Economic Impact of Electricity Restructuring in Oklahoma

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to the

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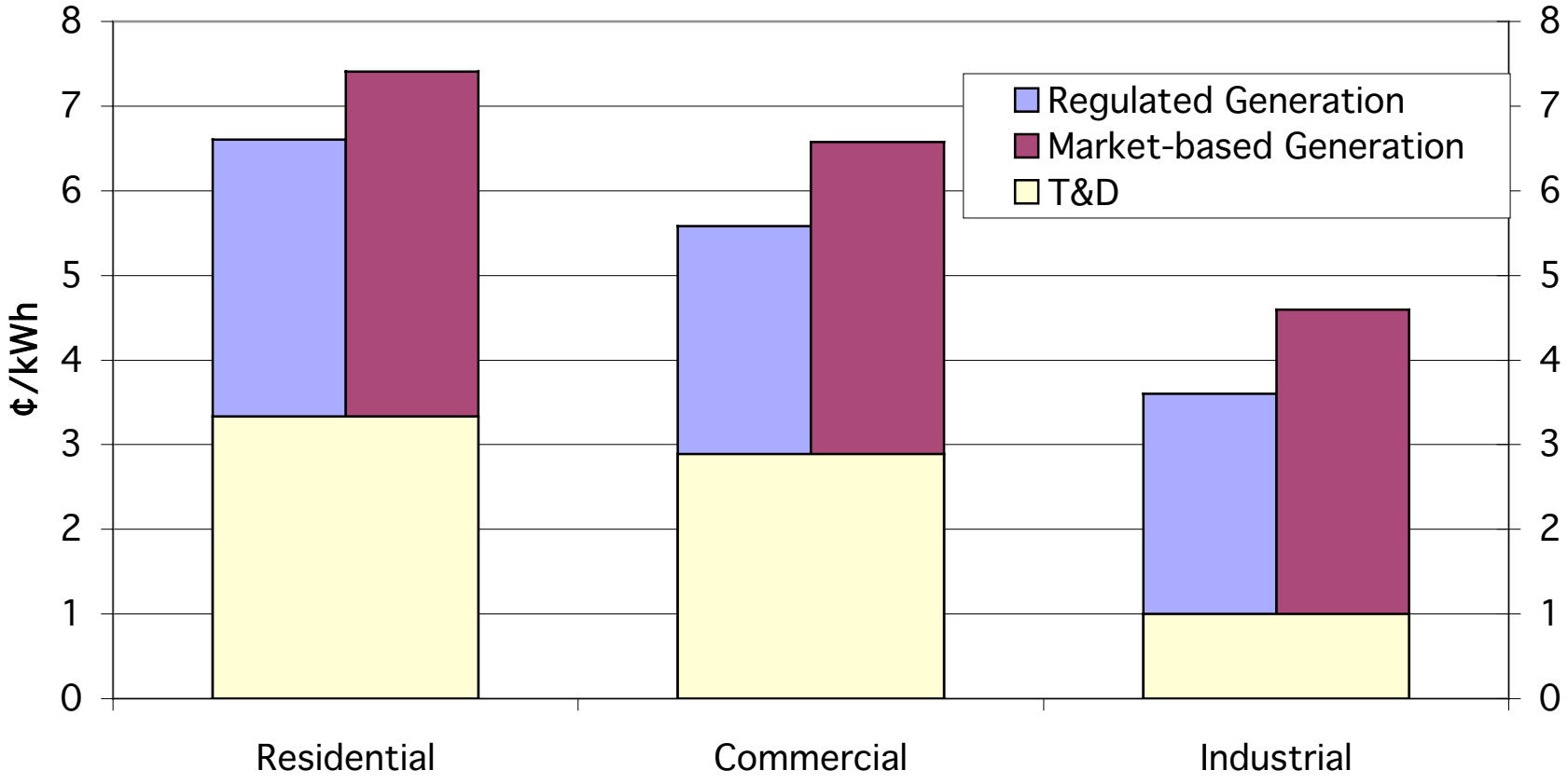
Purpose of Study

- What are the price and economic impacts of restructuring the OK electric sector
  - Phase I looks at near-term with existing facilities
  - Phase II (underway) looks further out, includes customer response and broader economic analysis
- Focus on just the state as whole, not individual utilities or surrounding regions

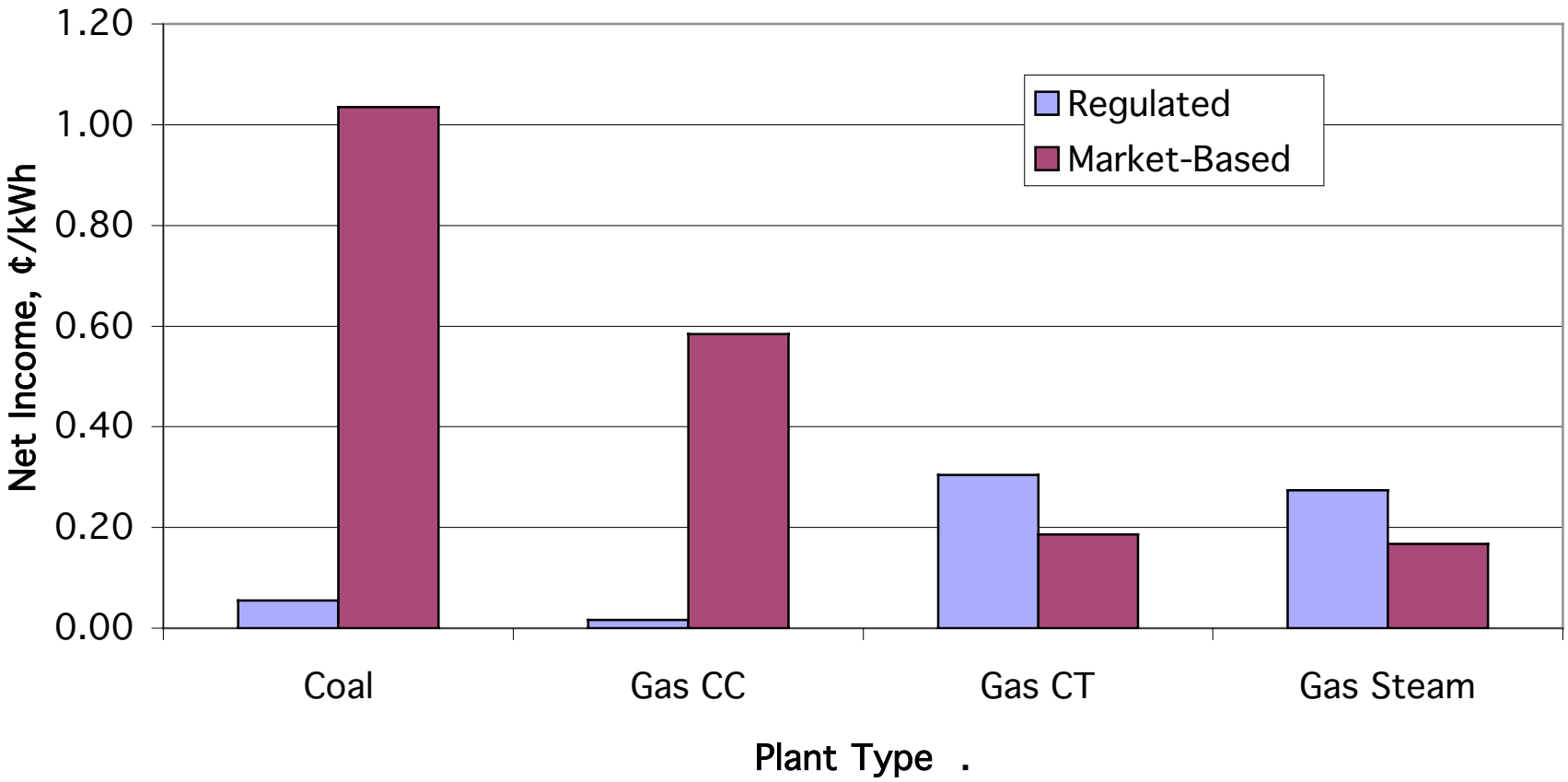
Summary of Conclusions

- OK is a mixture of low-cost coal and mid-cost gas power plants
- In regulated, average-cost pricing, coal "subsidizes" gas power plants
- In market-based pricing, gas plants are on the margin and set prices most of time
  - More sensitive to gas price increases
  - Profitability varies greatly by plant
- Customer prices are generally higher with restructured, market-based pricing

Average prices increase under market-based pricing



Base-load plants are more profitable while mid- and peak-load less so



Calculating average regulated and market prices to customers

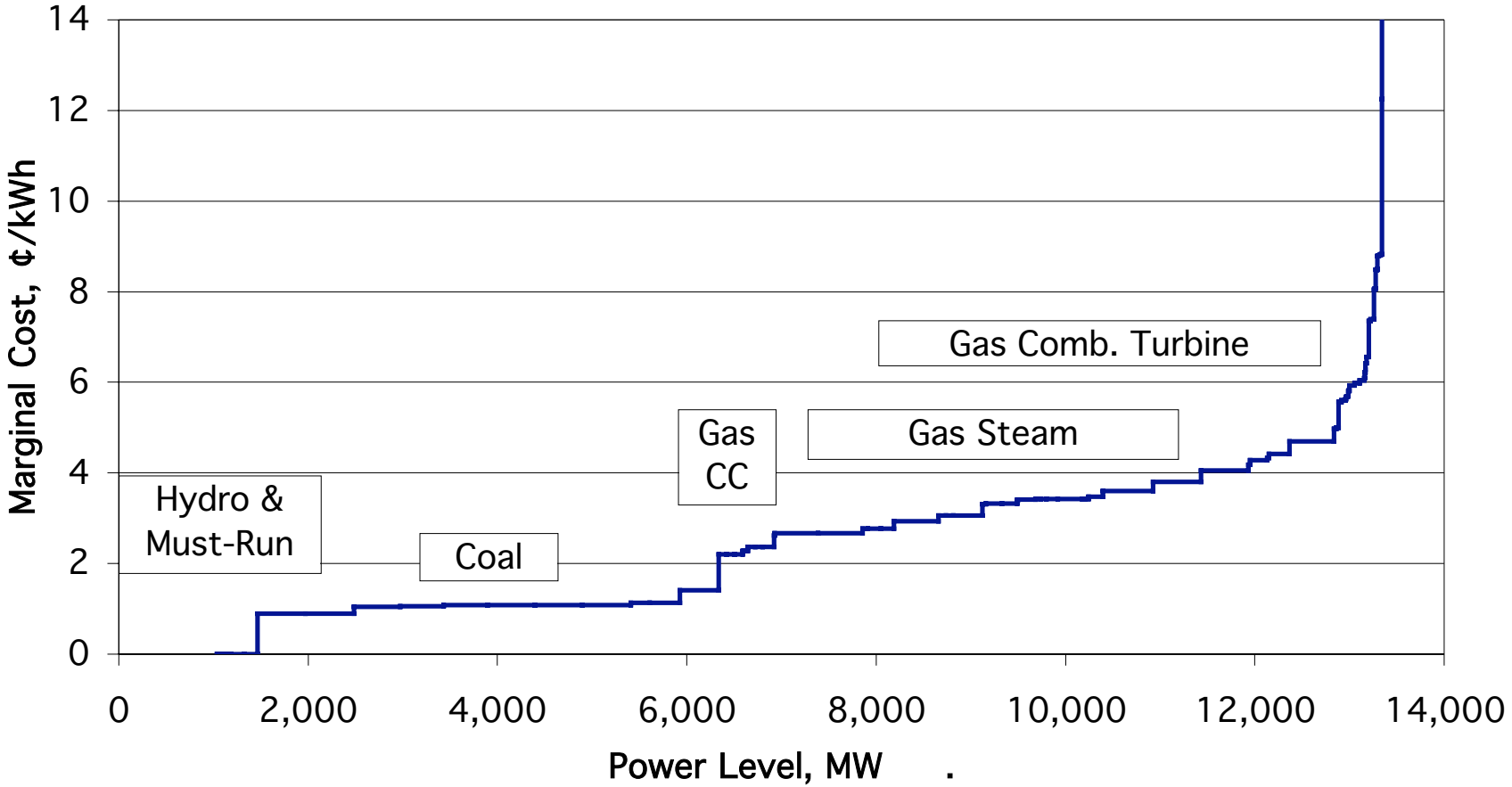
- Market prices found by applying marginal prices to each hour of customer demand
- Regulated prices found by allocating generation costs to customers
  - Separate demand and energy categories
  - Include all costs: production, depreciation, interest, taxes, regulated return on equity
  - Recognize different costs for non-IOU's
- T&D kept constant in both cases

Cost table for different plant types

	Capacity MW	Gener-ation GWh	Avg Capacity Factor	Avg Variable Cost ¢/kWh	Avg Fixed Cost* $/kWyr	Avg Total Cost ¢/kWh
Coal	5,155	33,880	75%	1.08	56	1.94
Gas Combined Cycle	766	3,907	58%	2.31	22	2.75
Gas Steam	5,707	13,018	26%	2.94	32	4.35
Gas Combustion Turbine	505	527	12%	2.82	27	5.40
Hydro	775	2,663	39%	0.21	31	1.12
Other	436	1,128	30%	3.36	50	5.28

*Fixed costs include O&M, depreciation, interest, taxes, and regulated return on equity

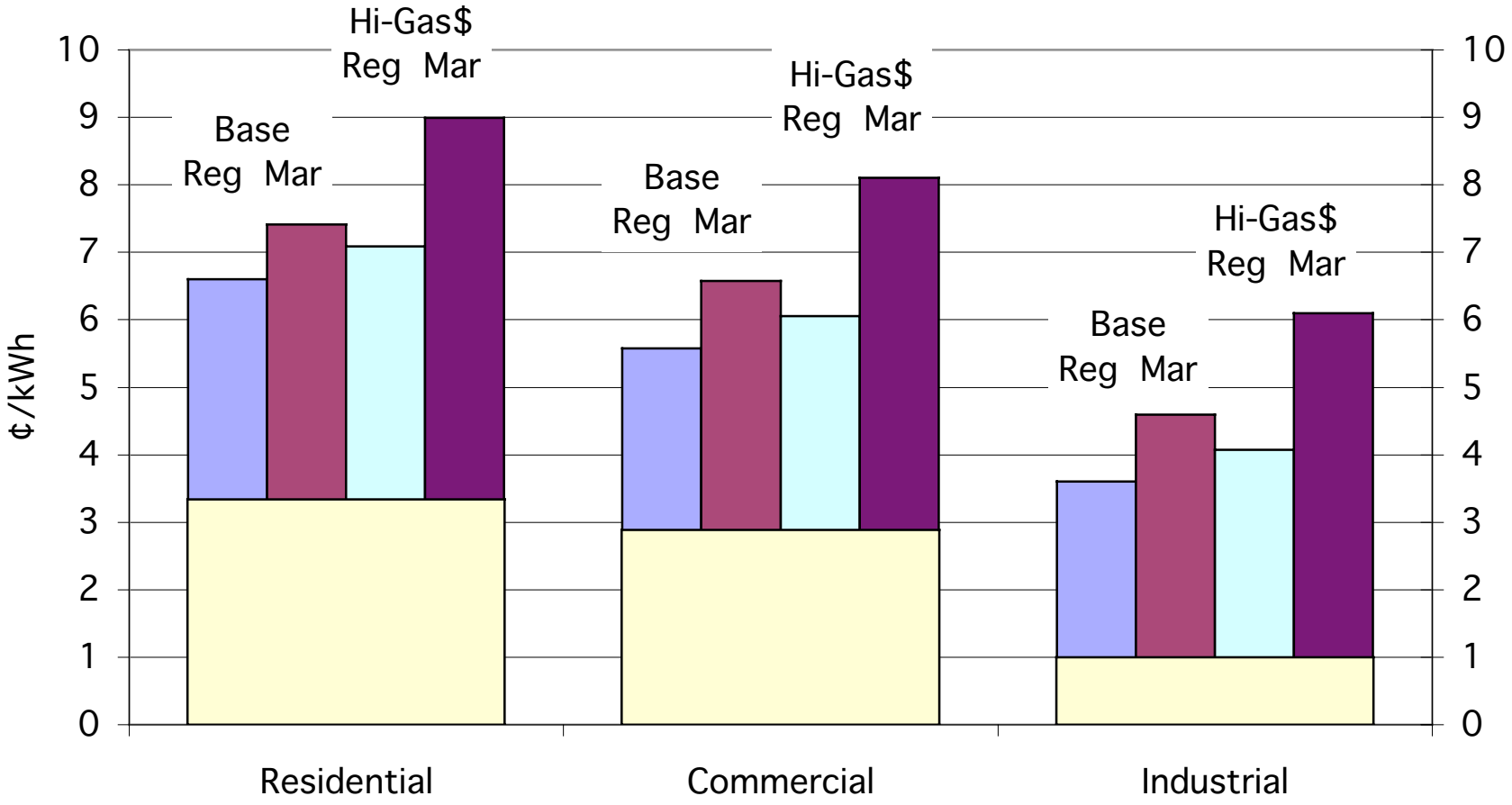
Order plants by marginal cost



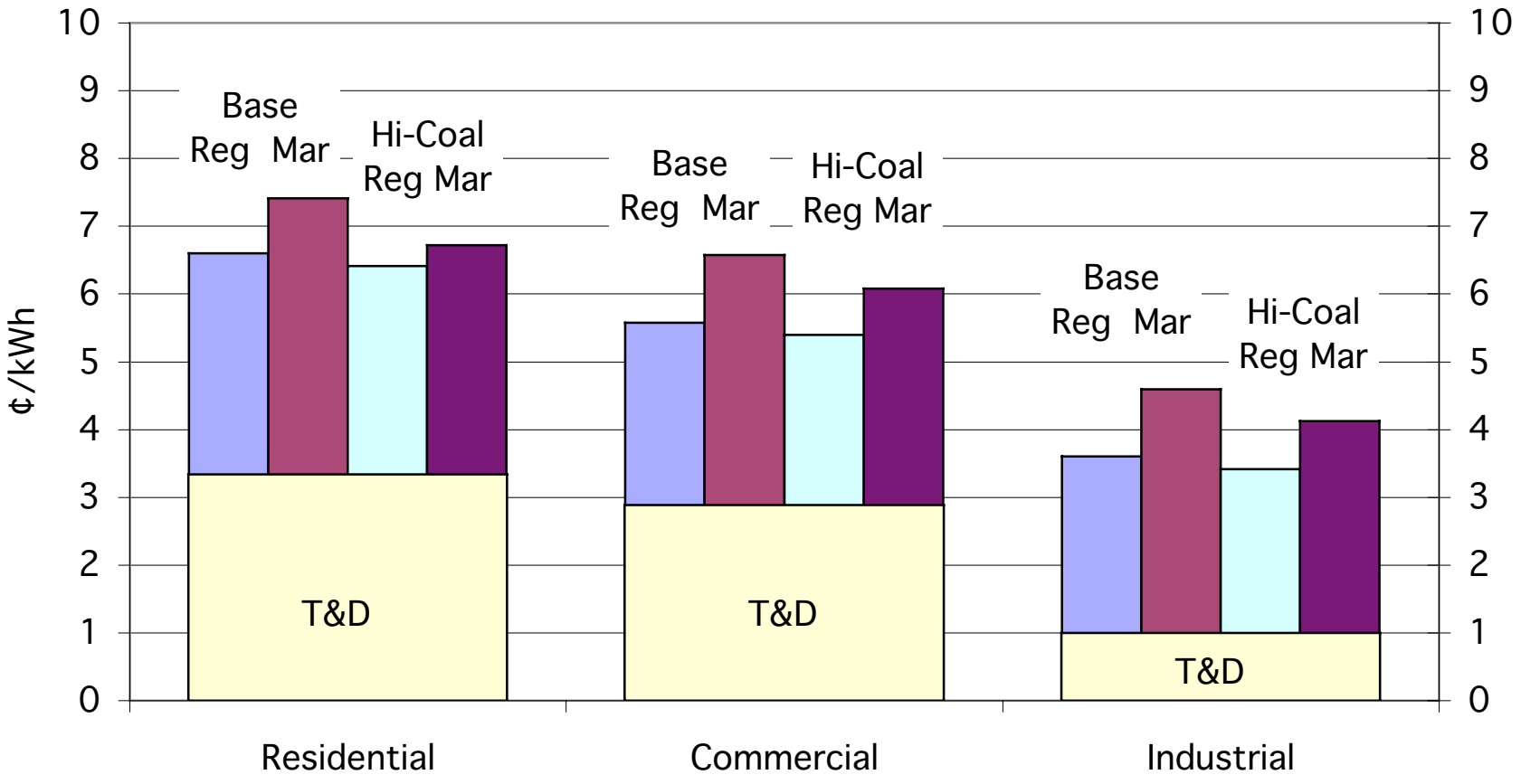
Sensitivities

- Higher gas prices
  - Base case uses average price of $2.76/MBtu based on 1999 purchases
  - Sensitivity uses $4.13/MBtu based on 2000 purchases
- Higher coal availability
  - Base case uses historical capacity factors for OK coal plants
  - Sensitivity raises the capacity factors to 84%

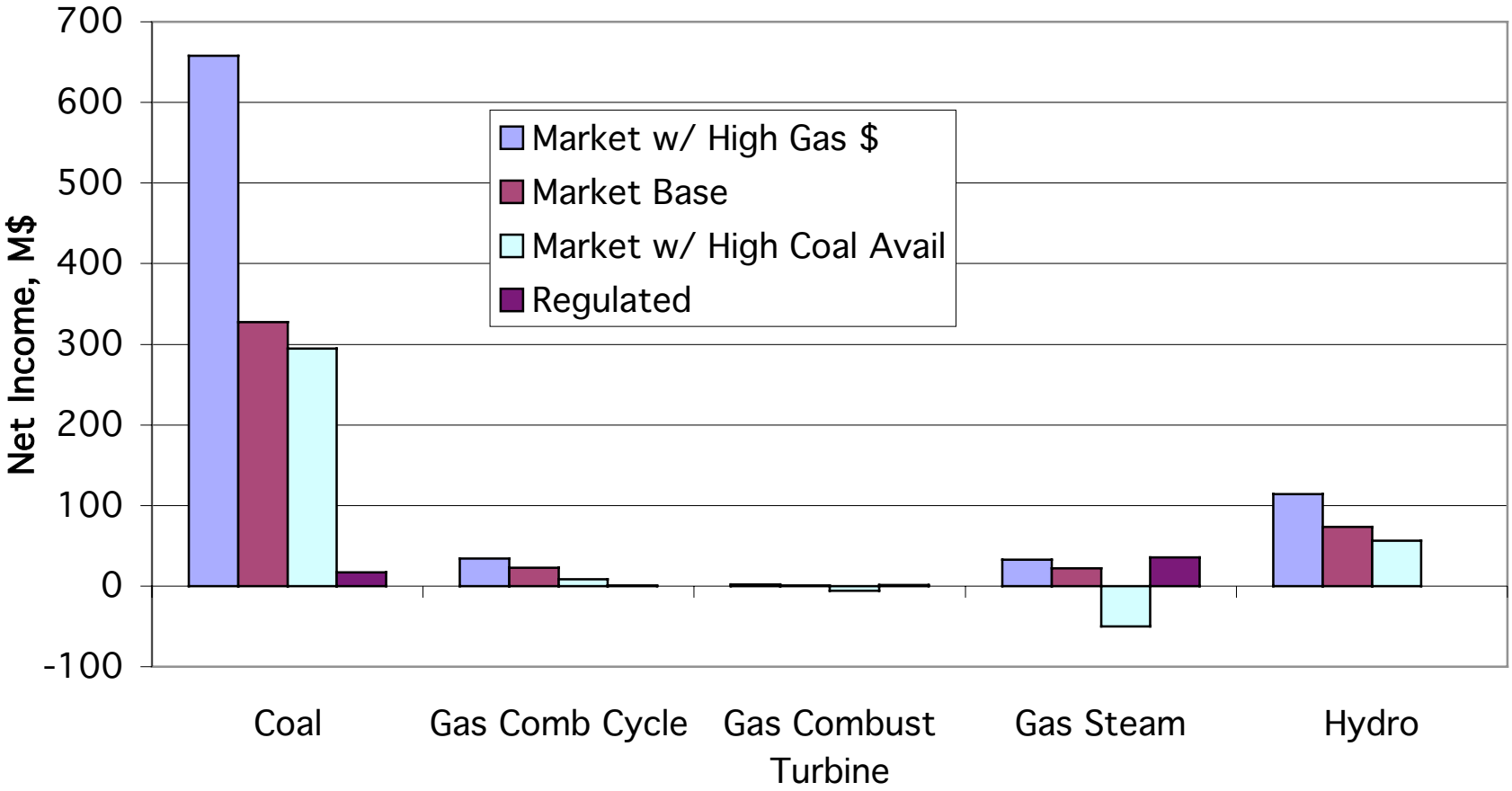
Higher gas prices raise market prices more than regulated prices



Higher coal plant availability lowers regulated and market prices



Profits of plants vary greatly



Stranded Cost View

- States with high-cost plants have let utilities recover their stranded costs
  - Net total cost from plants is higher than market
  - Some states have utilities sell plants to fix their value
  - Customer surcharge recovers stranded costs over time
  - Results sensitive to market price assumption
- Oklahoma faced with opposite situation
  - Net total cost from plants is lower than market prices
  - Detailed, multi-year analysis needed to estimate value for each utility
  - Result could be rebates or discounts to customers that offset price increases (e.g. through long-term contracts)

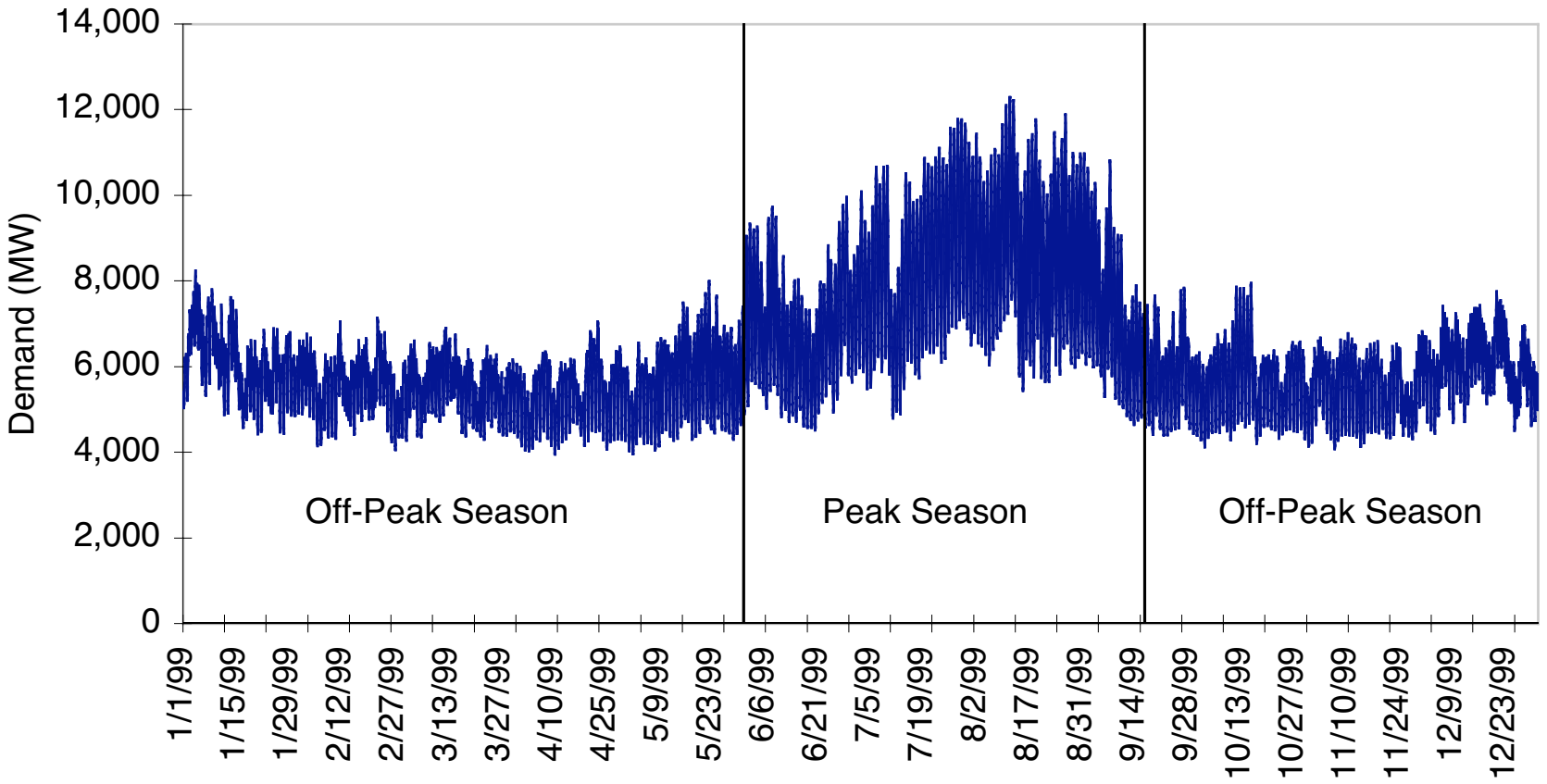
Methodology Details

- Define customer demands
- Define power plant supplies
- Dispatch power plants to meet demand
- Calculate market prices based on dispatch
- Calculate total costs of power plants for regulated prices
- Compare

Define electric power demand

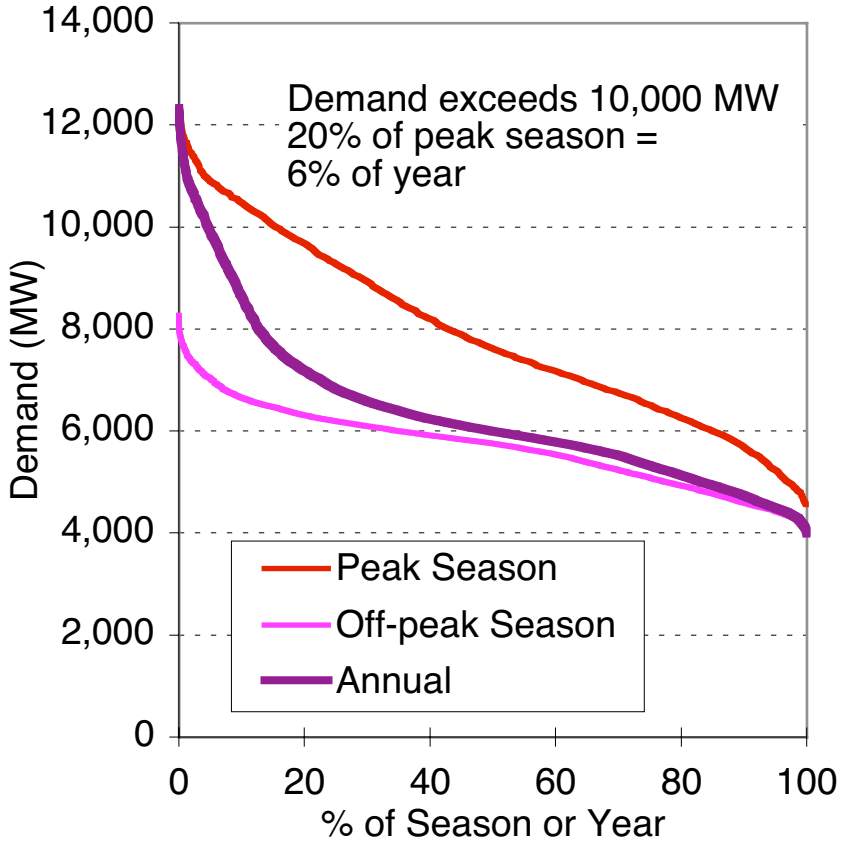
- Find Hourly System Demand
- Convert to Load Duration Curve (LDC)
- Separate demand by customer types
  - Residential, Commercial, Industrial, Other
  - Account for losses
  - Include external sales as additional demand

OK Hourly Demands for 1999



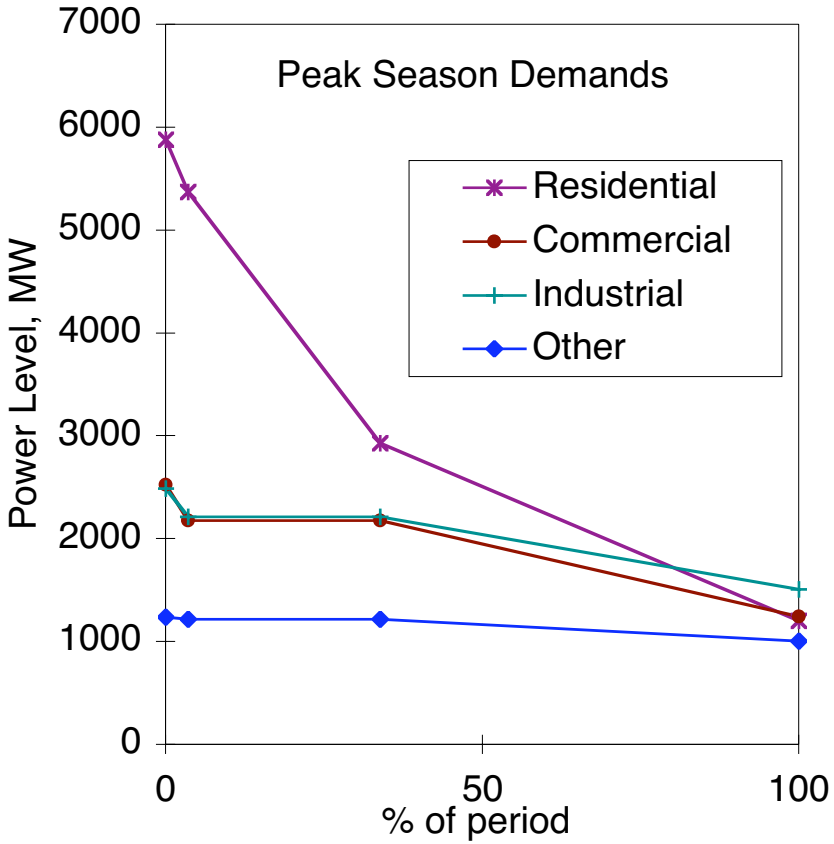
Load Duration Curve reorders demands by increasing amounts

- Percent of time demand equals or exceeds a power level
- Separate curves for peak and off-peak seasons



Split load between customer types

- Utilities report annual sales by class
- T&D losses raise generation requirements
- Treat external market simply as extra load

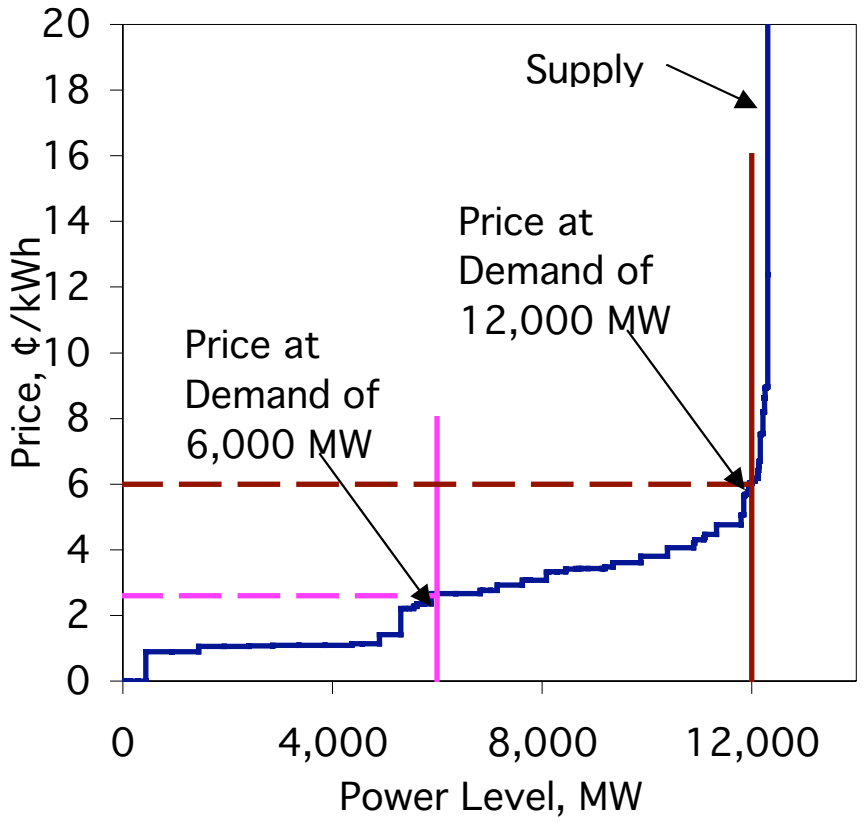


Define power plant supply

- Inventory of plants found from EIA and RDI databases show 190 units in OK
- This study not use plants in other states
- Data sets include information on:
  - Capacity
  - Efficiency
  - Fuel Cost
  - Age
  - Outage Rates
  - Construction Cost
  - Operations & Maintenance
  - Fuel types
  - Ownership

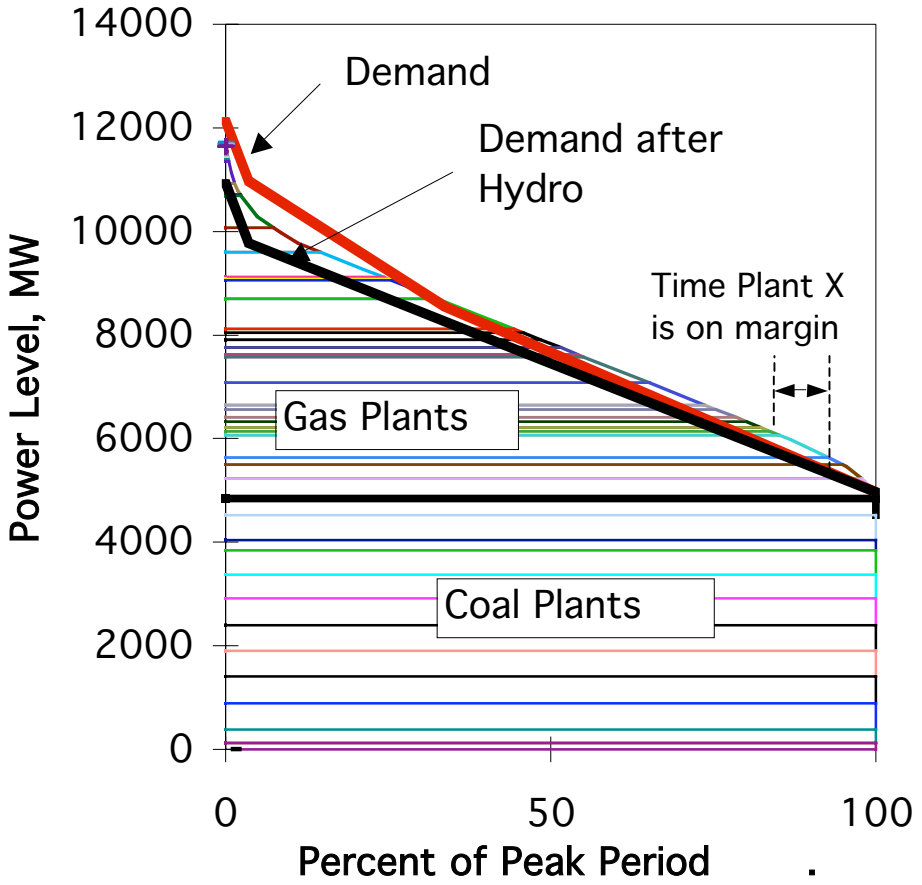
OK Supply Curve (w/o Hydro)

- As demands increase, higher-cost plants are used
- Plant outages act like extra demand
- Hydro treated as reduced demand

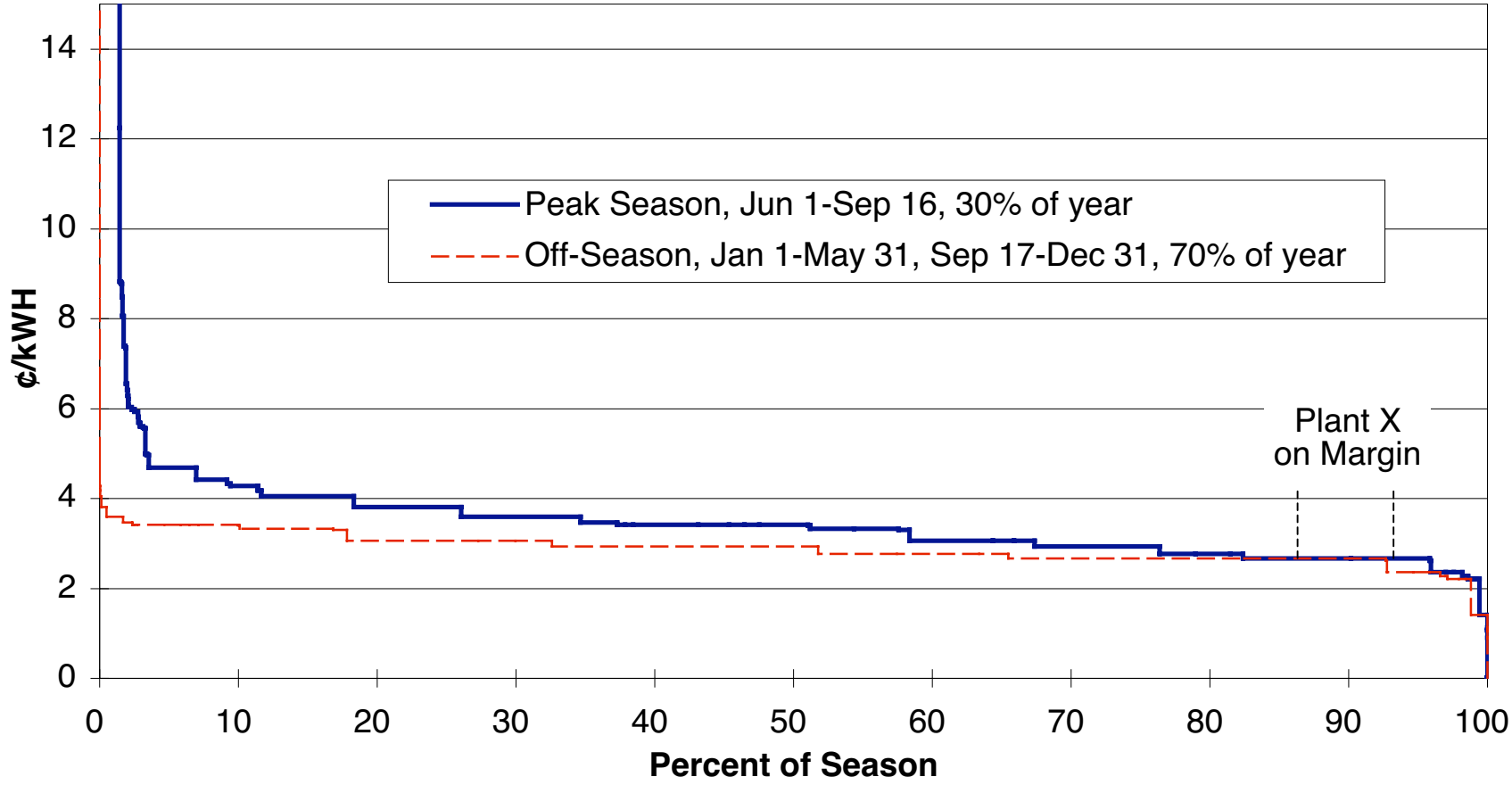


Dispatching into LDC (Peak period)

- Hydro flattens LDC
- Lower cost plants run more
- Marginal price set by cost of most expensive plant



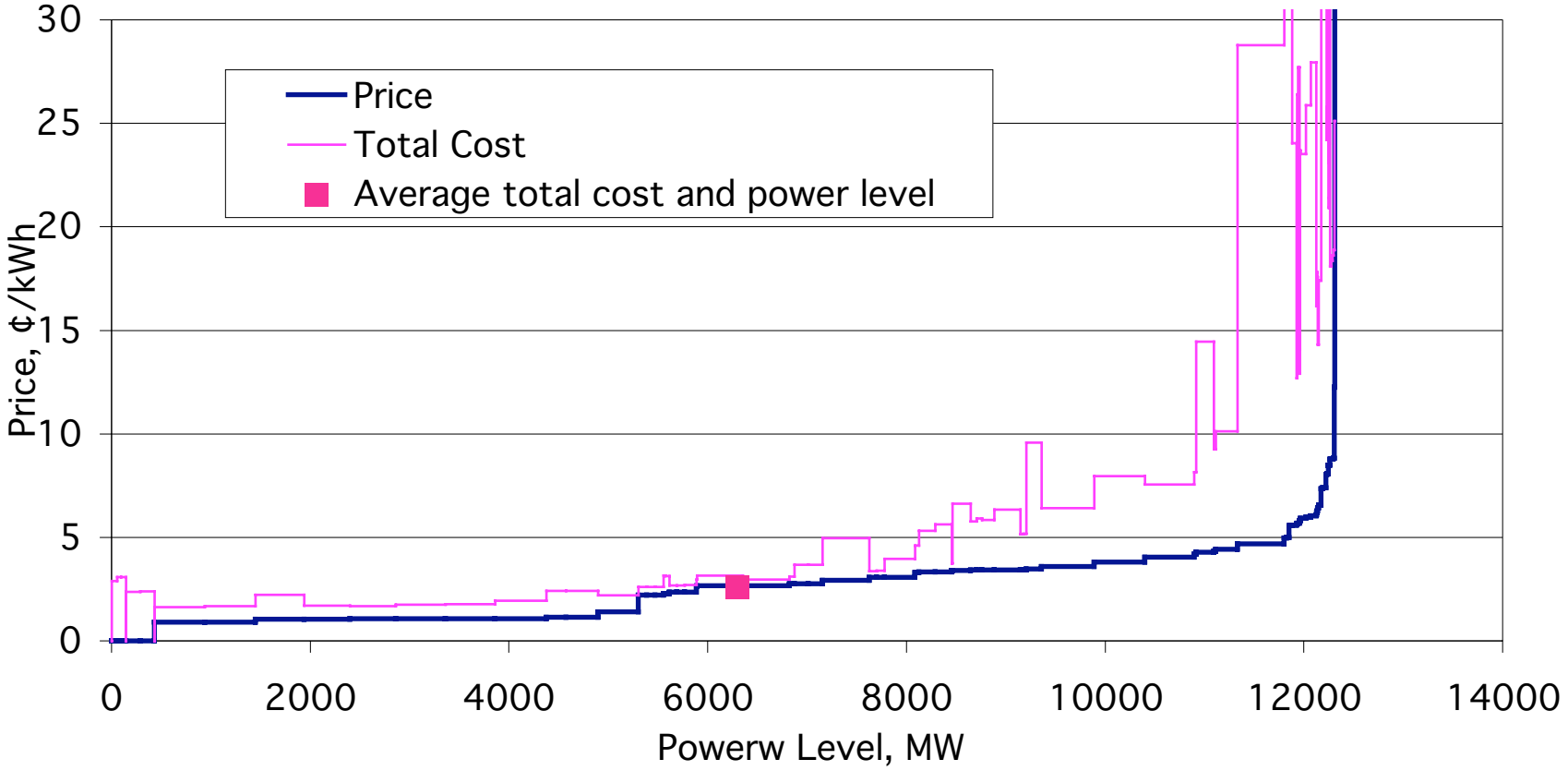
Prices rise as demand increases



Oak Ridge Competitive Electricity Dispatch (ORCED) model

- MS Excel model of bulk power market with marginal cost and average cost pricing
  - Up to 202 power plants
  - Covers single year
  - Based on earlier single utility model ORFIN
- Used in multiple carbon emission and restructuring studies, e.g.:
  - Generation adequacy under restructuring
  - Power prices in CA and Pacific NW
  - Carbon emissions in Midwest with carbon tax
  - National carbon emissions with clean energy programs
  - Multiple emission control strategies

Supply curve showing total cost



Phase II Analysis

- Increase demands to expected 2010
- Add planned and under construction plants
- Allow model to add plants if needed
- Calculate customer prices
- Use MPLAN economic model for broader economic impact
- Modify customer demands based on real-time prices
- Analyze impact of market power during peak demands
- Time and funding may limit last two analyses