Laboratory Economics Experiments – Window into Restructured Electricity Markets

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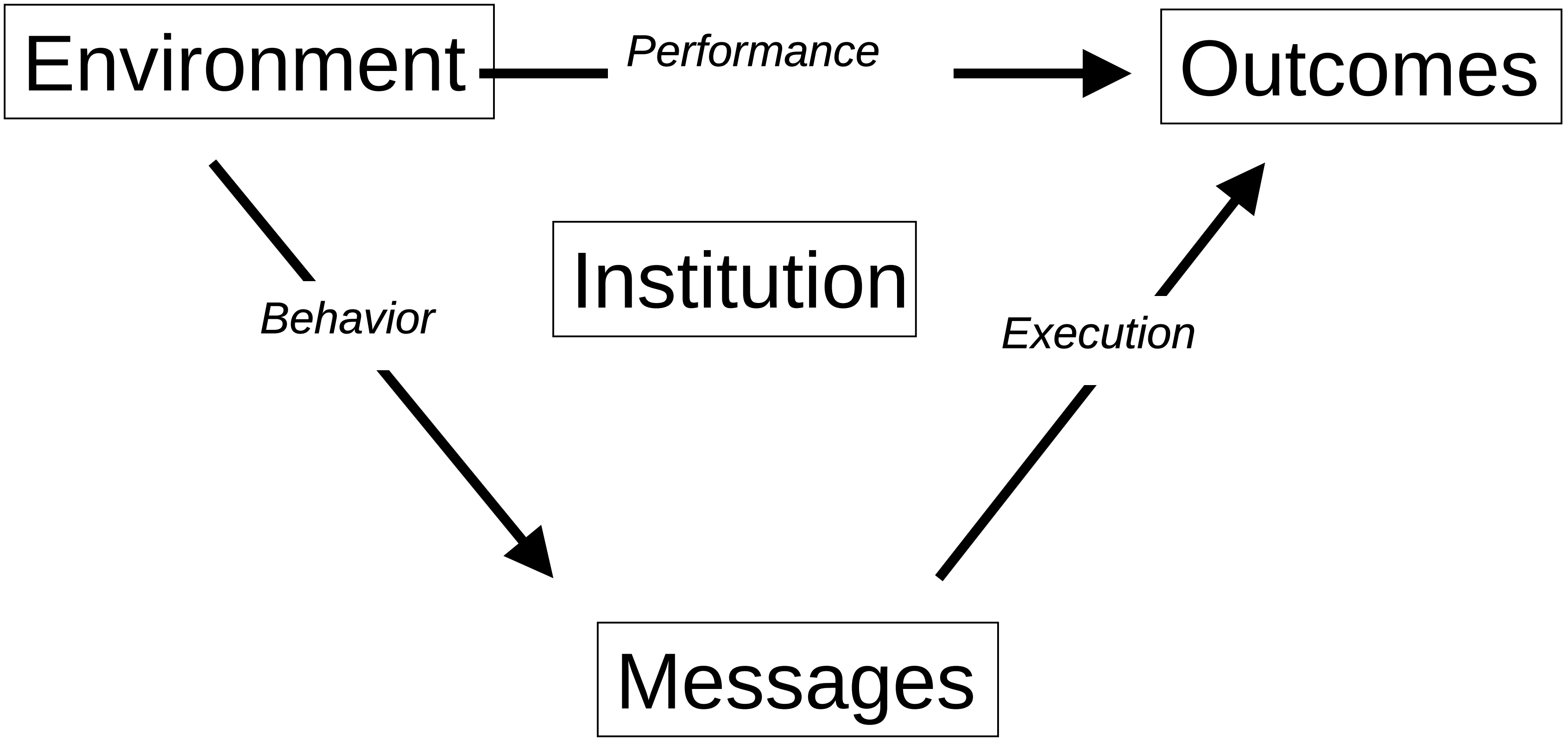
What is an Economic System?



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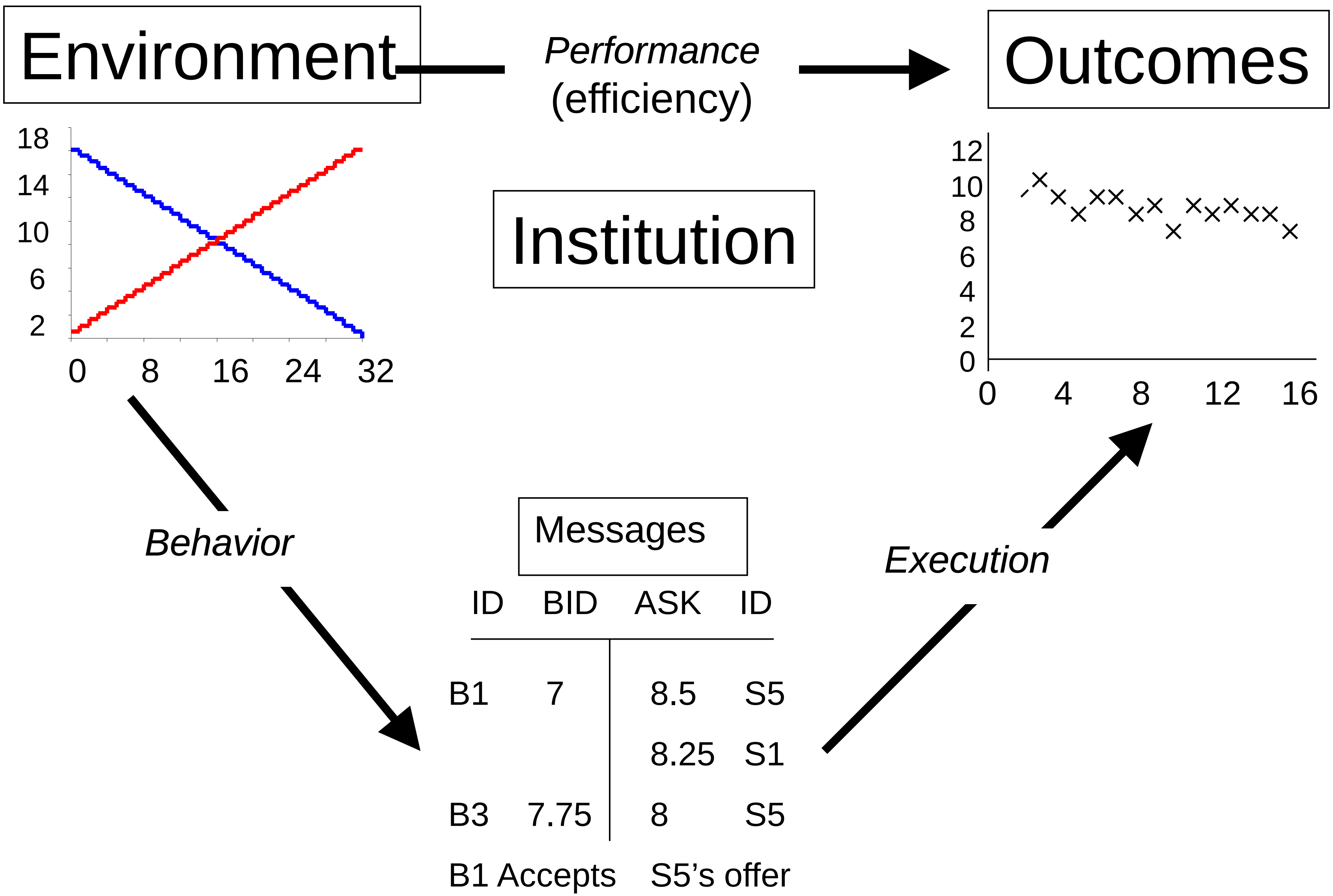
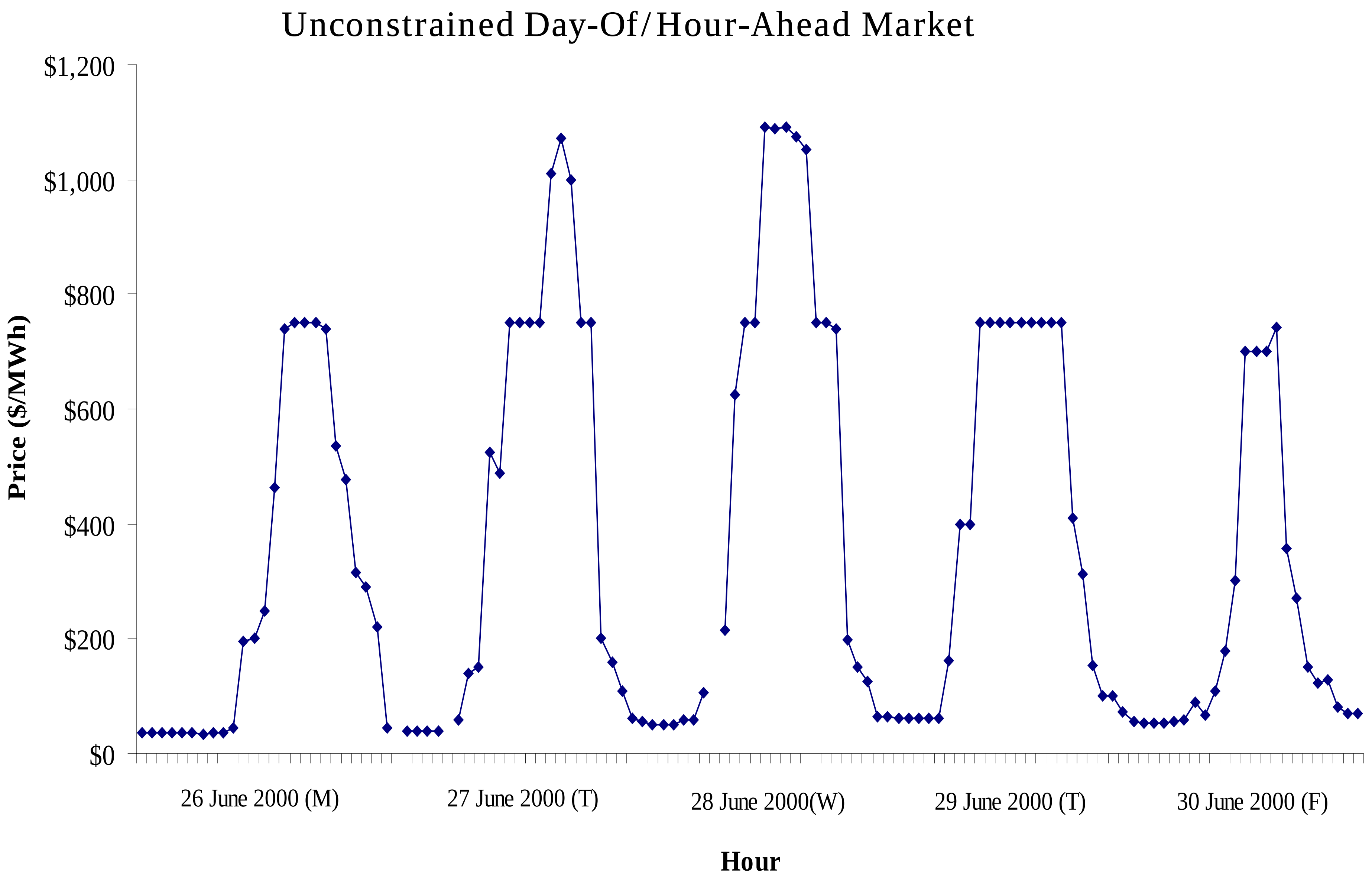


Motivation



Unconstrained Day-Of/Hour-Ahead Market
$1,200
$1,000
$800
$600
$400
$200
$0
Price ($/MWh)
26 June 2000 (M)
27 June 2000 (T)
28 June 2000(W)
29 June 2000 (T)
30 June 2000 (F)
Hour

Some Questions

- What market design features foster competitive behavior in the market?
- How different market rules affect outcomes if a market becomes more concentrated?
- Do competing suppliers end up offering their actual electricity generation costs?

Objective

- To compare the performance of two auction mechanisms – a complex offer auction and a simple offer auction - when *suppliers* act strategically.

- Criteria:
  - Price to consumers
  - Efficiency
  - Price volatility
  - Risk of losses

Overview of Wholesale Power Markets in the U.S.

- ISOs run daily auctions to allocate generation contracts to the suppliers of electric power:
  1. Suppliers submit complex-offers to the ISO
     – Offer structure: quantities, energy prices, plant start-up fees, and technical constraints.
  2. Buyers (LSEs) submit bids to the ISO.
  3. An ISO runs a market clearing algorithm that allocates generation contracts ensuring that the system demand and reserve requirements are met over a particular time period.
  4. Each selected supplier is paid his offered start-up fees and the *market clearing price - MCP -* (not the offered price!) for supplied units of electricity.

- It is a uniform-price sealed complex-offer auction.

Allocation Algorithms

1. Traditional **Offer Cost Minimization (OCM)**

2. **Simple Offer Auction (SOA)**

Offer Cost Minimization Auction

- The ISO minimizes the total offered cost of electricity, as if all selected sellers would be paid their offered prices and fees.

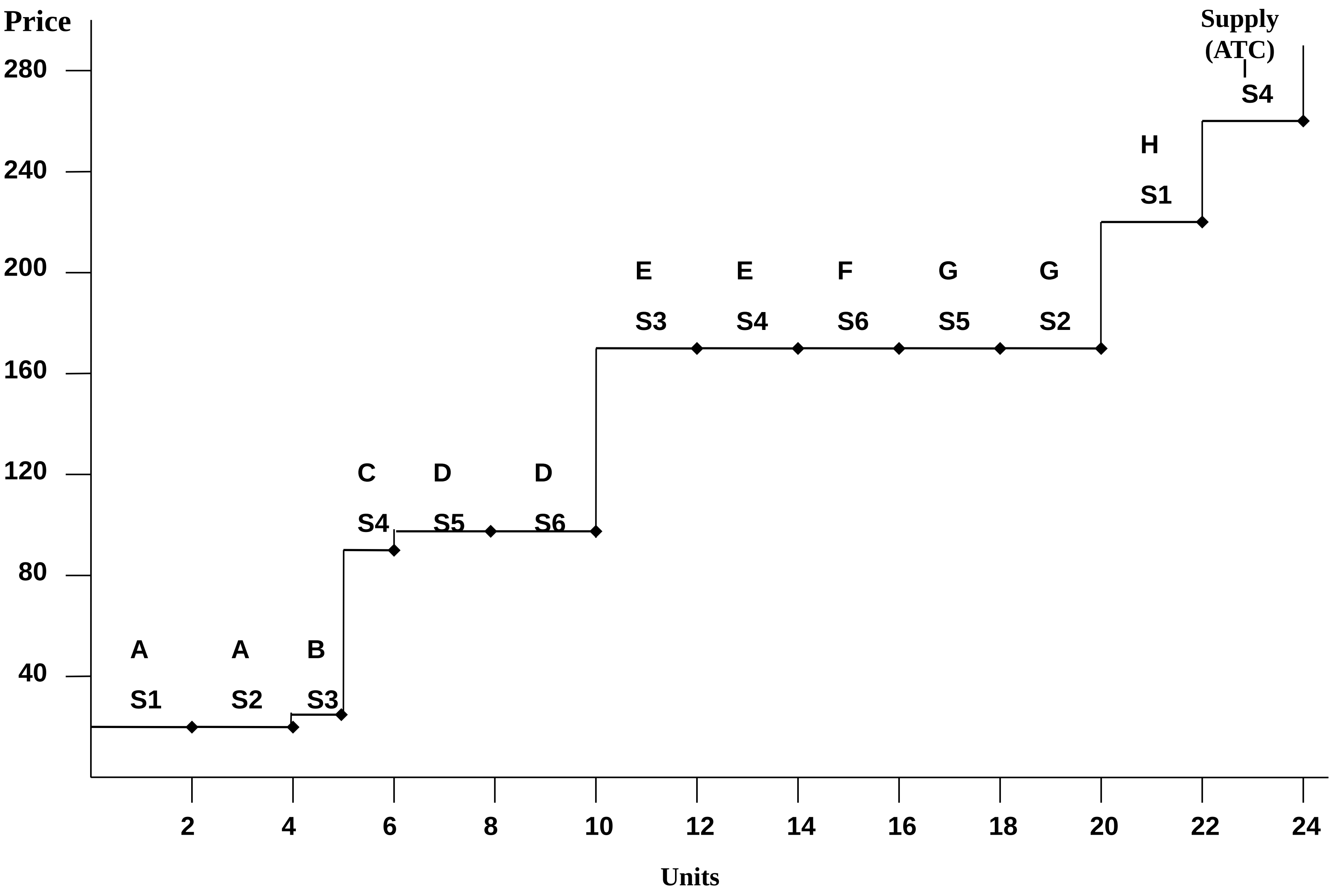
- *Sequentially*, after the offers are selected, a uniform MCP is determined as the highest accepted price for that period.

- All selected sellers receive their individual start-up fees and the uniform market clearing price for the supplied electricity during that period.

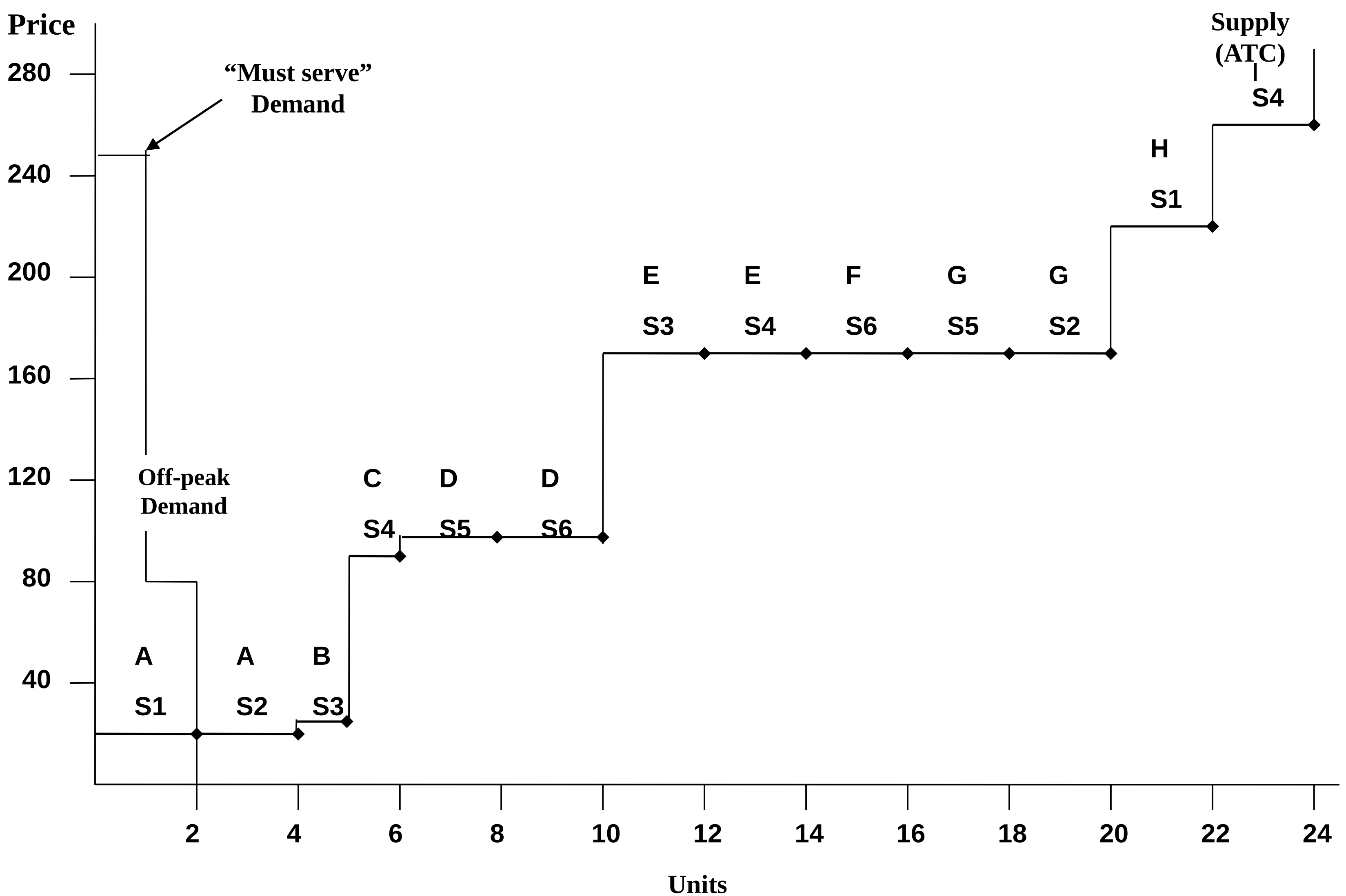
Simple Offer Auction

- The sellers can recover their generation costs – both fixed and variable – only through a uniform MCP.
- The ISO minimizes the total offered cost.
- Concerns about possible losses.

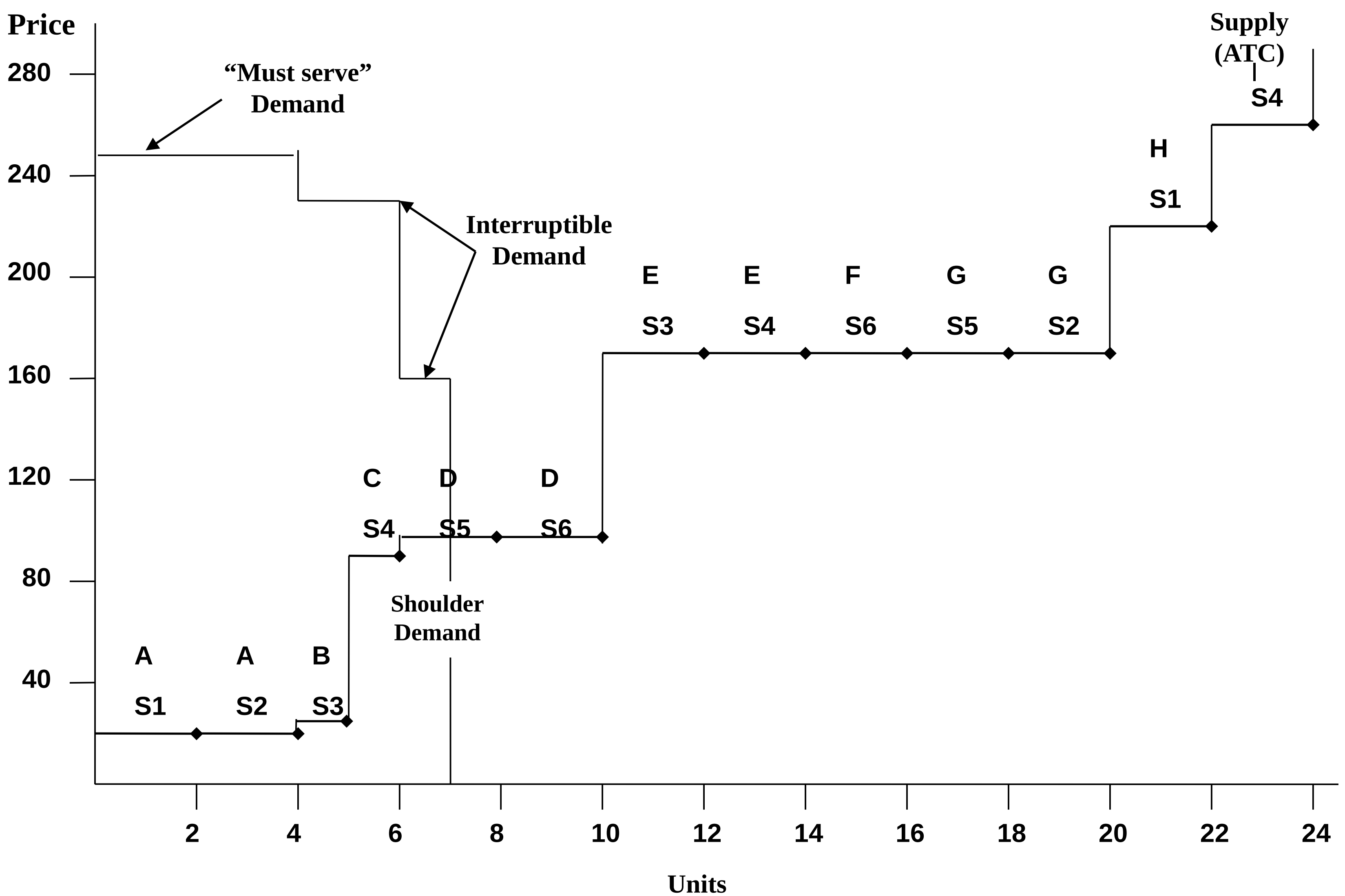
Environment: Supply



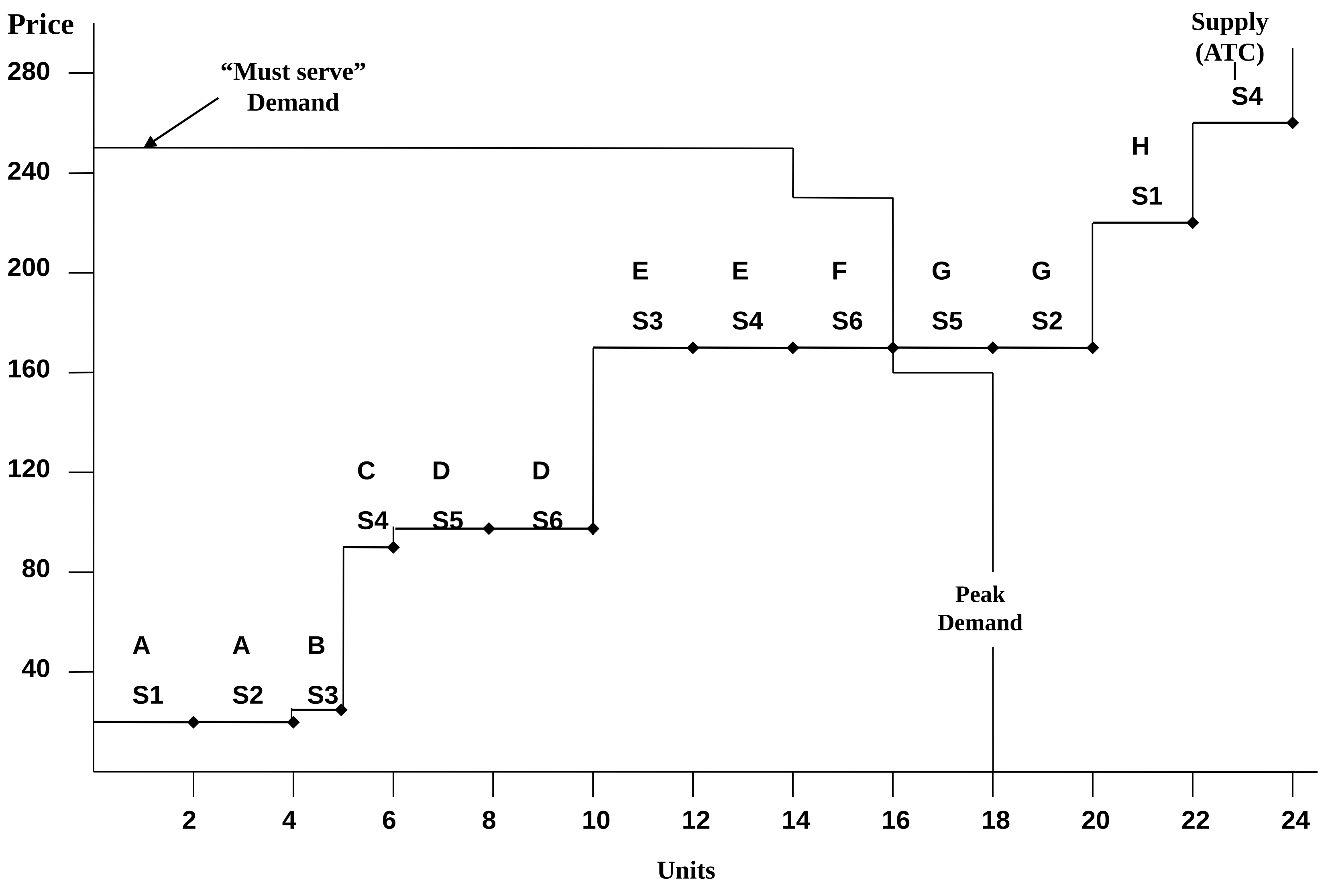
Environment: Off-Peak Demand



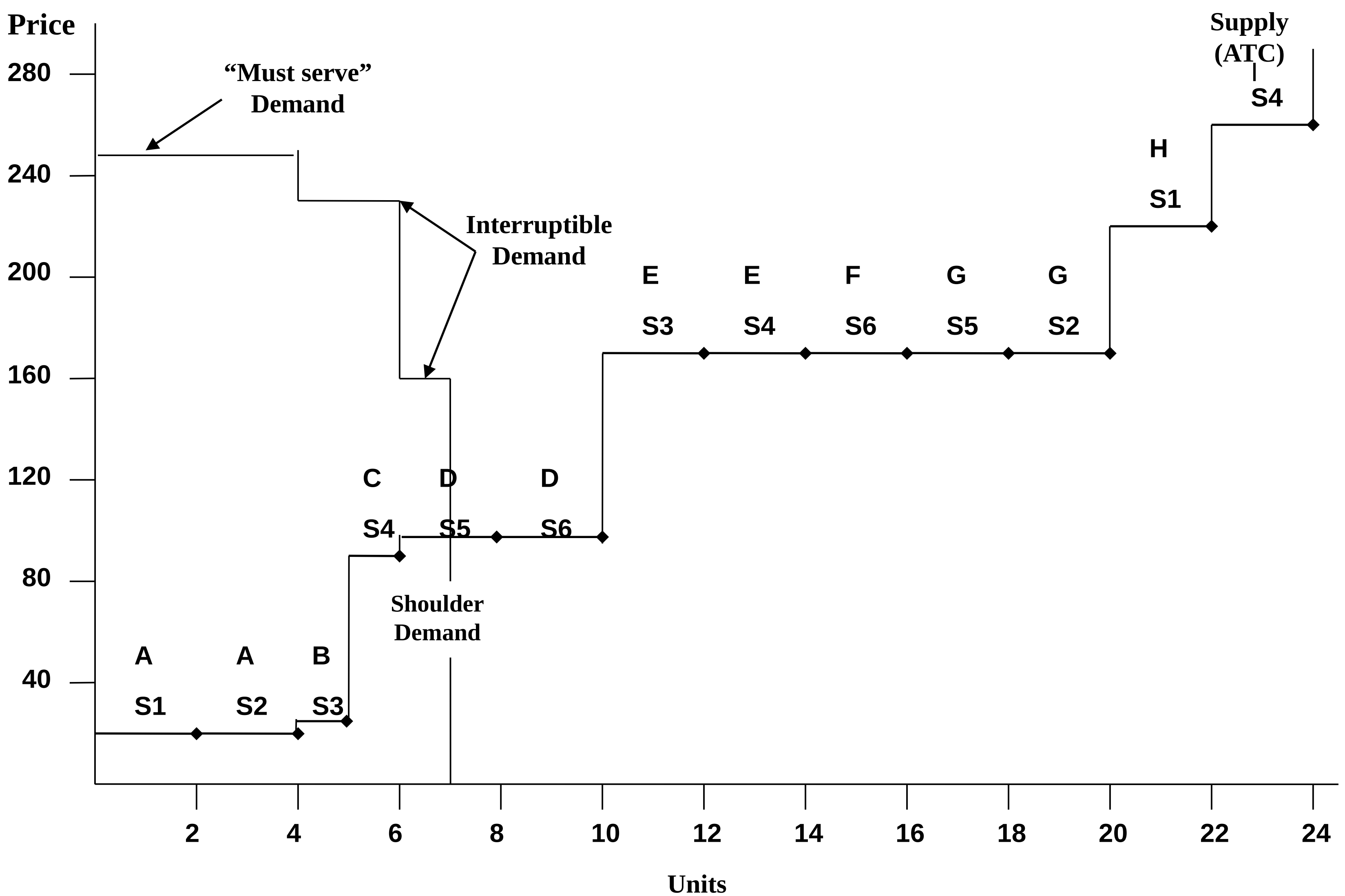
Environment: Shoulder 1 Demand



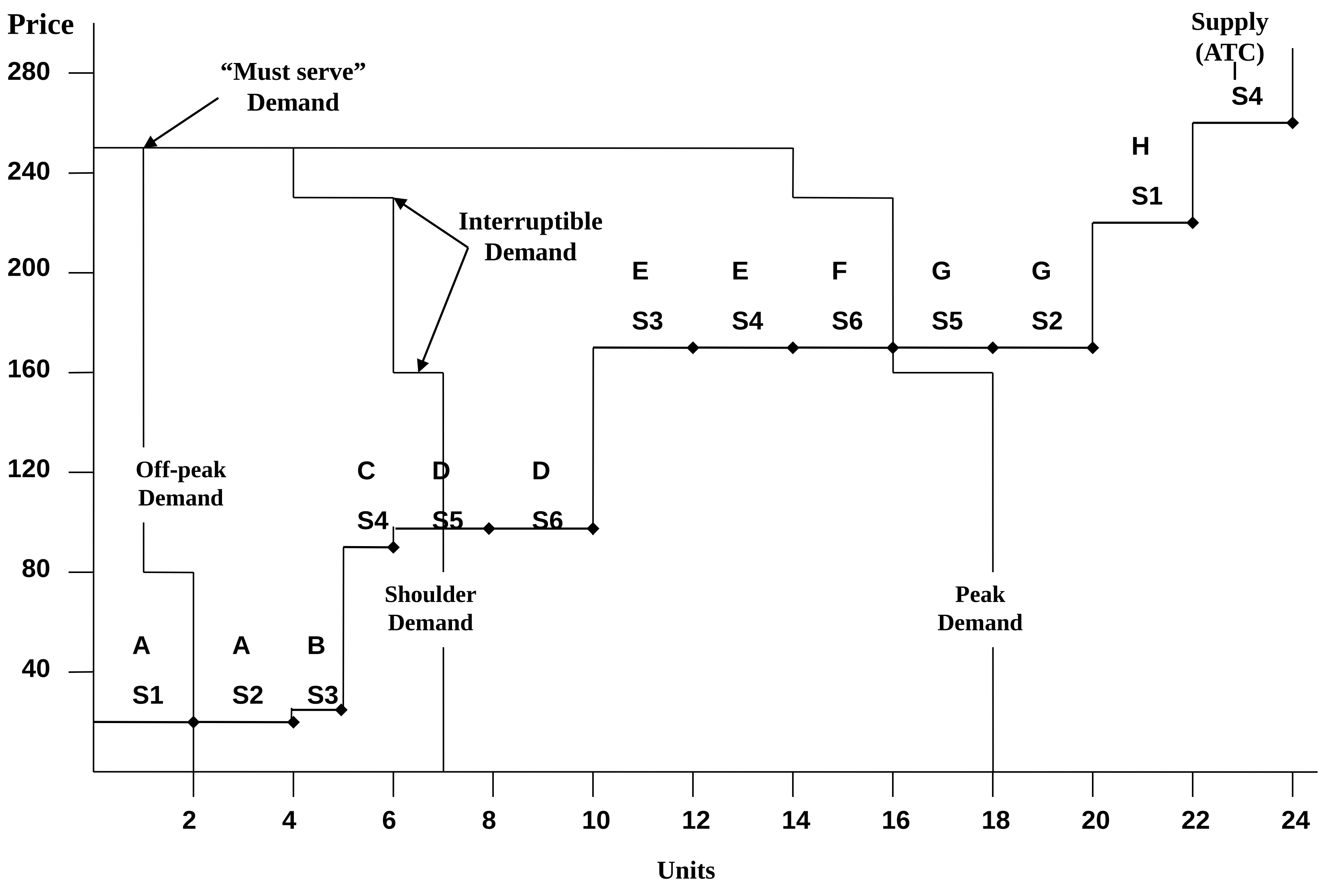
Environment: Peak Demand



Environment: Shoulder 2 Demand



Environment: Demand & Supply

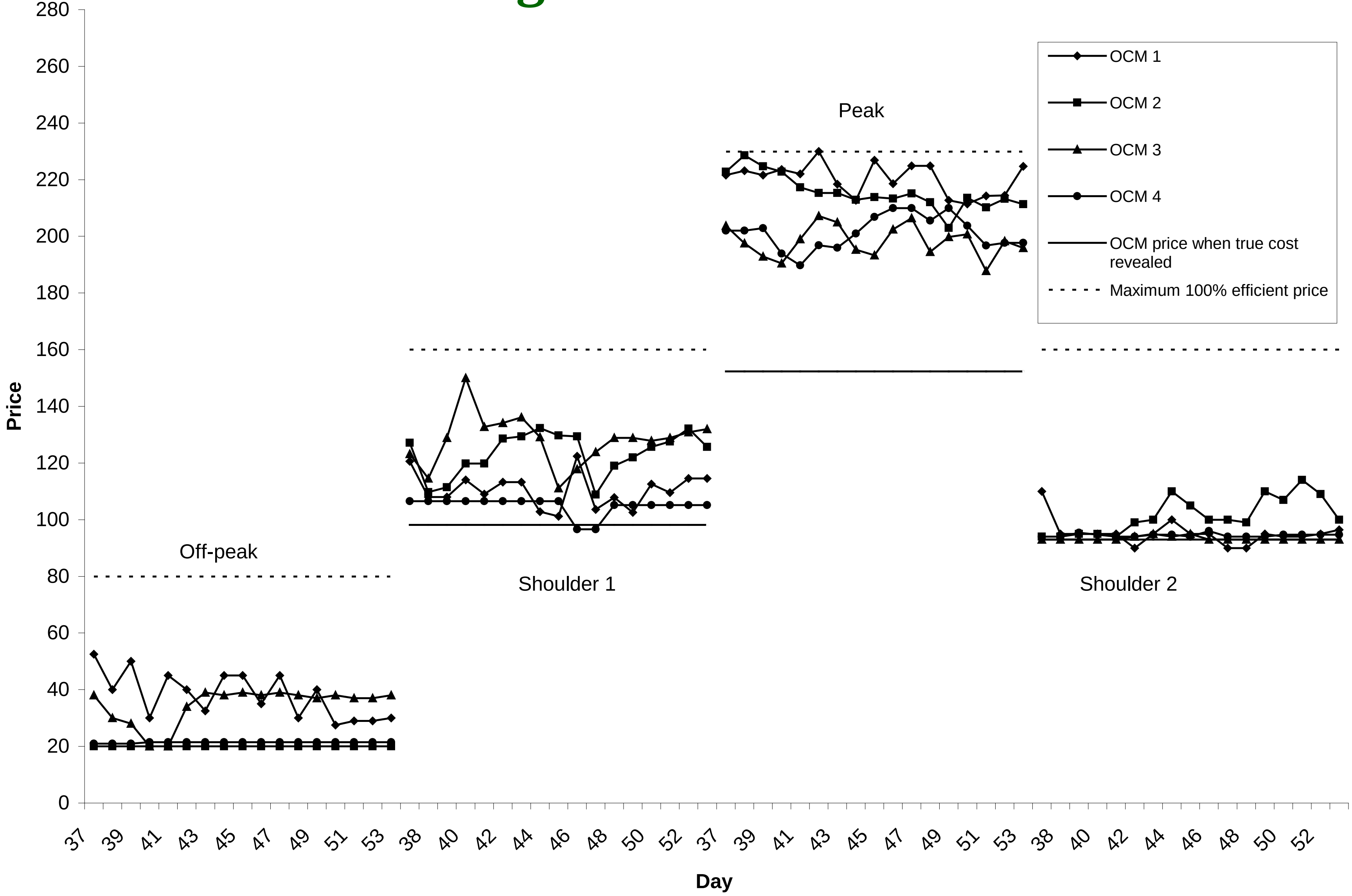


Treatments

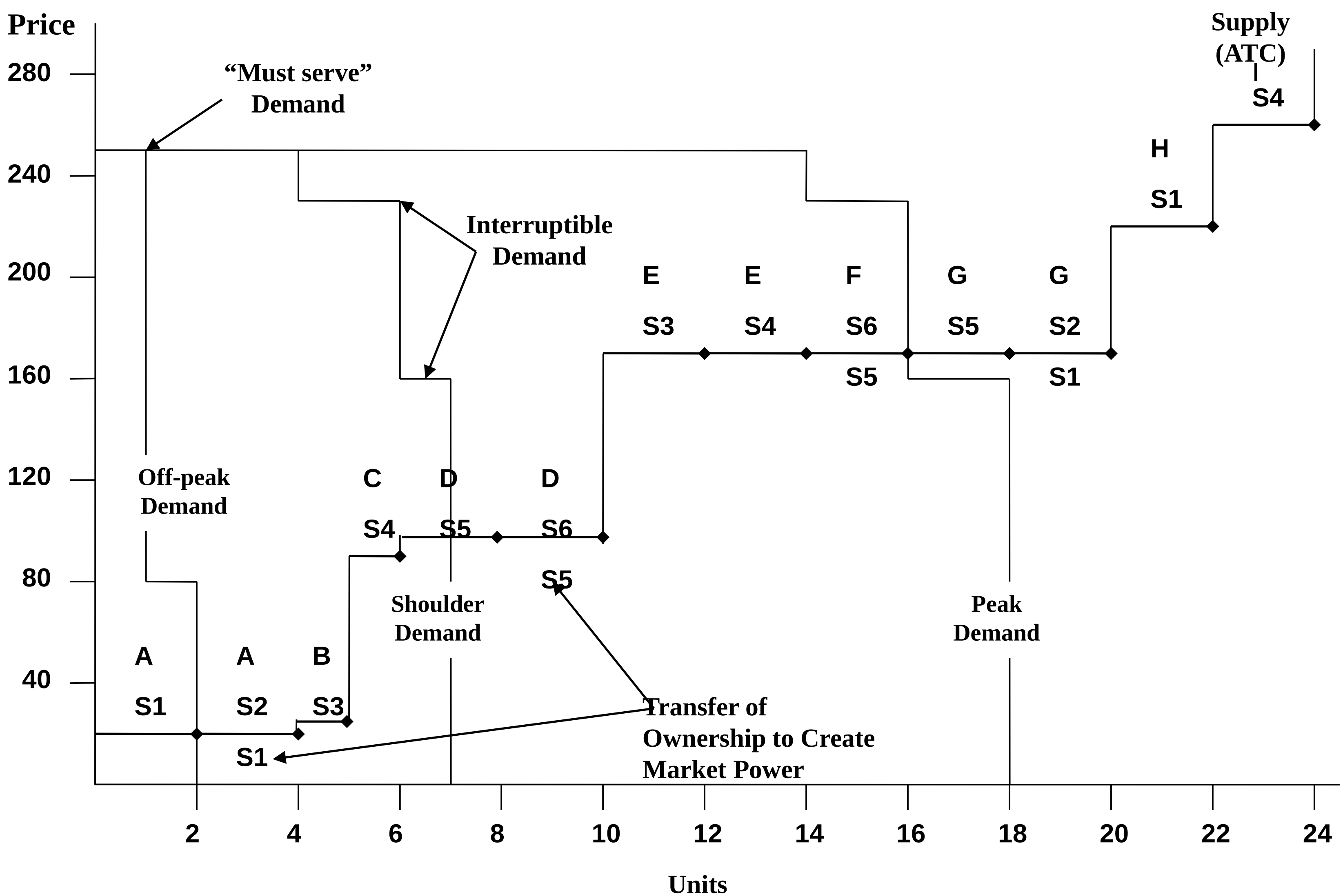
- Experimental Design (No. of Sessions; No. of Trading Days per Session)

	OCM	SOA
No Power	(4; 53)	(4; 53)
Power	(4; 53)	

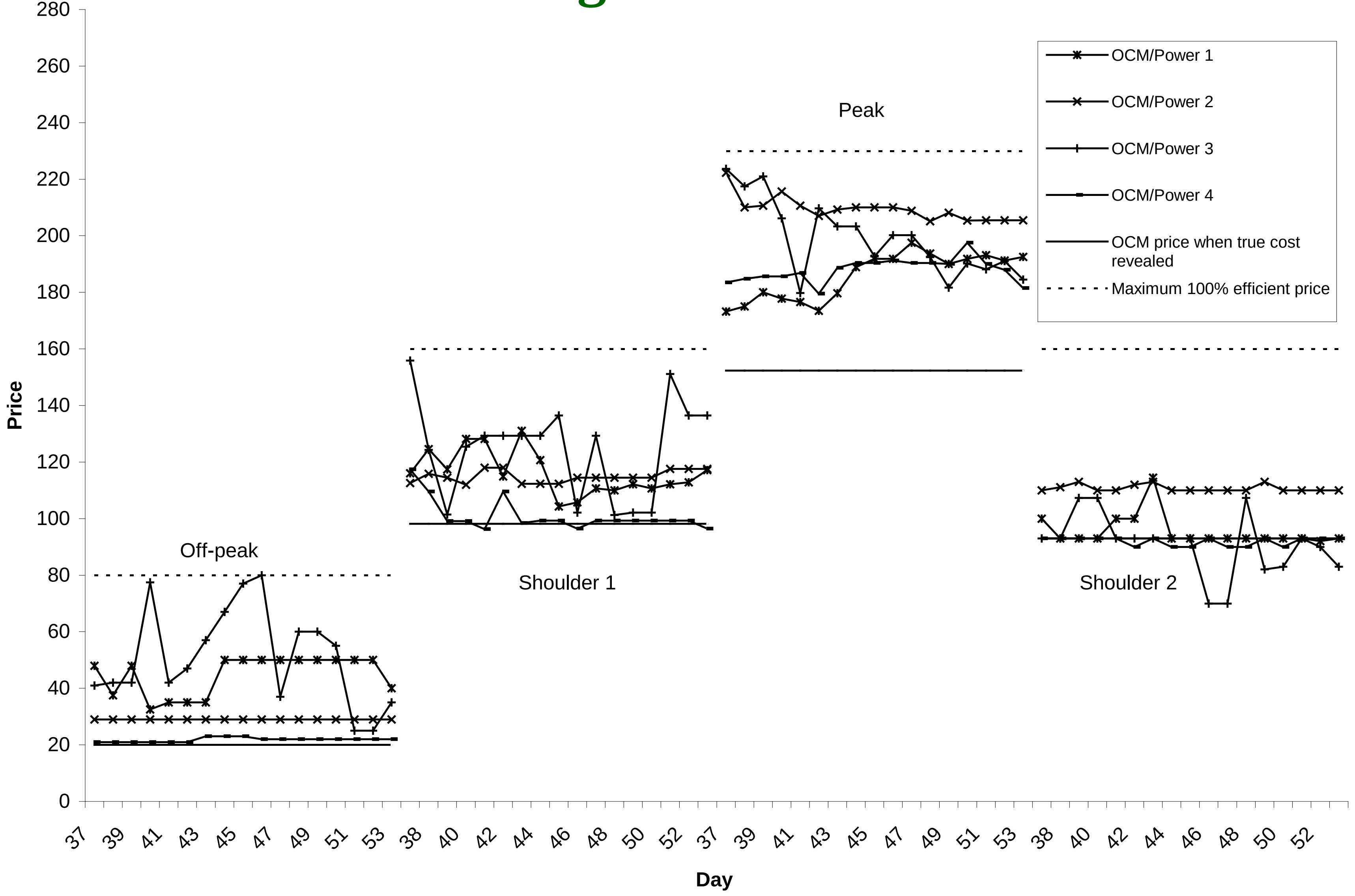
Findings: OCM/No Power



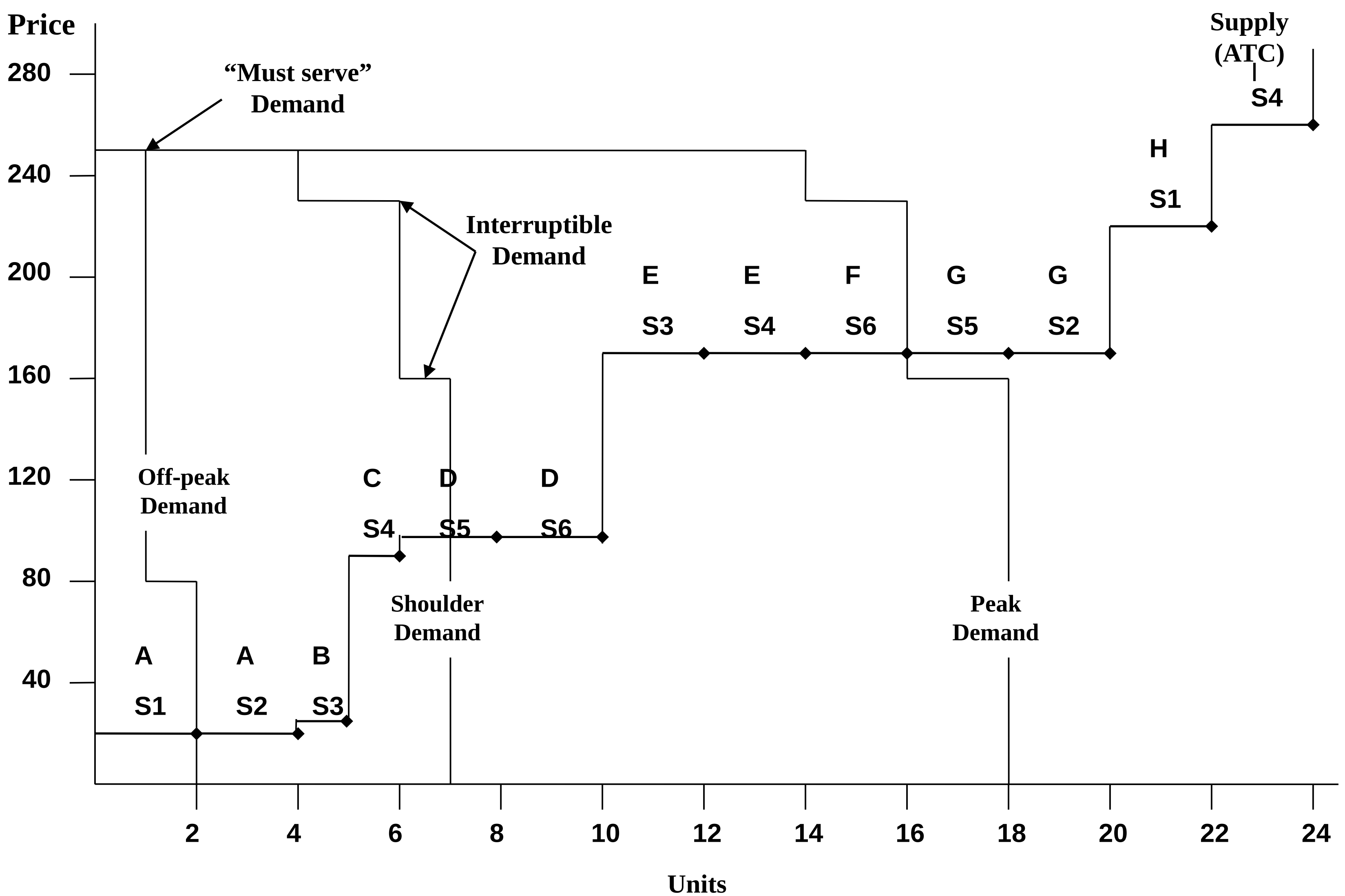
Environment: Market Power



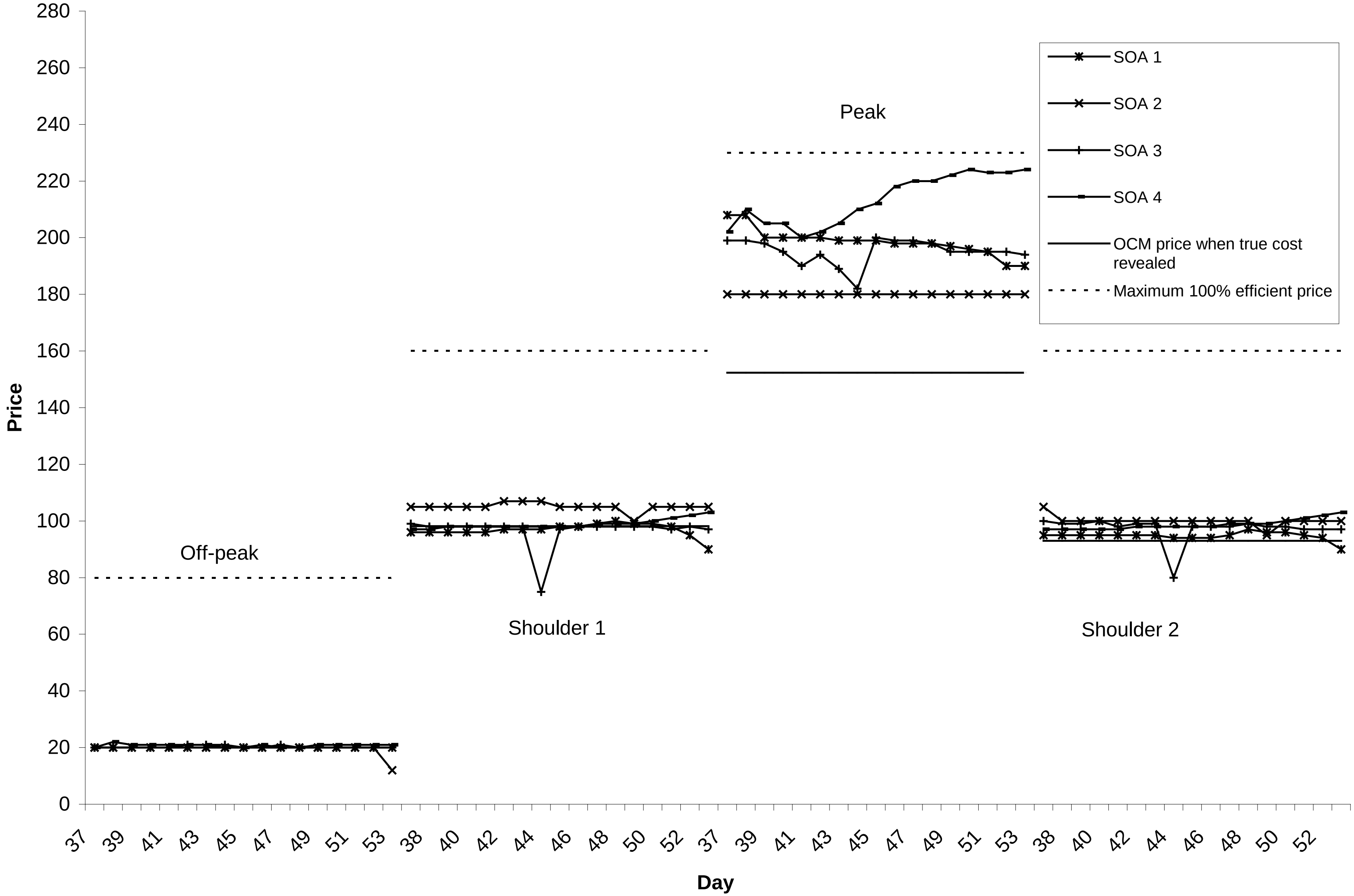
Findings: OCM/Power



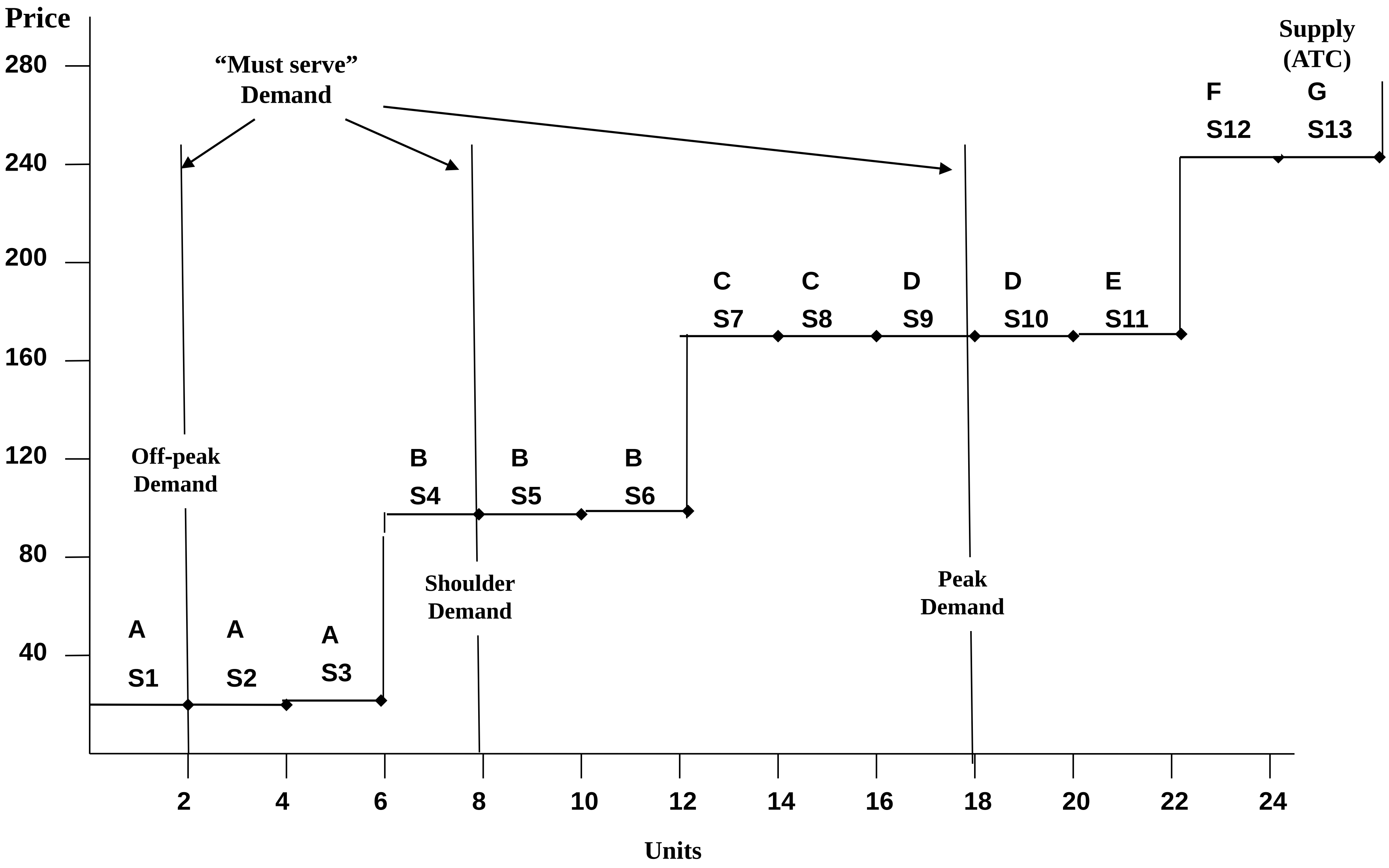
Environment: Demand & Supply



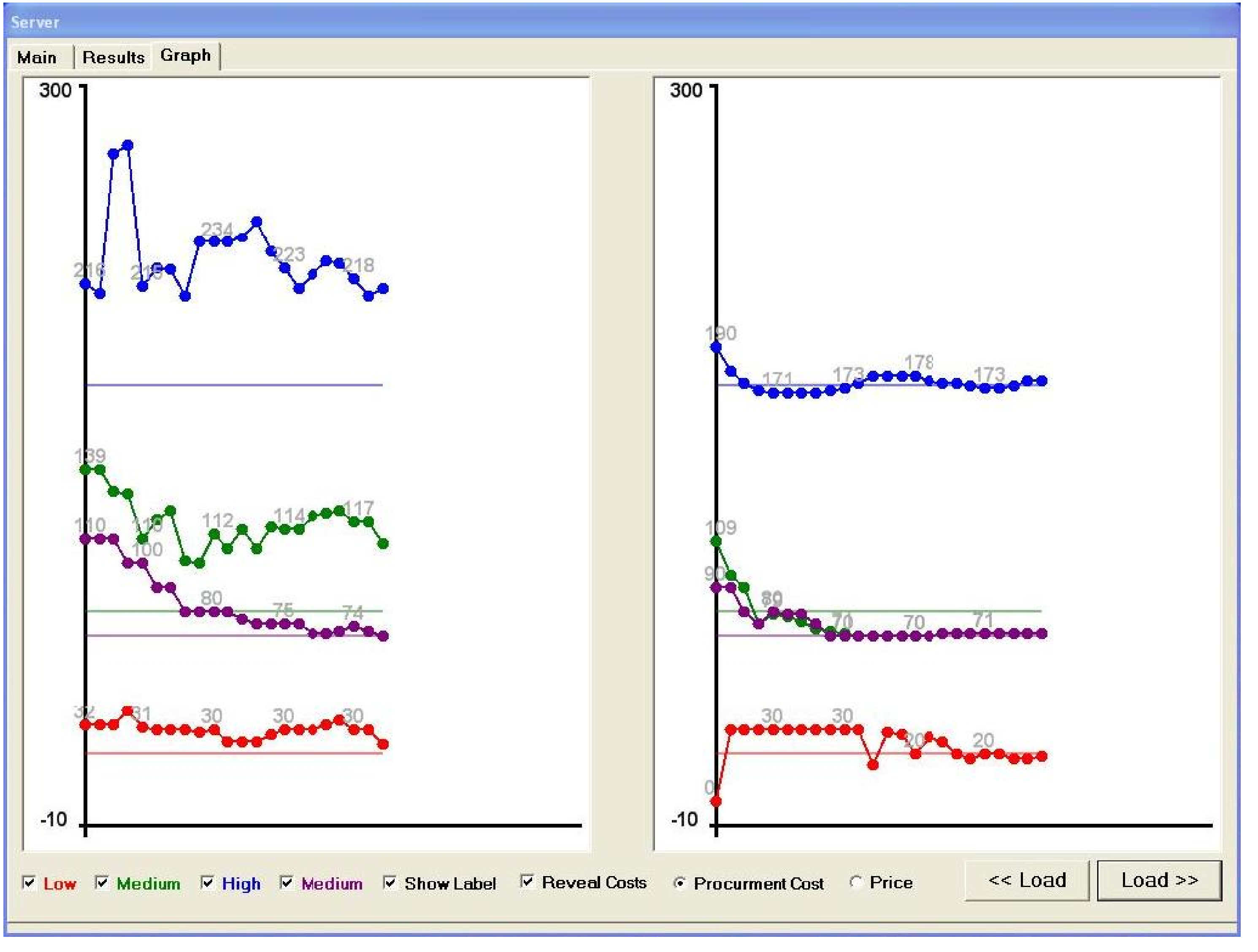
Findings: SOA/No Power



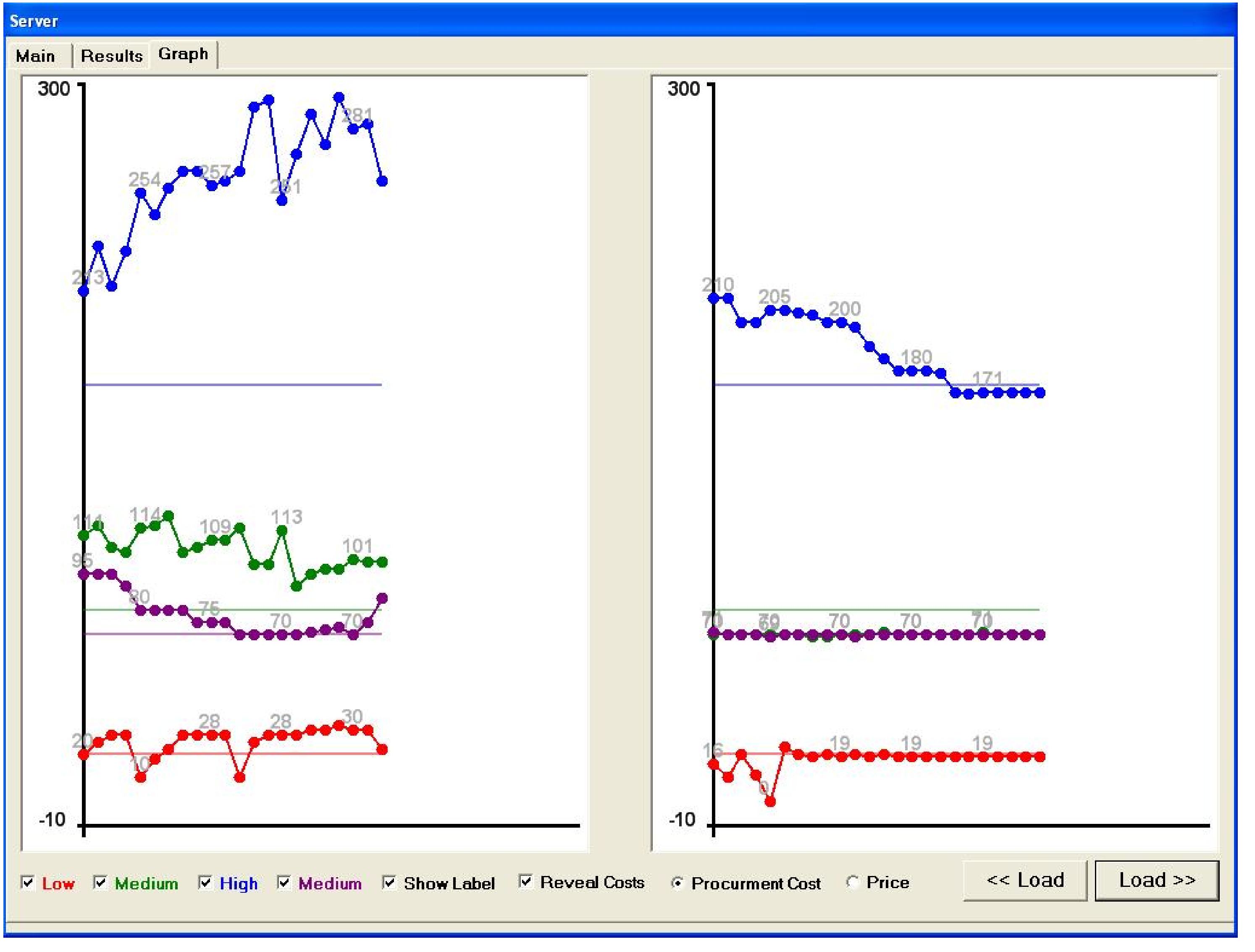
Grad Workshop Environment: Demand & Supply



Grad Workshop Data: Group 1



Grad Workshop Data: Group 2



Conclusions

- The good intentions of the complex offer auction are to help recover the avoidable fixed costs and reasonably appear to be benign, but the unexamined assumption of policy that people truthfully reveal their costs in a competitive environment have unintended consequences.

Let’s take a look at your data!