

Electricity market game

(from Stanford PESD)

Overview

- Realistic game based on California electricity markets
- Goals:
 - Understand how bidding and profits work in deregulated markets
 - Explore possibilities for market power
 - Study how a carbon tax works in this market

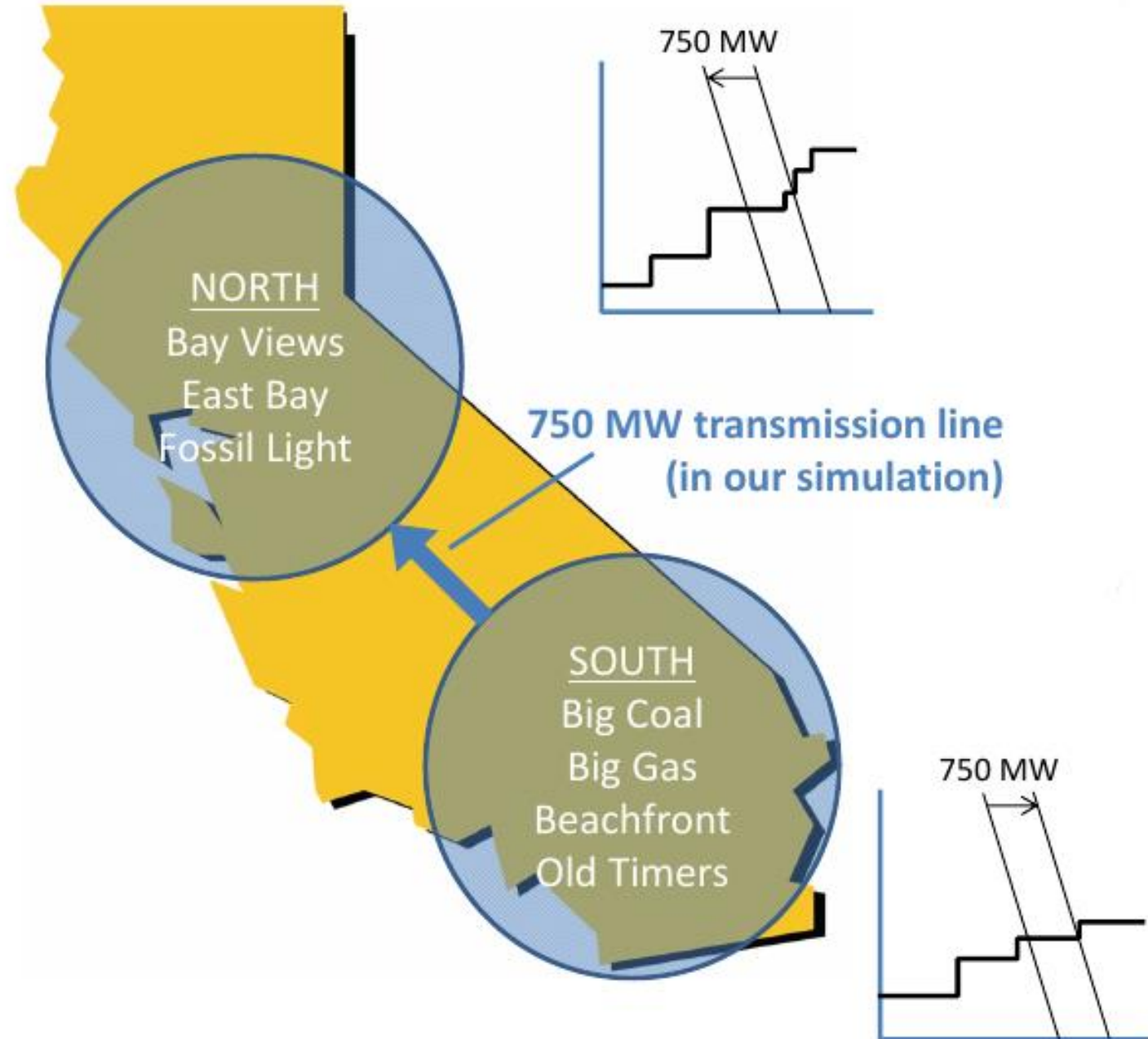
More info: [Manual](#)

7 Generation companies ([full portfolios](#))

Portfolio	Location	# of Units	Capacity by Fuel	Range of Unit Variable Costs	Base Case Emissions, 4 Days (tons CO₂)
Big Coal	South	6	1900MW coal; 2000MW gas	\$19.00- 51.50/MWh	23,436
Big Gas	South	7	3600MW gas	\$29.00- 62.50/MWh	10,701
Beachfront	South	8	3800MW gas	\$26.50- 52.50/MWh	14,323
Old Timers	South	5	1500MW coal; 250MW gas; 1000 MW hydro	\$0.00- 37.50/MWh	11,936
Bay Views	North	5	2650MW gas	\$23.00- 42.50/MWh	10,449
East Bay	North	6	3000MW gas	\$25.50- \$48.50/MWh	8,492
Fossil Light	North	5	650MW gas; 800MW hydro; 1000MW nuclear	\$0.50- 53.00/MWh	1,310

2 regions

[with congestion]



4 Demand periods

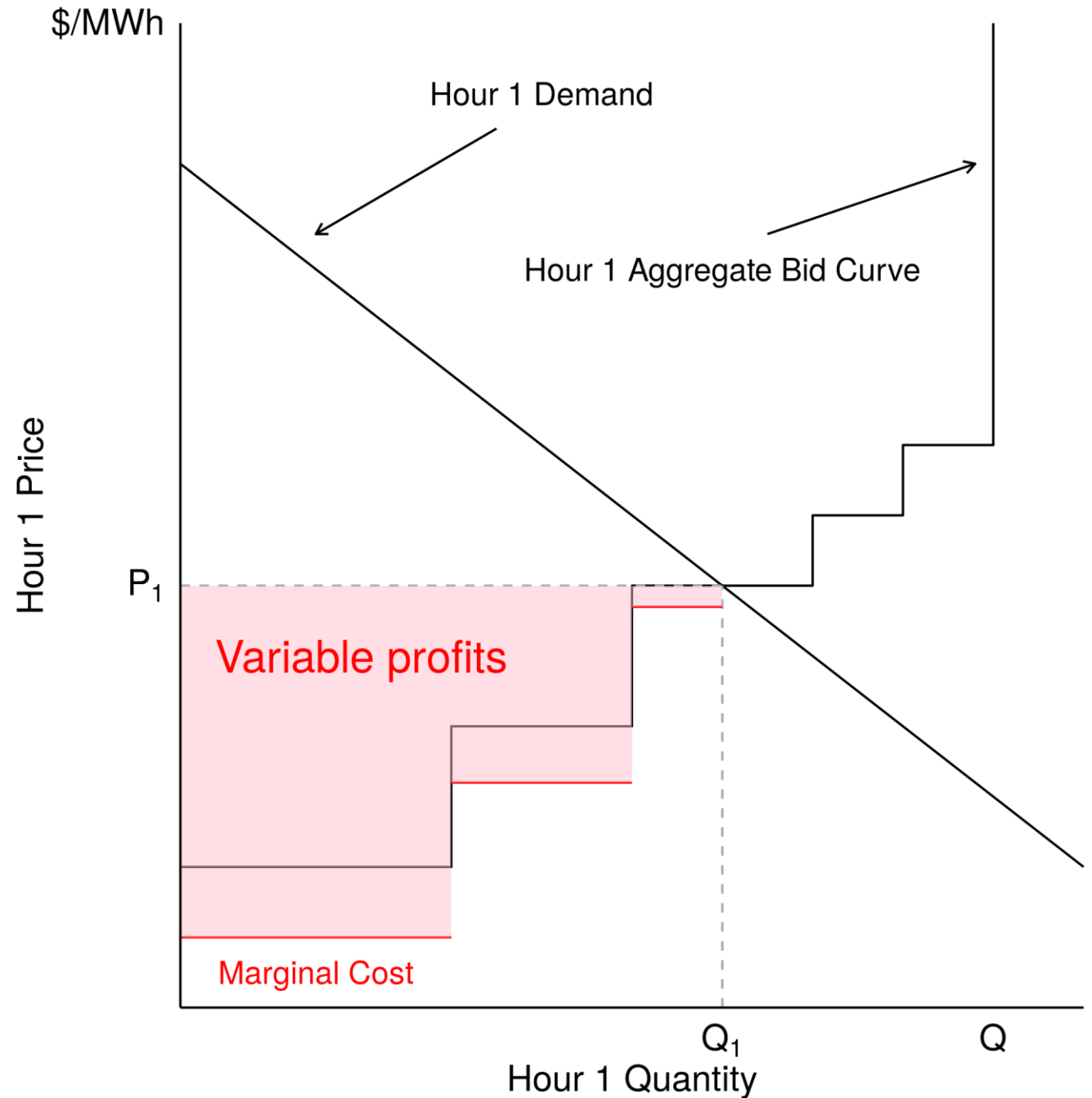
Period	Location	Load intercept	Load slope
1 (Day 1 4am)	North	4020	-2
1 (Day 1 4am)	South	7035	-2
2 (Day 1 10am)	North	4020	-2.54
2 (Day 1 10am)	South	11055	-2.54
3 (Day 1 4pm)	North	8786	-2.41
3 (Day 1 4pm)	South	12631	-2.41
4 (Day 1 10pm)	North	6709	-2.54
4 (Day 1 10pm)	South	12132	-2.54

- The realized demand intercept in both North and South regions is a random variable with mean equal to the forecast demand intercept and standard deviation equal to 3% of the forecast demand intercept

First price [uniform] Auction

[2 when there is congestion]

- Every generator submits a bid
- Cheapest bidders dispatched until supply = demand
- All dispatched plants get highest dispatched bid



Instructions

- Go to the Google sheet I emailed
- Click on your team's link for the relevant game
- Place bids
 - Enter bid for each generator for relevant period
- GM will increment period (1 to 4)
- Each team can “view market results”
 - Go to "display files" > "genco display.csv"
 - Copy your team's total profits into Google sheet

More info: [Manual](#)

Games

- Base game 1
 - Leave bids as is (= MC)
 - Which of your units will be dispatched?
 - What do you think the price will be?
 - How would you figure it out?
 - We will walk through the periods 1 by 1
 - For each period:
 - Which firm had the “marginal” generator?
 - Does anyone wish they had bid differently?

Games

- Base game 2
 - New demand shocks
 - Submit bids
 - 2 periods at a time
 - What was your strategy?
 - Now that you see the price, do you wish you bid differently?

Games

- Base game 3 – Market power
 - Demand shocks reset to game 1
 - Go back and see which plant was on the margin during each period
 - Have teams set the bid for that plant in that period equal to something really high (999)
 - Recompute all 4 auctions
 - What happened to each teams profits?
 - Did anyone's profits go up? Down?
 - What does this tell you about market power in electricity markets?

Games

- Game 4 – Pay as bid
 - Demand shocks reset to game 1
 - Now you will be paid your bid (rather than the highest bid)
- Recompute all 4 auctions
- What was your strategy?
- What happened to each teams profits?
 - Did anyone's profits go up? Down?

Games

- Game 5 – Congestion
 - Demand shocks reset to game 1
 - Uniform auction again
 - However now there will be two prices
 - One in the North and one in the south
 - How will this change your strategy?
 - Recompute all 4 auctions
 - What happened to each teams profits?
 - Did anyone's profits go up? Down?

Games

- Game 6 – Carbon tax
 - Demand shocks reset to game 1
 - Uniform auction, no congestion
 - Now there will be a \$40/ ton carbon tax
 - Based on the carbon content of each generator
 - This should be reflected in your new pre-filled in marginal costs
 - Recompute all 4 auctions
 - What happened to each teams profits?
 - Did anyone's profits go up? Down?