

Homework 1 (due ?):

Using the paper, “In (Reluctant) Defense of Enron...” (posted on the website as “CaliforniaCrisisExplained”) as a resource, answer the following sets of questions 1-5. Each set of questions are drawn from the section of the paper having header the same as (or similar to) the headers of the question set.

1. General historical review:

- a. What two developments occurred between 1965 and 1980 that resulted in foundations for the creation of wholesale energy markets?
Pg. 218: (1) PURPA and QFs, and (2) NERC and interconnections
- b. What two provisions of the 1992 EPACT further introduced competition into the electric power industry?
Pg. 218-219: (1) Creation of Exempt Wholesale Generators and (2) Wholesale transmission wheeling.
- c. What did the 1996 Order 888 do towards furthering competition within the electric power industry?
Pg. 220-221: (1) Required open transmission access and (2) Suggested creation of ISOs.
- d. How did FERC Order 2000 promoted competition?
Pg. 221: By eliminating discriminatory behavior of transmission line owners, improving operational efficiency, and increasing reliability through coordination of the RTO.
- e. Section I-B of the paper refers to a “regulatory gap.” What was this?
Pg. 226: The general notion of a “gap” referred to the jurisdiction between federal and state regulators. The specific reference here referred to the fact that while FERC had jurisdiction in design of California’s wholesale power market, regulation of retail rates did not require federal approval and was left up to the states.

2. California Market architecture:

- a. What was the main reason that the California Public Utilities Commission decided to move to a competitive wholesale electricity market in 1995?
Pg. 228: California residents were paying on average 50% more for electricity than the rest of the country.
- b. What two things did California require in its attempt to eliminate market power engendered by vertical integration?
Pg. 229-230: (1) Divestiture of generation and (2) All transactions had to go through the PX.
- c. Was there any mechanism in place to allow utilities to hedge price volatility?
Pg. 230: No, because all power was required to be purchased through the PX, and because utilities could not own generation, the utilities had no price hedge.
- d. Identify the wholesale energy markets conducted by the California PX:
Pg. 230-231: Day ahead, hour ahead, and real-time.
- e. The PX conducted market transactions via a double auction procedure. What was “double” about it?
Pg. 230: Both supply and demand bids were submitted to the auction.

- f. What caps were placed on retail and wholesale rates, respectively?
Pg. 232: Retail rates were capped at 90% of the previous year's prices. Wholesale rates were not capped.
3. Economic principles:
 - a. What are the four conditions necessary for a market to be considered perfectly competitive?
Pg. 233: Product must be uniform/homogeneous, many buyers and sellers, perfect information, and no barriers of entry.
 - b. Why is additional capacity available to generate at a particular time period the only market mechanism available to discipline price?
Pg. 235: Because, (a) without storage, the only competitor to producers that are engaged in the market during a particular hour are those units that have additional capacity which can be used during that hour, and (b) demand is inelastic (not price responsive) and so does not react to price variations caused by supply.
 - c. What two reasons is electricity not a homogeneous product?
Pg. 236: First, because of differences in ramping capabilities in different units. Second, because generators have different network effects based on where they are located.
 - d. Why is electricity demand relatively inelastic?
Pg. 237: Due to lack of information as to prices at the end-user level.
4. Problems with California's Market:
 - a. Identify the 9 defects within California's market design and implementation.
Pg. 239: (1) lack of excess capacity; (2) lack of demand responsiveness; (3) implementation of retail price caps; (4) implementation of wholesale price caps in California and across the west; (5) pervasiveness of plant outages in the fall; (6) inability of utilities to hedge volatility; (7) inability of insolvent utilities to procure power in the winter; (8) the misconception that monopoly power wielded on behalf of the state would lower energy prices; and (9) the wielding of market power by generators.
 - b. Identify at least three reasons why California did not benefit from excess capacity?
Pg 240-242: (1) The supply of in-state generation capacity barely grew between 1996 and 2000; (2) No new interstate transmission had been recently built to increase access to out-of-state generation; (3) In-state generation was aging, were not as reliable, and therefore were subject to more frequent maintenance; (4) high emissions plants were constrained to operate only during peak periods; (5) Entry of new generation into California was delayed (due to incentive-based ratemaking's emphasis on short-term profits, and the uncertain regulatory and permitting environment of the future); (6) Transmission upgrades inside the state had been insufficient.
 - c. Why was demand not responsive to wholesale price increases?
Pg. 245: Because consumers were insulated from the wholesale price increases by the retail price cap.
 - d. Is there any evidence that consumers would have decreased their demand if they would have been exposed to the higher prices at the retail level?

P. 246: Yes, when California consumers were exposed to the rate increases, they reduced demand by 14%.

- e. What was the retail price cap, in \$/MWhr, which two of California's investor-owned utilities were subjected to, and which investor-owned utilities were not subjected to it?

Pg. 247: \$65/MWhr. SCE and PG&E were subjected to it. SDG&E was not.

- f. What happened to the investor-owned utilities that were subjected to the retail price cap, and what happened to the retail rates of the utilities that were not?

Pg. 247-248: PG&E went bankrupt, and SCE almost did. SDG&E did not get into financial trouble, but their customers saw excessive rate hikes.

- g. Name at least two reasons why during fall 2000 and winter 2001, an unusually large number of generators were taken off-line for maintenance?

Pg 250: (1) exercises in market power; (2) delaying of scheduled maintenance due to the high use during summer and fall of 2000; (3) overly-sustained peak conditions during fall 2000 due to the hot fall weather.

- h. What is hedging?

Pg. 251: The ability to reduce risk.

- i. Why were California utilities unable to hedge against the volatility in the spot market?

Pg. 251: They were required to buy all their power through the spot market (PX) and thus were barred from procuring power via long-term contracts. In addition, they were required to sell their own generation. Finally, once these requirements were lifted, it was too late, because the utilities were already insolvent and because the long-term contracted prices had converged with the short-term prices.

- j. How did the financial insolvency of the investor-owned utilities contribute to the power shortage of spring 2001?

Pg. 252-253: Fuel suppliers (mainly gas), out-of-state generators, and marketers began to refuse to sell to SCE and PG&E because, if SCE & PG&E filed for bankruptcy, the sellers might not get paid.

- k. Why did the long-term auction organized by the state, and coordinated by LADWP, in January 2001, with the purpose of increasing power availability in the state at reasonable prices, actually result in higher prices? In answering this question, it may be helpful to know that almost all of California's fossil-fired plants run on natural gas.

Pg. 254: When the auction opened, gas prices were very high due to cold fronts in the northwest and northeast; power suppliers bid based on the price of gas they were able to get at the time, resulting in inflated bids. When summer 2001 weather was relatively mild, spot power prices were lower than the prices the state obtained in the auction, and California had to "eat" the losses of \$80/MWhr.

- l. What is a monopsony, and why was California not one when it tried to heal the state's problems via the January 2001 long-term auction?

Pg. 255: A monopsony is a market form with only one buyer. California was not one because power suppliers could also sell to other agencies outside California for higher prices.

- m. What were the three reasons why the state of California tried to purchase the transmission system from the three investor owner utilities?
Pg. 255: (1). It would bail the insolvent utilities out from their debts; (2) it would bypass FERC (FERC was perceived as being unsympathetic to the crisis); (3) it was perceived to be politically astute in that it was some action to save California from disaster.
 - n. What effectively stopped California from purchasing the transmission system?
Pg. 256: PG&E declared bankruptcy.
 - o. Identify at least 3 reasons why market power is exercisable in electricity markets.
Pg. 256: (1) Electricity, not being easily storable (at least not in 2001), cannot use inventories to limit the exercise of market power; (2) Electricity demand is inelastic; (3) There are multiple ways to exercise market power in electricity markets, e.g., withholding capacity or raising price; (4) Supply response may be limited, especially during peak hours. (5) Generators are not homogenous, with different heat rates and fuel costs; (6) Some plants have locational market power.
 - p. How many MW were off-line in April 2001 and how did this affect prices during this period?
Pg. 258: Over 15000 MW of capacity were off-line during April 2001. Average monthly prices in 2000 were \$30/MWhr and \$1500/MWhr in 2001.
5. Antitrust laws and FERC's SMD:
- a. Provide brief descriptions of the following strategies that Enron was thought to have used during the California power crisis:
 - i. Load shift: Enron submitted too much (overscheduled) load in Southern California and too little (underscheduled) load in Northern California. Thus the total balance was right but the location was wrong. This created north-to-south congestion for which Enron got paid as a result of its owning the Financial Transmission Rights (FTRs) to the north-to-south transmission. FTRs are like insurance: if you own them for a certain transmission line, and if the line is congested (at its capacity), then you get paid for it in proportion to the amount of capacity your FTR is.
 - ii. Ricochet: Enron bought power from California day-ahead market, exported it to a second entity outside of the state, and then resold it to the California ISO in the real-time market or an out-of-market sale.
 - iii. Fat boy: Enron submitted load schedules that were larger than what they actually expected in order to ensure Enron would get its generation scheduled into the market, thus guaranteeing itself energy payments for its generation.
 - b. What was identified in the paper as the central part of the FERC SMD to provide a "prescription" against the problems leading to and resulting from the California Energy Crisis?
Pg. 281: Locational Marginal Pricing