power outside of California and then the ISO had to outbid those outside of California to get it back. The efficiency of the market is improved: at the margin, consumers outside of California are paying no more than consumers inside of California. Producers outside of California receive no more for their power on the margin than do producers inside California.

C. Non-firm export

When the system is congested, say from North to South, flows that go from South to North relieve the congestion. Consequently, they rightly earn payments. Enron would schedule flows against the flow of congestion and earn these credits, then cut off the flow, re-creating the congestion and re-schedule another flow to once again earn the credits. The ISO objected to the cutoff of counter-flow that re-established the congestion and Enron stopped using the strategy. It is unclear logically why they objected to this practice. Enron is under no obligation to schedule counter-flows. In any case, Enron’s strategy here helped to achieve convergence of prices in Northern and Southern California.

D. “Death Star”

In this strategy, Enron simultaneously schedules a transaction through California from South to North and North to South. If the congestion charge from North to South were exactly the same as the congestion relief paid from South to North, this strategy would make no money. In well-constructed systems, e.g., the NY ISO or the Pennsylvania–Jersey–Maryland (PJM) system, this is exactly what happens. The California payment scheme did not require the payment of observed congestion charges on transactions that passed completely through California, instead charging an accounting-based rate. When conditions were right, Enron could do nothing and pocket fees.

This strategy does not improve market efficiency but does not reduce it either. It can only work when the congestion charge exceeds the embedded accounting-based rate. The market was not allowed to clear for this transmission, since at the tariff price there were more demanders of this transmission than there was transmission available. Whoever purchases the transmission receives a windfall gain equal to the difference in the transmission prices. If Enron had not received these profits, someone else would have, since the constrained lines would always be fully demanded.

E. “Load Shift”

In this strategy Enron causes congestion by misstating the sources of its loads, causing congestion, and then is paid to relieve this congestion by reallocating the load back where it belongs.

The effectiveness of this strategy stems directly from the balanced schedule requirement. Were it not for this requirement, any generator could relieve the congestion by offering to generate more within the congested zone.

This strategy cannot affect the real-time market price, since real-time prices are determined only after Enron has restated the loads correctly. Such a strategy does have potential to distort day-ahead prices. Of course, this would not be a problem if producers or consumers were free to choose the market in which they bought and sold; those adversely affected in one market can simply shift their demands to the real-time market which must
always reflect, free of trader distortions, true supply and demand conditions. This was not always possible to do owing to the requirement that the investor-owned utilities carry out the bulk of their trade in the day-ahead markets, but may have gone quite some way to explain why they strived mightily in the summer of 2000 to avoid doing so.

In any case, this effect was well known at the time the rules were approved for the California market. It should not be surprising that Enron used this strategy. Further, there is no reason to expect it to have any large effect on price for the simple reason that it could not affect real-time price and for most of the latter part of the summer of 2000, the real-time price was in fact higher than the day-ahead price. Thus, it is unlikely to have any significant effect on efficiency.

F. "Get Shorty"

In this strategy Enron sold ancillary services in the day-ahead market that it did not possess and bought them back in the real-time market. This is clearly an efficiency-enhancing arbitrage strategy to equilibrate prices between the day-ahead and real-time markets.

The objection to this practice appears in the memo to stem from the fact that Morgan Stanley was not allowed to enter the market to do the same trades. The clear efficiency problem is not that Enron was allowed to do these trades, but that Morgan Stanley was not.

G. "Wheel Out"

When a transmission line is out or already full, Enron schedules a transaction over the line. The ISO cancels the transaction and sends Enron a payment for having the transaction canceled. Like Death Star, the success of this strategy depends on an inefficient process of allocating transmission capacity. If only those who bid the most for transmission capacity were allowed to use it, all such strategies would be fruitless. Instead there is a first-come first-served process with the payment of an accounting-based rate. When queues develop, the ISO pays people waiting in the queue under some circumstances.

Further, of course, there is a real risk to this strategy, namely that the bottleneck will be partially resolved. In this case the transaction will be sent through and Enron will owe a sizable congestion charge.

H. "Ricochet"

Ricochet is exactly the same as non-firm export when the ISO price is less than $250. Again, it is nothing more than an arbitrage strategy to equate price in the day-ahead and real-time markets and, as such, efficiency enhancing.

I. Selling non-firm energy as firm

The California ISO allows the "self-provision" of ancillary services for imports of so-called firm energy. The basic idea is that this energy is supposed to be more reliable because there are backup sources if the generator fails to generate. First, even this backup is only statistical in nature. No power is ever guaranteed. The practical effect of firm power is that the ISO does not purchase ancillary services within California to support this flow and consequently does not charge the importer for them. There is no reason for the existence of a category known as "firm power." If the price of energy less the cost of associated ancillary services in California is too high, the importer should not sell in California. As a practical matter it is impossible for any supplier to guarantee his exports into California—this supply is a feature of the neighboring system, not a feature of the local level of backup. Suppose there are 1,000 MW of imports...
from Oregon of which I am sending 100 MW to California. Whether 1,000 MW in fact flows across the intertie depends on the aggregate excess capacity in Oregon, not on my possession of sufficient backup to supply my load.

In any case, the treatment of firm power between jurisdictions is a complicated question of the protocols for the exchange of power between the jurisdictions and the payments for failure to deliver power promised. From the evidence of the memo, it is unclear that any prices were changed by this practice, but on the evidence of the memo alone it is difficult to tell.

J. Scheduling energy to collect the congestion charge II

Here, Enron schedules a counter-flow and fails to provide it. This, too, is a simple arbitrage strategy. They profit if the congestion charge exceeds the price of power. This strategy, like many arbitrage strategies, is quite risky because the price of power is only determined after the fact. It is a form of arbitrage between the hour-ahead market and the real-time price. Again, such strategies improve overall market efficiency.

VI. Summary

In this article I have critically examined the strategies cited as distorting the electricity market in California. Far from distorting the market, the majority of these strategies actually corrected potential distortions in complicated interrelated markets. To the extent that some of these strategies exploited market flaws to bring some of these markets out of alignment, there were obvious corrections available that policymakers should focus on rather than the futile, or at least unproductive, search for scapegoats.

Endnotes:

1. There are actually two memos. The “smoking gun” memo is available online at http://www.nerc.gov/electric/bulkpower/pa02-2/Doc5.pdf. There is another memo explaining this memo which is far more benign, making some of the same points made earlier, at http://news.findlaw.com/hdocs/docs/enron/brobeckenronstrpt.pdf. I have no knowledge about the accuracy of these memos, or whether there are nefarious practices which have not yet come to light. In this article I evaluate them only on their own terms.

2. “Every individual … generally, indeed, neither intends to promote the public interest, nor knows how much he is promoting it …. [H]e intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention.” The Wealth of Nations, Book IV, Ch. 2.

3. It should be noted that Enron was not a pure trading firm. However, the strategies in the Stol Rives memo all go to the trading function alone of the Enron operation.

4. When I speak of markets here, I am thinking of markets in the abstract, i.e., not grounded to any particular set of market institutions. Nothing in this article should be construed to mean that I believe that California markets for power were in equilibrium in the summer of 2000, or that the logical outcome of the specific market institutions implemented in California by themselves yield a socially beneficial equilibrium.

5. This is also done to help give guidance to generators about whether or not to turn their units on and synchronize them to the system on the next day.

6. This article will not attempt to describe the California markets in comprehensive terms or to defend any particular aspect of the final prices arrived at in such markets. If there are flaws that distort prices away from some economically efficient equilibrium, then those flaws should be corrected. This article focuses instead only on the internal consistency between the derived prices.

7. The biggest flaw of the California market was the requirement that the utilities bid their customers’ demands without passing prices through to them. This flaw, while directly causing much of the California problem, has little to do with the trading strategies I describe here.

8. The PX was a scheduling coordinator as well.

9. This rule was modified in 2000 to charge more of the costs to those who needed more demand in real time than they had contracted for in the day-ahead market.

10. The hour-ahead market was yet another market run by the PX which operated on the day of production but in advance of real-time.