Mandatory Real-Time Pricing: What California Can Do to Reduce the Cost of the Summer of 2001

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Outline of Talk

- Demand-side management is only option for reducing the cost of the summer of 2001
- Real-Time Pricing versus Rolling Blackouts
- Fixed Prices versus Real-Time Pricing
- Monopsony Buyer Requires Real-Time Pricing
- Real-Time Pricing and Monopsony Buyer Reduces Forward Contract Prices
- Real-Time Pricing versus Time of Use Pricing
- Mandatory Program is Essential

Real-Time Pricing versus Rolling Blackouts

Rolling blackouts impose loss of electric service on all customers regardless of their willingness to pay for electricity

- Loss of economic output can be enormous
- Significant potential for loss of life or injury

Real-time pricing allows customers to choose to reduce demand

- Customers will high value of electricity reduce less than others

Real-time pricing does not need to impoverish customers on program

- Set reasonable target and provide carrot and stick to achieve it

Rolling blackouts are difficult to plan in advance

With real-time pricing customers can plan their reduction in consumption in advance

Current Fixed Price Plan versus Real-Time Pricing

Example: Two periods, two prices: 5 cent/KWh and 50 cent/KWh
- Currently consumer purchases 50 MWh in each period for a total of 100 KWh
- Total bill is for energy $27.50

However consumer is currently paying 10 cents/KWh for all consumption
- Consumer only pays $10
- Taxpayers must pay $17.50 to make up difference

Suppose we give customer right to purchase 85 percent of each hour's usage at last year's rate of 10 cents/KWh--this is 42.5 KWh in each hour
- Any additional purchases are made at real-time price
- Any reduction in purchases are paid at real-time price

Suppose consumer now uses 41 KWh in high-priced hour and 59 KWh is low-priced hour, so he still consumes 100 KWh
- His total bill is $8.58 = (85 KWh)*(10 cents/KWh) + (16.5 KWh)*(5 cents/KWh) + (1.5 KWh)*(50 cents/KWh)
- Taxpayers now pay $14.87
- His total energy bill is $23.47 = $14.87 + $8.58

Real-Time Pricing Saves Californians Money

Real-time pricing creates win-win situation
- California taxpayers pay less for electricity
- California consumers pay less for electricity
- Consider example from previous slide

Without real-time pricing
- Consumer pays $10
- California taxpayers pay $17.50 = $27.40 - $10 =
  - Wholesale energy purchases - revenues collected from consumer
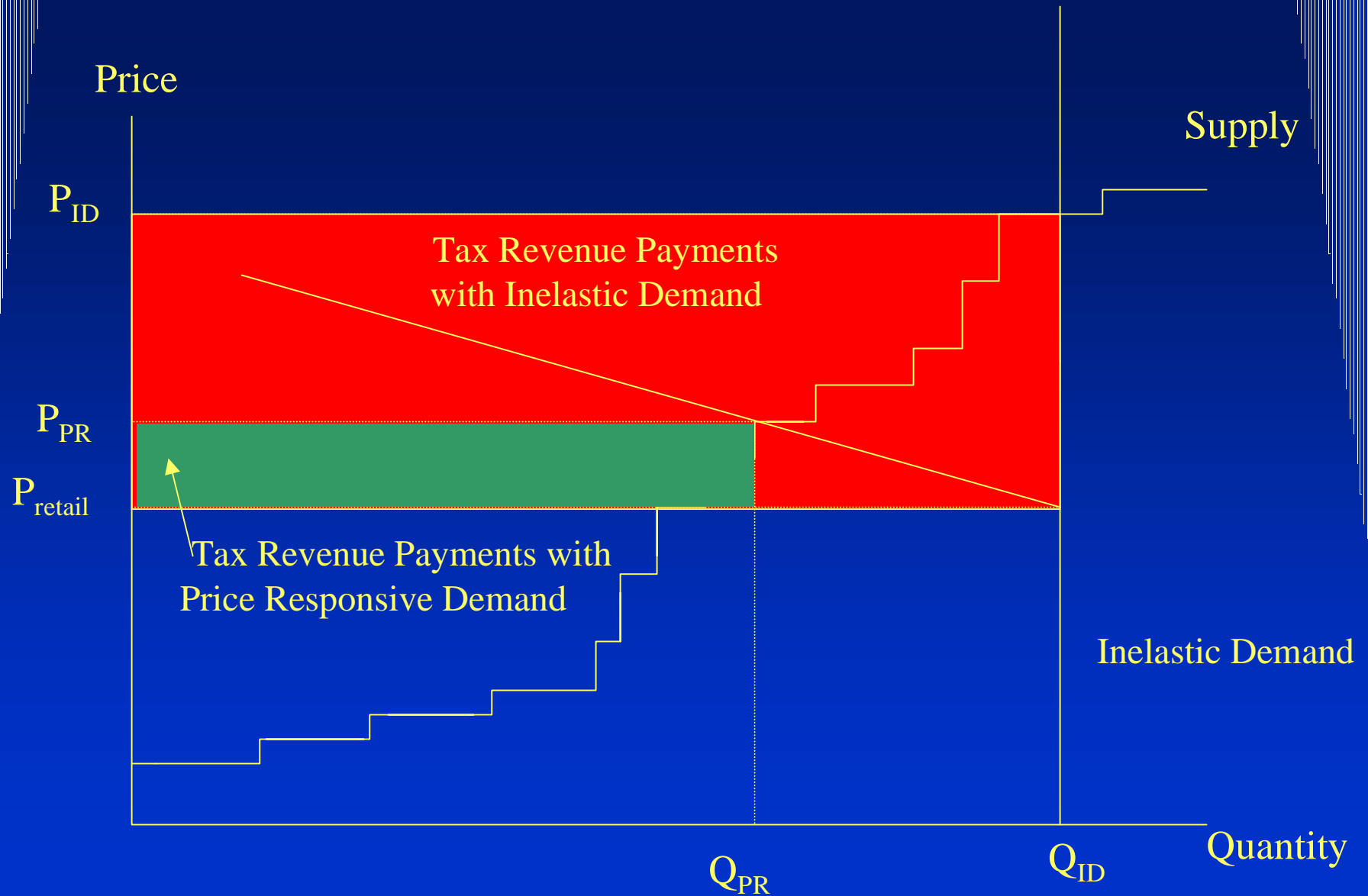
With real-time pricing
- Consumer pays $8.58
- California taxpayers pays $14.87 to consumer to take on real-time price risk.

Saving to California taxpayers and ratepayers = $4.05
- Ratepayer Saves $1.42
- Taxpayers Save $2.63

Real-Time Pricing versus Tax Revenue Financing

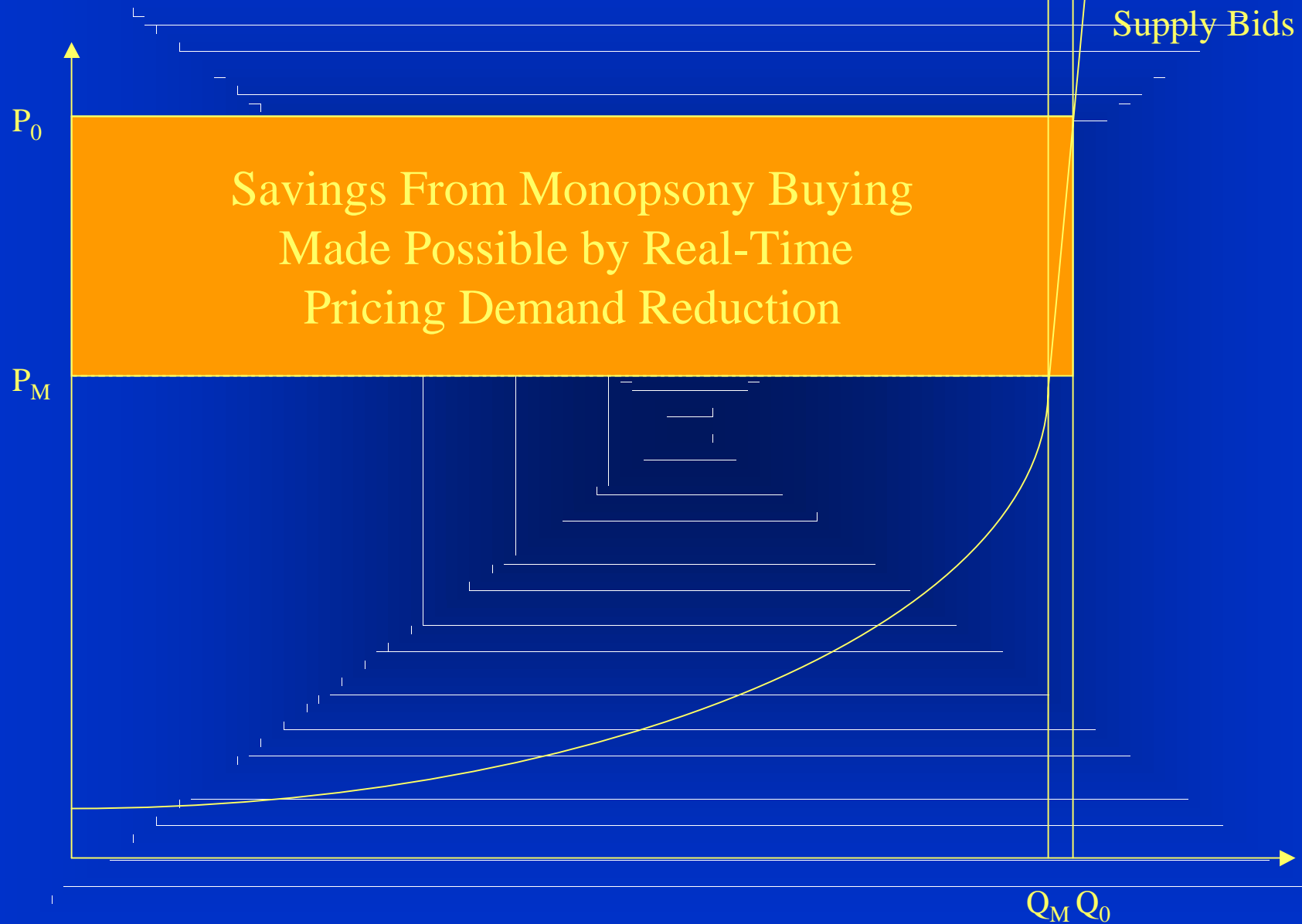# State Level Solution to California Crisis

- Real-time pricing
  - Mandatory for all large customers with interval meters
  - Mandatory interval meter installation as soon as possible
  - Each customer class paid to take on real time price risk
    - Area of small box
  - Different baseline allocation for different customer classes designed to provide each customer with the opportunity to reduce their bill by being price-responsive
  - Current retail rate hike for businesses makes above real-time pricing program even more attractive
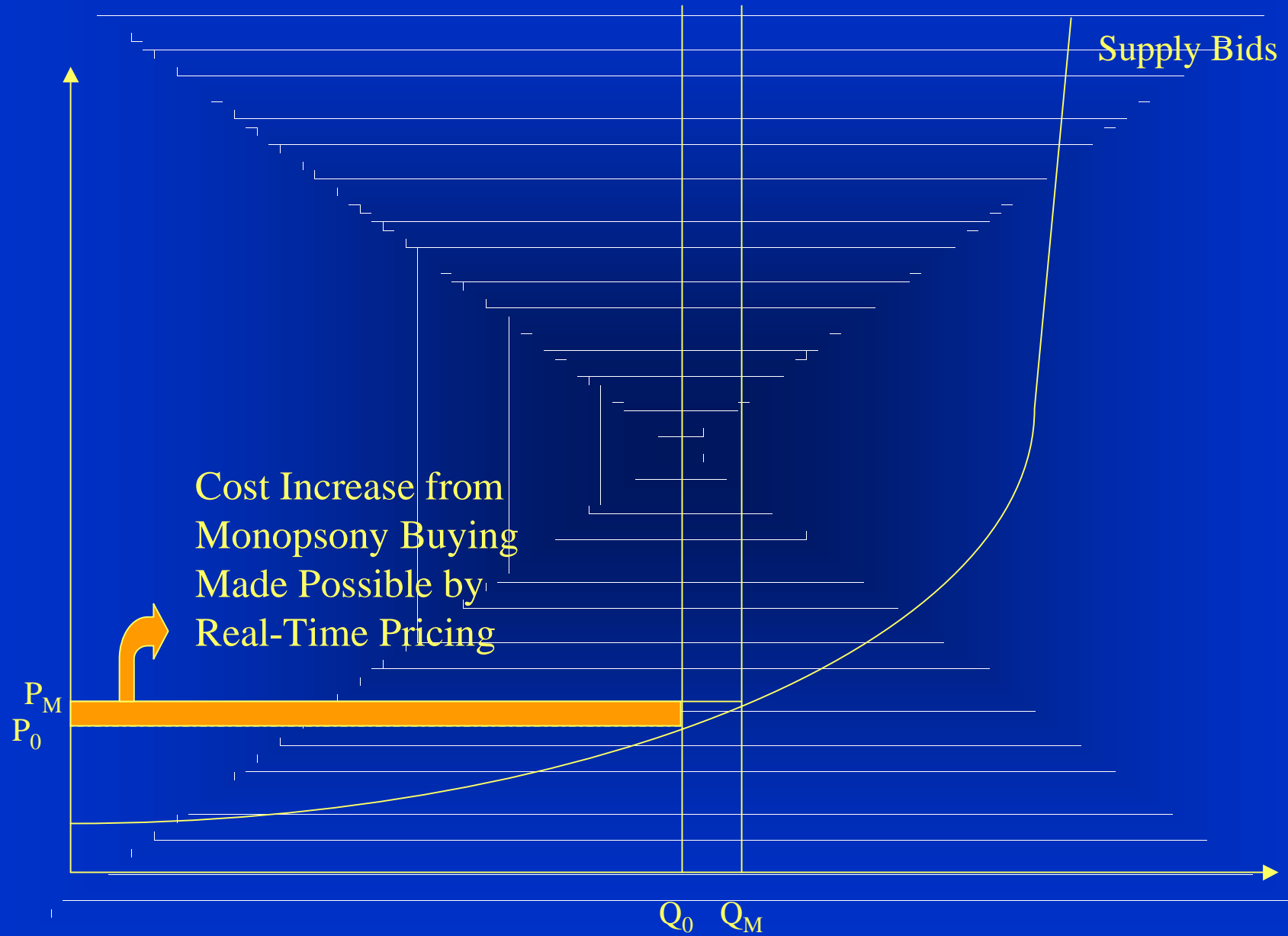
Real-Time Pricing

- With significant amount of load facing real-time prices, retailer can exercise monopsony power
    - Use price responsiveness of customers on real-time pricing contract to limit demand in certain hours
    - Bid demand into wholesale market in anticipation of this price responsiveness to minimize wholesale purchase costs
- This strategy has potential to save California billions of dollars in wholesale energy costs over next two years
    - Necessary condition is real-time pricing for as many megawatts as possible--all customers with interval meters

Peak Period Monopsony Buying

Supply Bids

P_0

P_M

Savings From Monopsony Buying
Made Possible by Real-Time
Pricing Demand Reduction

Q_M Q_0

Off-Peak Period Monopsony Buying

Supply Bids

Cost Increase from
Monopsony Buying
Made Possible by
Real-Time Pricing

P_M
P_0

Q_0 Q_M

Real-Time Pricing Allows Retailers to Obtain Lower Forward Contract Prices

Generators will recognize that effects shown on previous slides will operate to reduce spot prices and demand, particularly during high load periods

- This implies that spot market prices will be lower in future than they would be in the absence of significant real-time pricing

- The lower future spot prices that will result from a significant commitment to real-time pricing will create a lower opportunity cost to a generator signing a forward contract

- Consequently, generators will be more likely to sign forward contracts at lower prices than they would in the absence of a large commitment to real-time pricing

Immediate benefits to consumers to reducing market power in spot and forward markets from real-time pricing

- Only losers from real-time pricing are generators

Real-Time Pricing not Time-of-Use Pricing

Consumers must pay hourly wholesale price in hourly retail rate

Time-of-use pricing creates the same basic incentives as fixed-rate billing scheme--two fixed prices instead of one

Time-of-use pricing may not yield lower average spot electricity prices or increase incentives for generators to sign low-priced forward contracts

Time-of-use pricing creates similar incentives to those from load-profile billing

Mandatory Program is Needed

California is in state of emergency

Everyone must do their part

Customers with real-time meters currently in place can help the most and be rewarded for helping

Those without real-time meters cannot

If program is mandatory, California can have more than 10,000 MW of load on real-time pricing by Summer of 2001

Using real-time pricing program of this magnitude, California can save billions of dollars over Summer of 2001

Voluntary Program

- Only customers that will accept program are those who can earn higher profits with little change in load profile
- Voluntary program will show little shifts in demand due to real-time pricing
- Real-time pricing will be deemed a failure for wrong reason
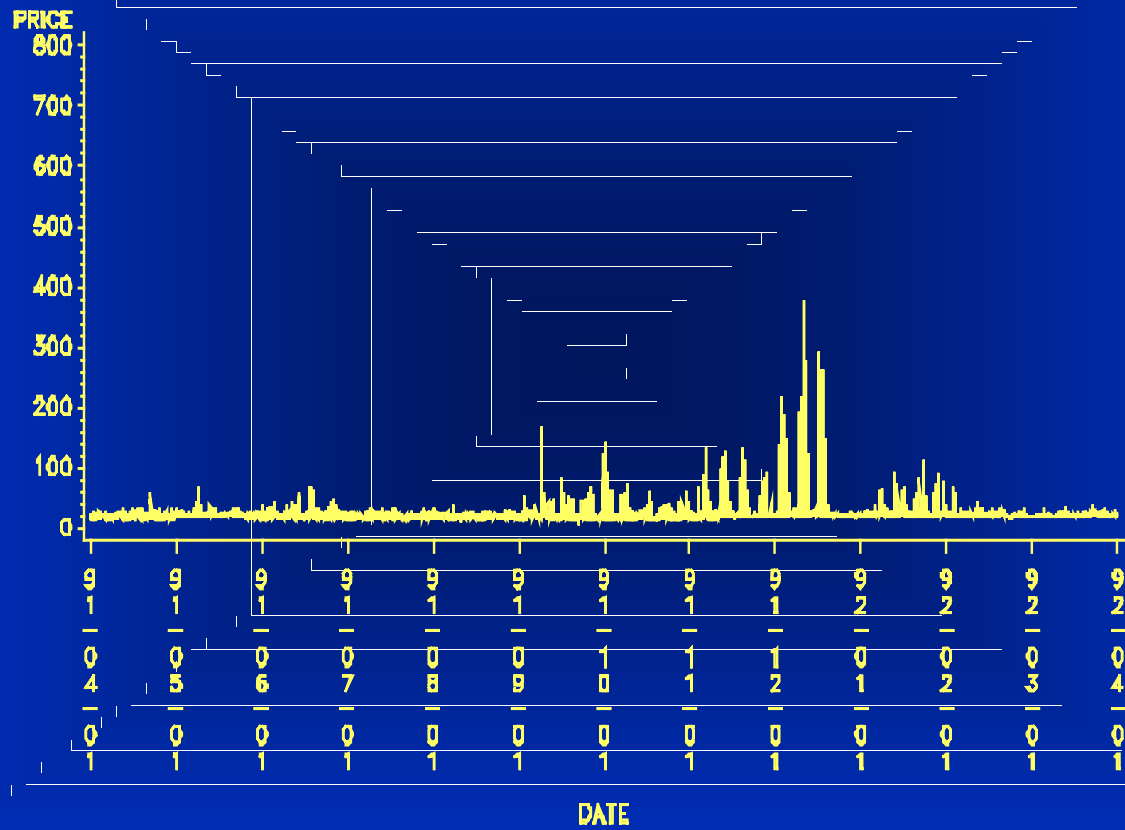 - Already know voluntary program will have little impact
- A small program eliminates ability to exercise monopsony power and save California billions of dollars over next two years

Real-time pricing contracts

- All England and Wales retail customers have option to purchase hourly consumption according to hourly pool price plus transmission charge

- Many large industrial customers purchase according to this pool price contract

- "Estimating the Customer-Level Demand for Electricity Under Real-Time Market Prices" Patrick and Wolak

- Estimate half-hourly price responsiveness of a sample of large industrial and commercial customers in England and Wales

  – Significant price response from all classes of industrial customers-- water suppliers, industrial process plants, retail stores

  – Even with a small fraction of these customers bidding into demand side of pool, market power can be mitigated.

Figure 2 (a)

Price 91-92

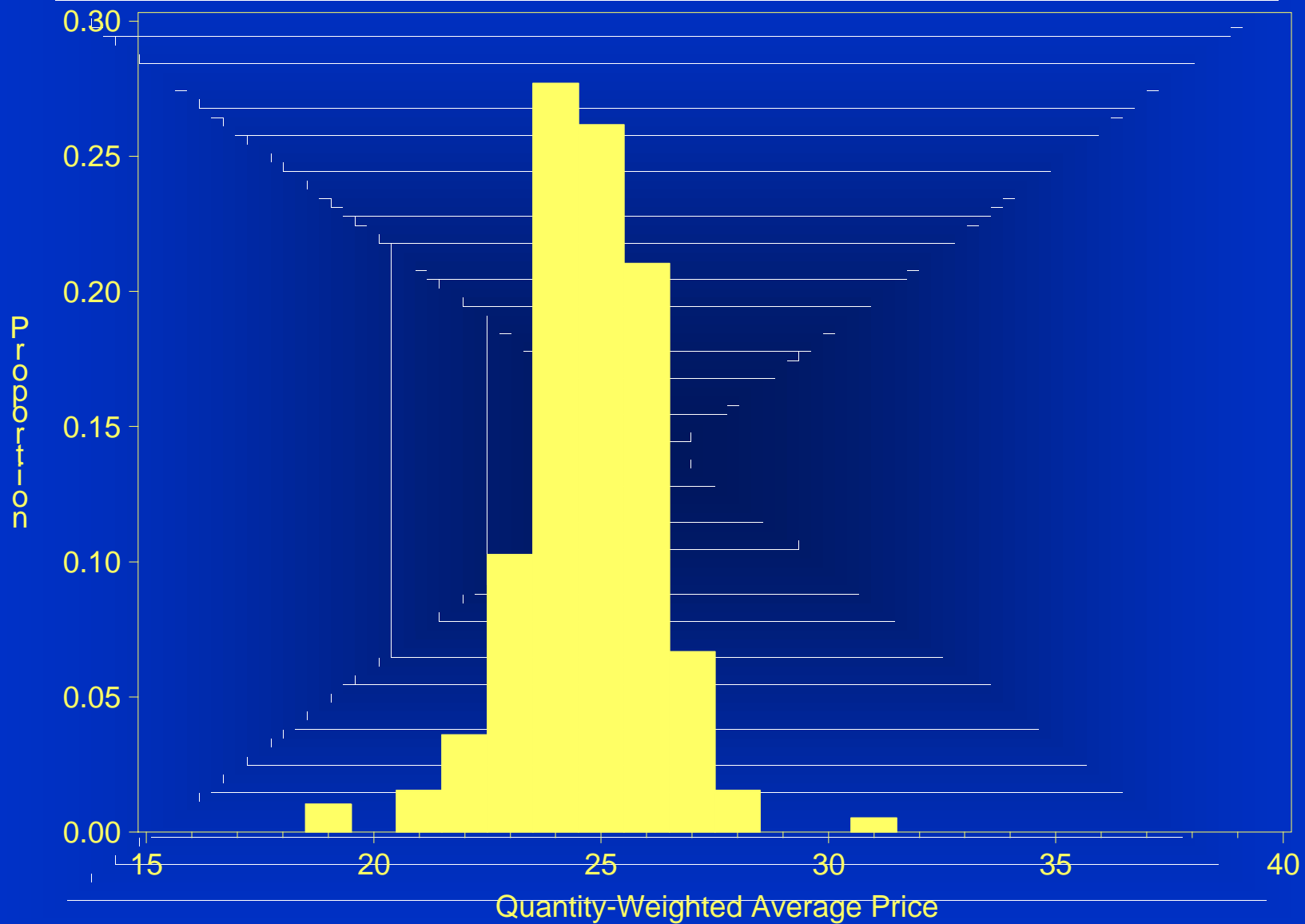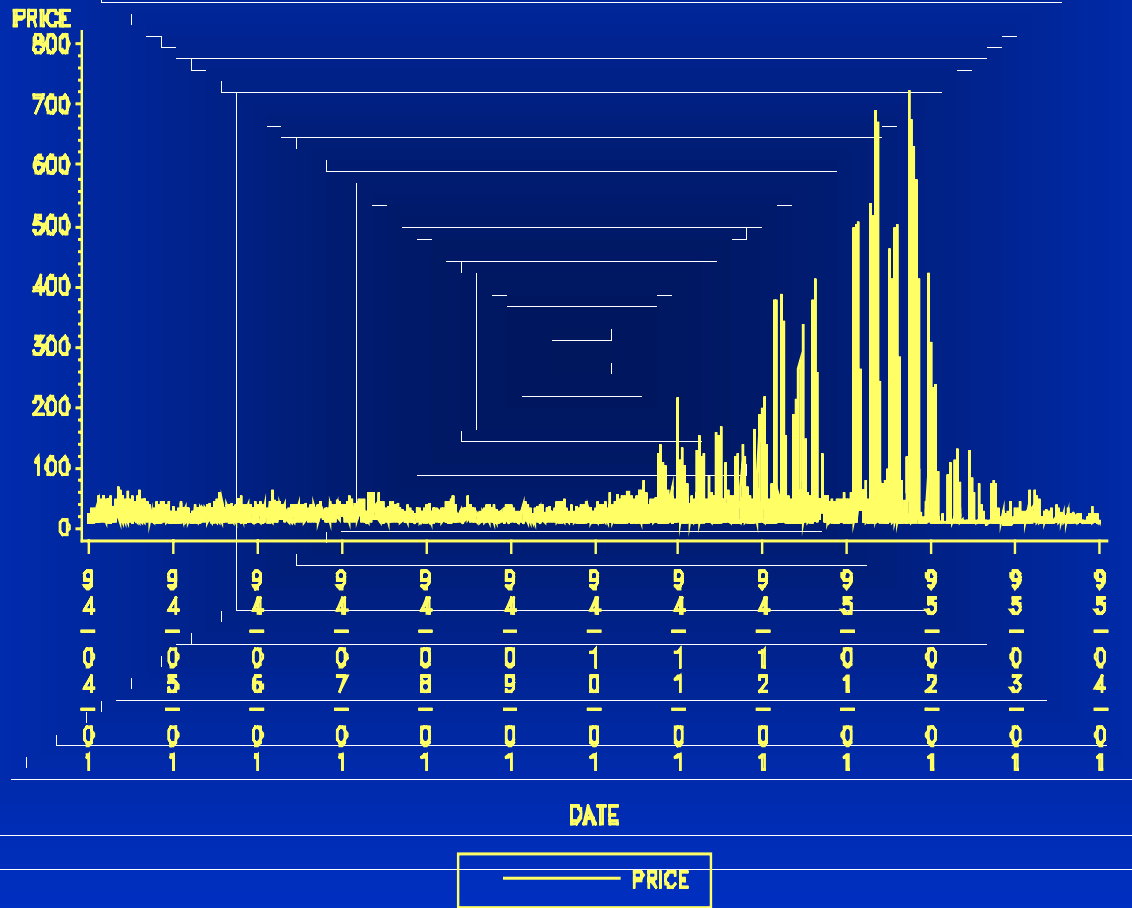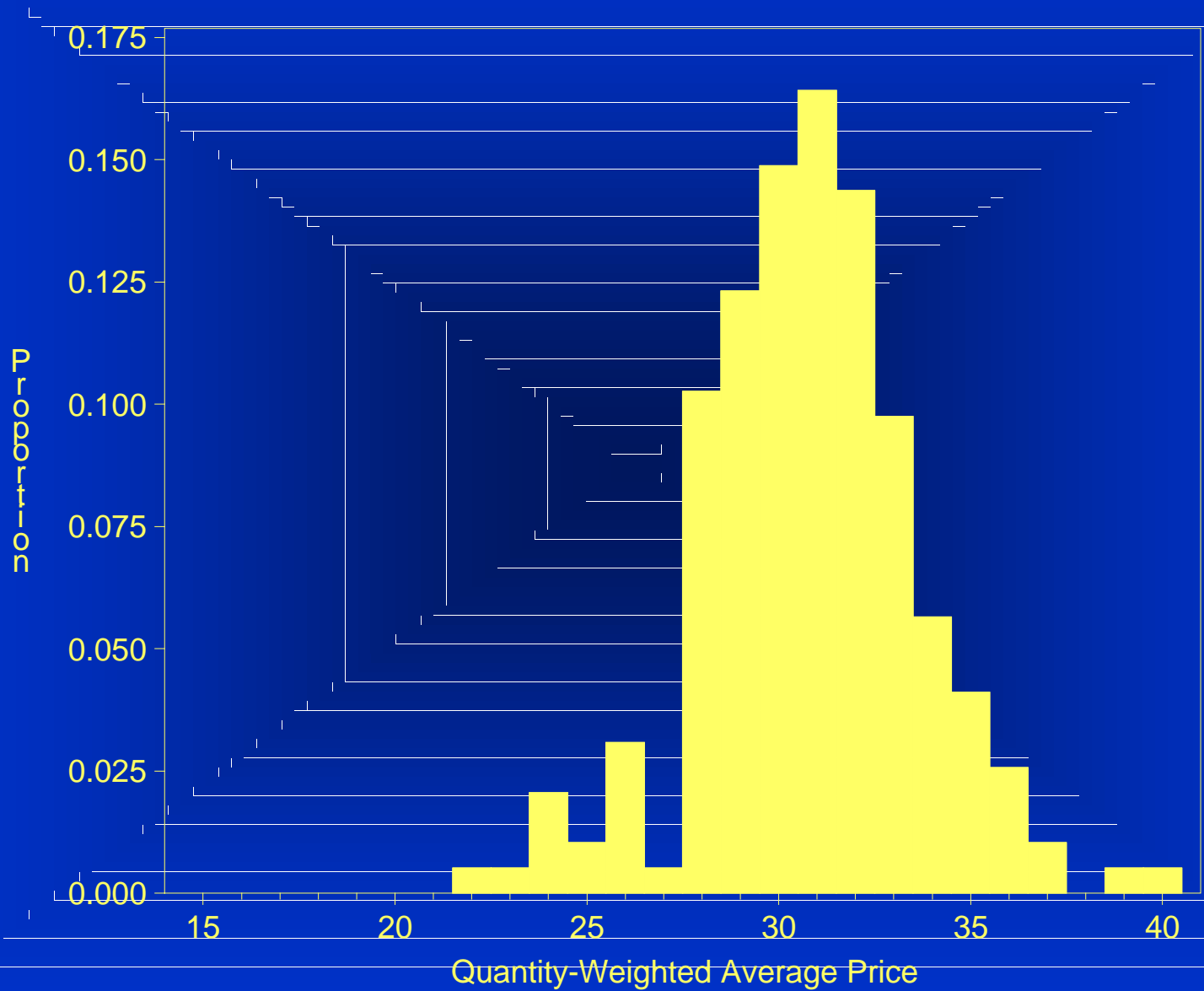Average Prices for FY 1991 Across RTP Retail Customers

Figure 2 (d)

Price 94–95

PRICE

800 —
700 —
600 —
500 —
400 —
300 —
200 —
100 —
0 —

| 94-04-01 | 94-05-01 | 94-06-01 | 94-07-01 | 94-08-01 | 94-09-01 | 94-10-01 | 94-11-01 | 94-12-01 | 95-01-01 | 95-02-01 | 95-03-01 | 95-04-01 |

DATE

PRICE

Average Prices for FY 1994 Across RTP Retail Customers

Load-Profile Billing

- Measure total monthly consumption of electricity
- Representative load shape used to compute weighted-average energy price for month
  - p(h,d) = price for hour h of day d,
  - w(h,d) = weigh for hour h of day d, $\sum_{h,d} w(h,d) = 1$
  - Monthly bill = (monthly consumption) x (monthly weighted-average energy price). $\sum_{h,d} w(h,d) p(h,d) = p$
- Demand reduction when hourly energy price is $0/MWh leads to same monthly savings as same demand reduction when hourly price is $250/MWh.
- Want consumer to realize maximum benefit from reducing consumption when wholesale price is highest
  - Imagine difficulty in running competitive long-distance telephone company only measuring minutes of phone use per month

Robust Retail Competition Requires Real-Time Metering

- Without real-time metering, competition takes place on one dimension
  - Monthly average price
- Recall that conventional meters only measure total monthly consumption of electricity
- Firms have no idea who in a given customer class is more expensive to serve in terms of wholesale energy costs
- No surprise there is little retail competition
- With real-time meters competition can take place on
  - (hours of the 24)*(Days of the Month), p(h,d) = price for hour h of day d
  - May not need all of these dimensions, but with widespread real-time metering there will be robust retail competition
- Recall dimensions that service measurement in telephony

July 2000 Avg. Hourly System Loads
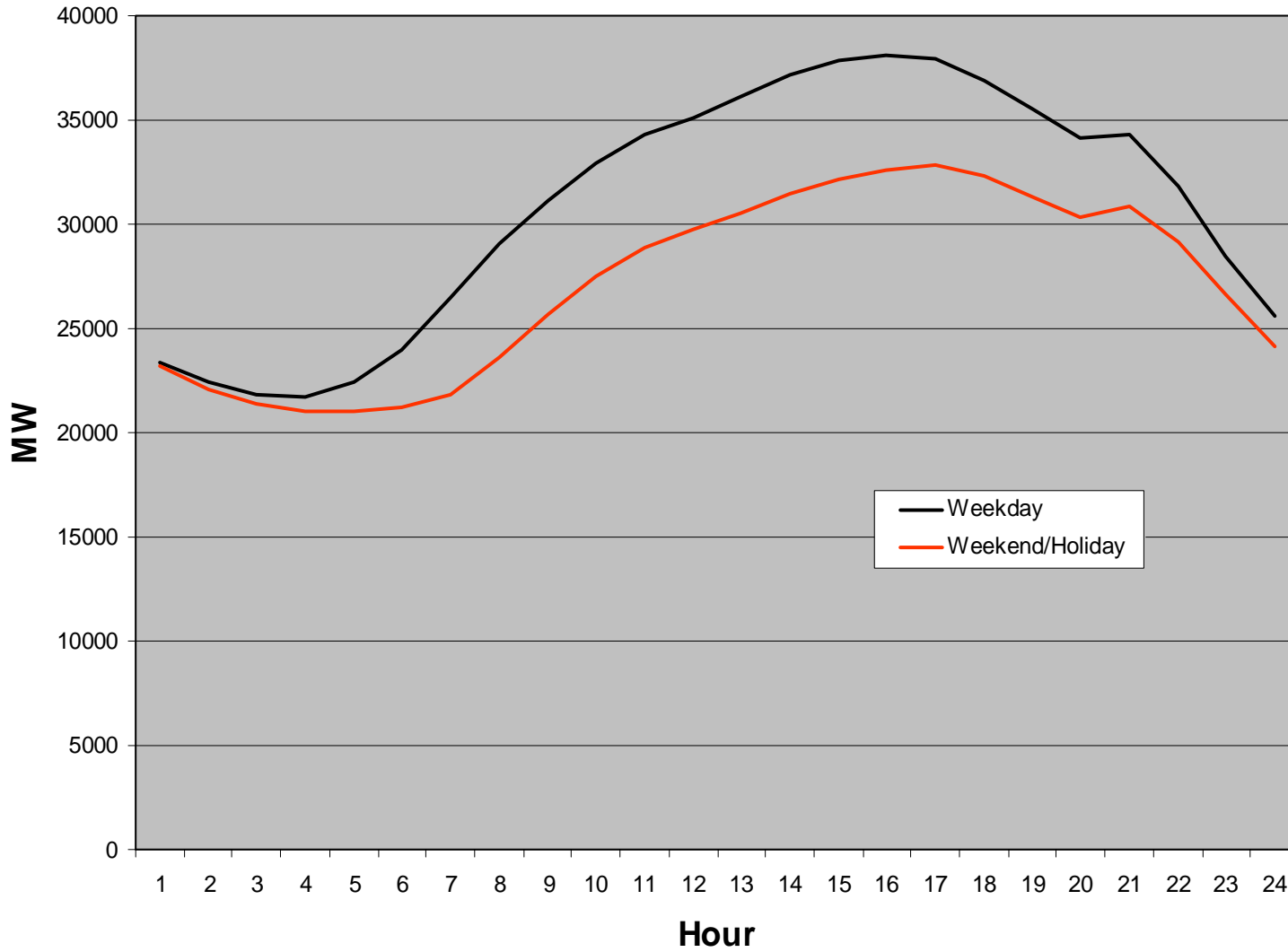
January 2000 Avg. Hourly System Loads