The Brattle Group

THE ECONOMICS OF DYNAMIC PRICING FOR THE MASS MARKET

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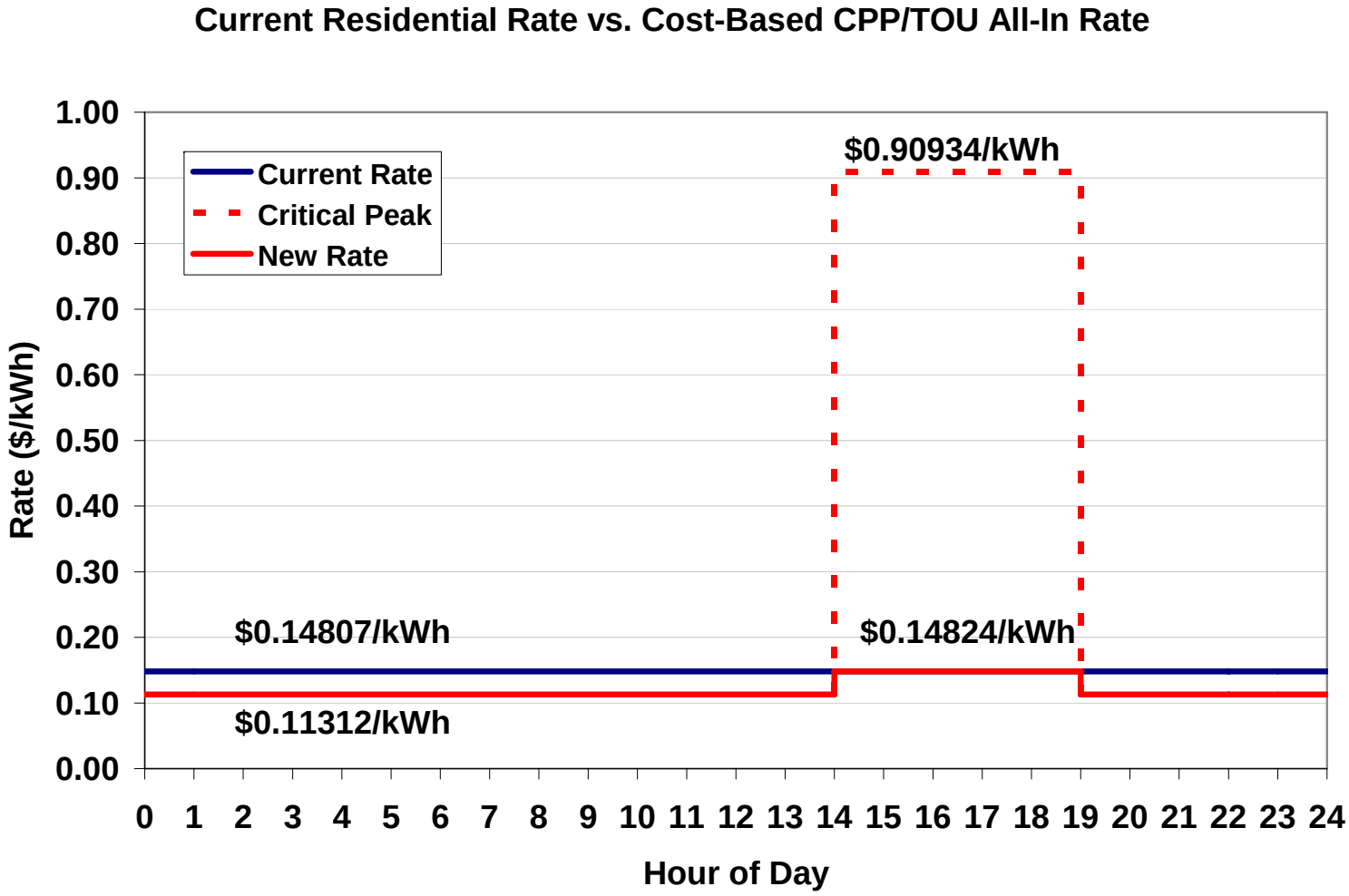
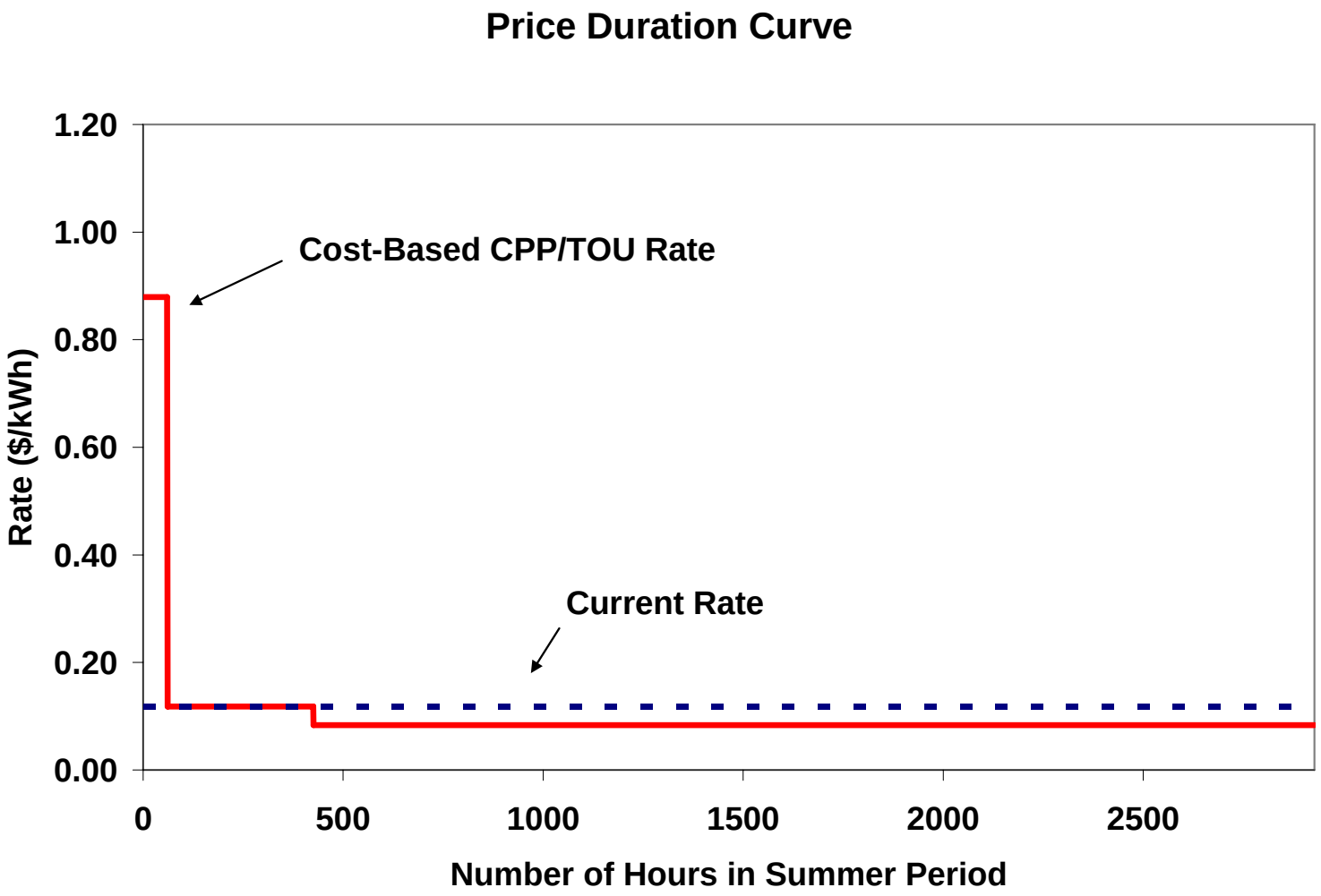
Critical-peak pricing (CPP) is a popular form of dynamic pricing



CPP provides customers with an incentive to reduce peak usage and lower their monthly bill



Peak-time rebate (PTR) is gaining in popularity

- Customers face their standard rates at all times
  - In the previous example, that was 14.8 cents/kWh
- However, if they cut their consumption during peak hours, they earn a rebate on every kWh curtailed
- The amount of the rebate is set based on the same principles that were used to set the critical-peak price
  - In the previous example, the rebate is 76.127 cents/kWh (or 90.9 cents – 14.8 cents per kWh)
- This requires knowing the amount that the customer would have consumed *but for* the rebate
  - Statistical techniques are available for estimating this amount

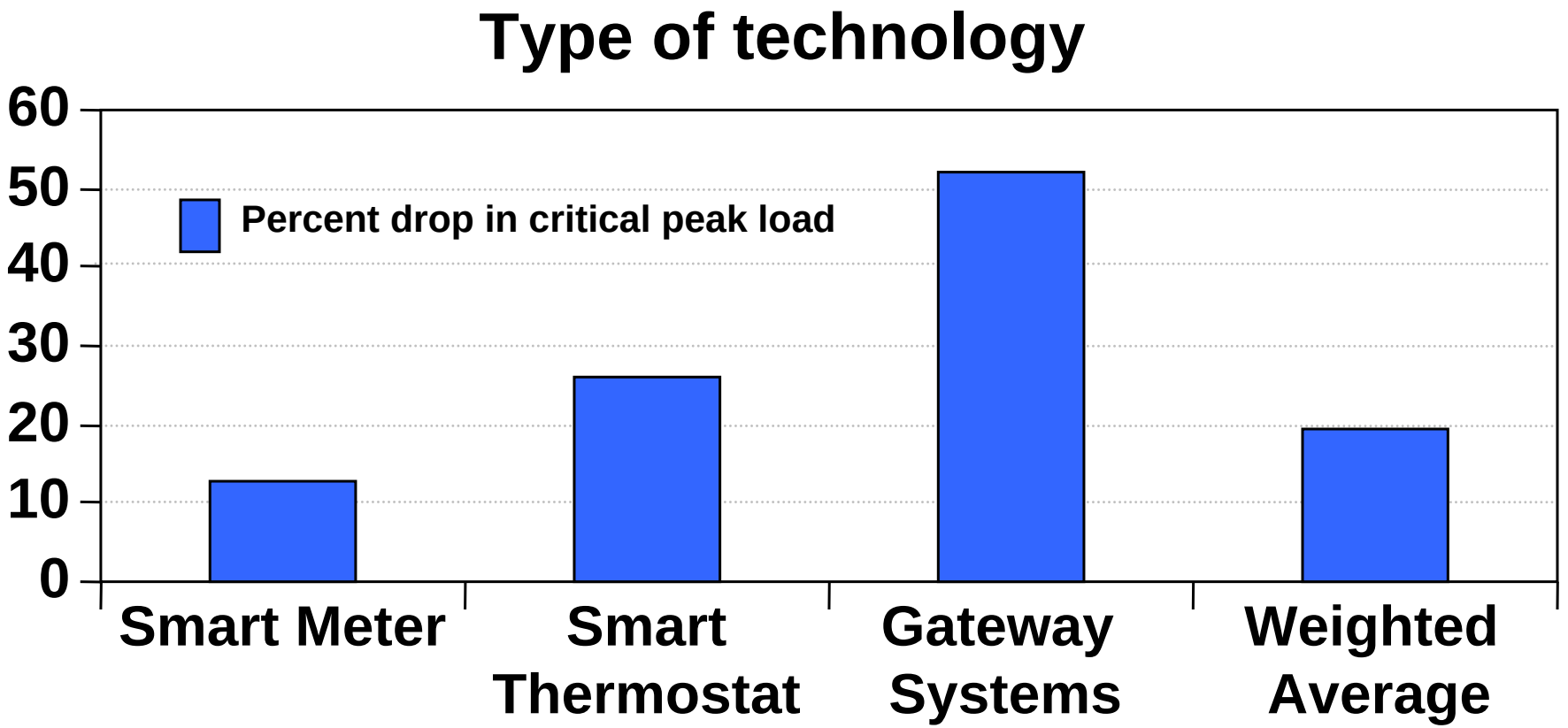
Will customers exhibit demand response?

- Yes, according to dozens of experiments that have been carried out over the past 30 years in Europe and North America
- Most of the early experiments involved conventional time-of-use (TOU) rates
- Recent experiments feature dynamic pricing and TOU rates

The most comprehensive evidence comes from California's statewide pricing pilot (SPP)

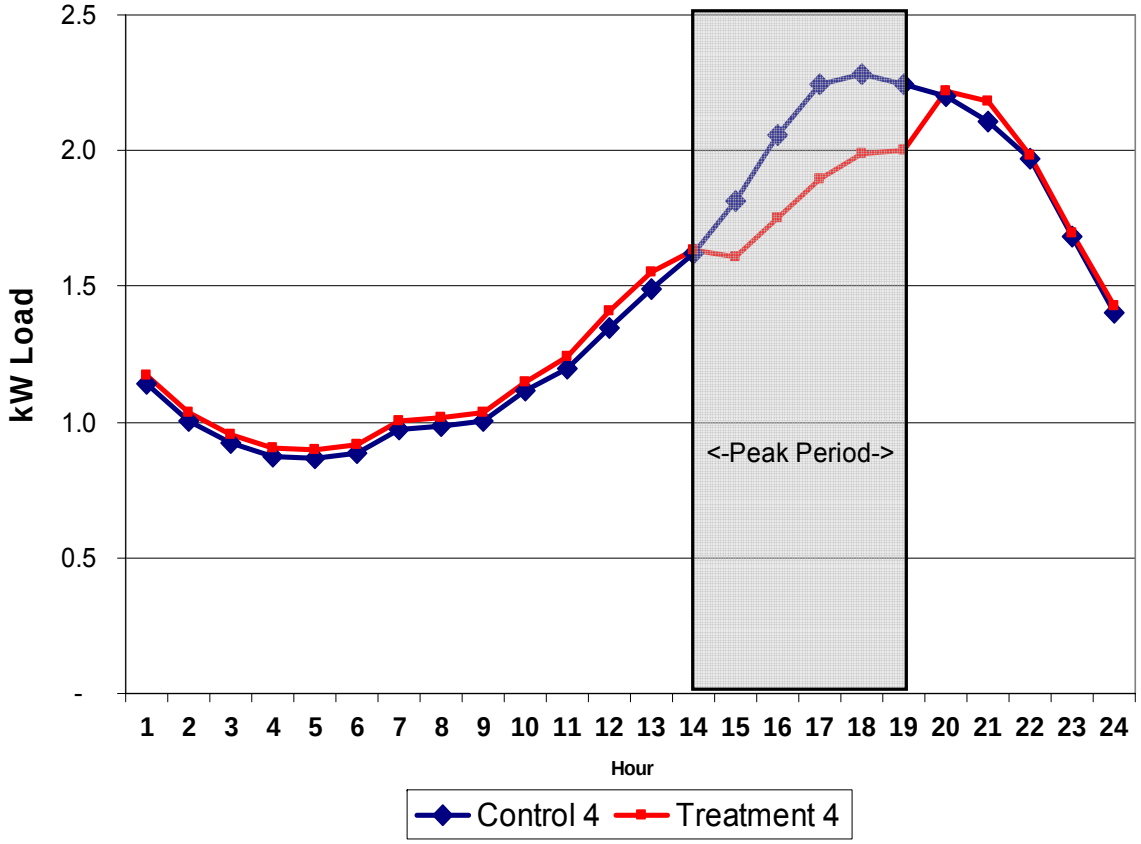
- It involved 2,500 residential and small commercial and industrial customers over three years (2003-05)
- The results were reviewed by staff at two state commissions, three investor-owned utilities, equipment vendors and intervenors
- On average, residential customers dropped peak loads on critical days by 13 percent
  - Critical period rates were five times higher than existing rates, which averaged 13 cents per kWh)
- Customers with central air-conditioning (CAC) dropped loads by 16 percent while those without CAC dropped loads by 8 percent
- 30% of the customers accounted for 80% of the impact
  - Not every customer has to respond for dynamic pricing to have a significant impact on system loads

In the SPP, enabling technologies boosted the drop in critical peak loads

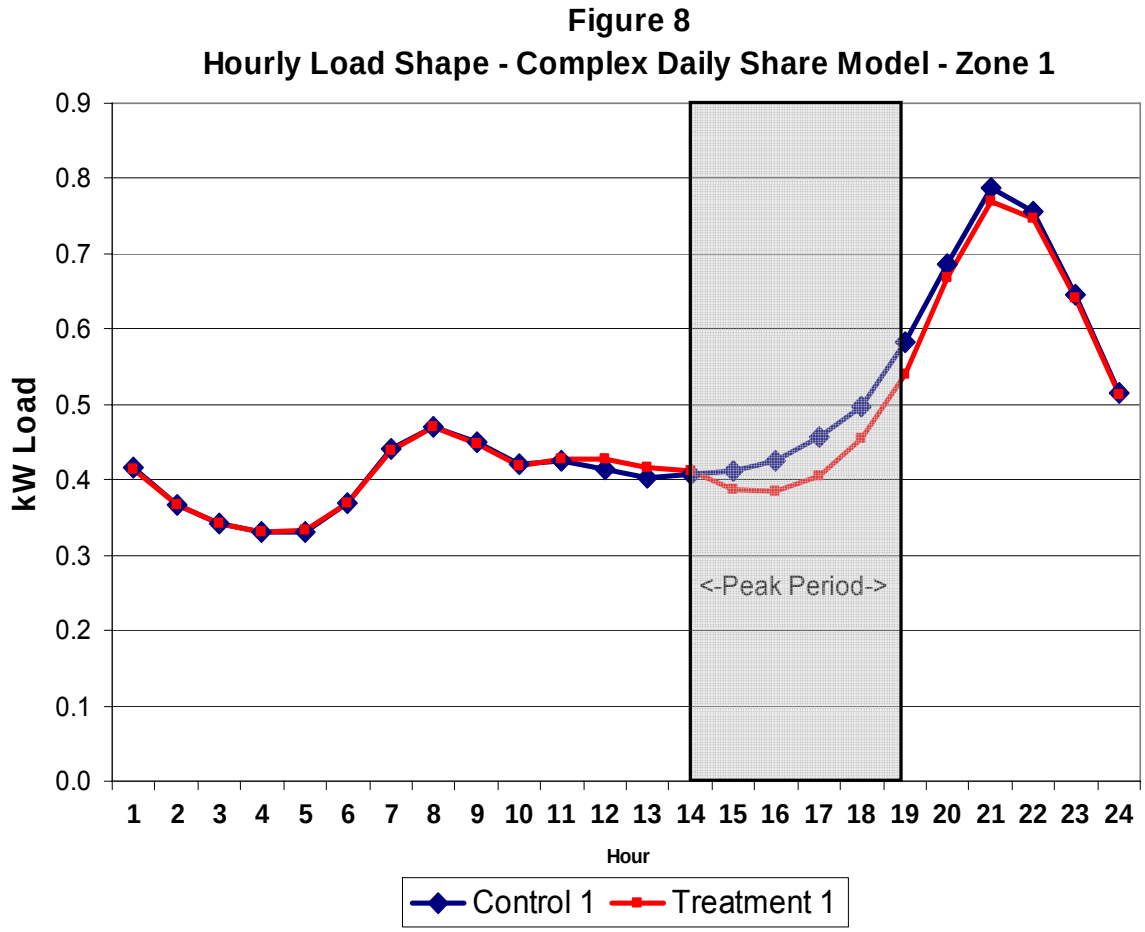


Dynamic prices have a substantial impact in a hot climate such as the Central Valley's

Figure 11
Hourly Load Shape - Complex Daily Share Model - Zone 4



They produce an impact even in a mild climate such as San Francisco's



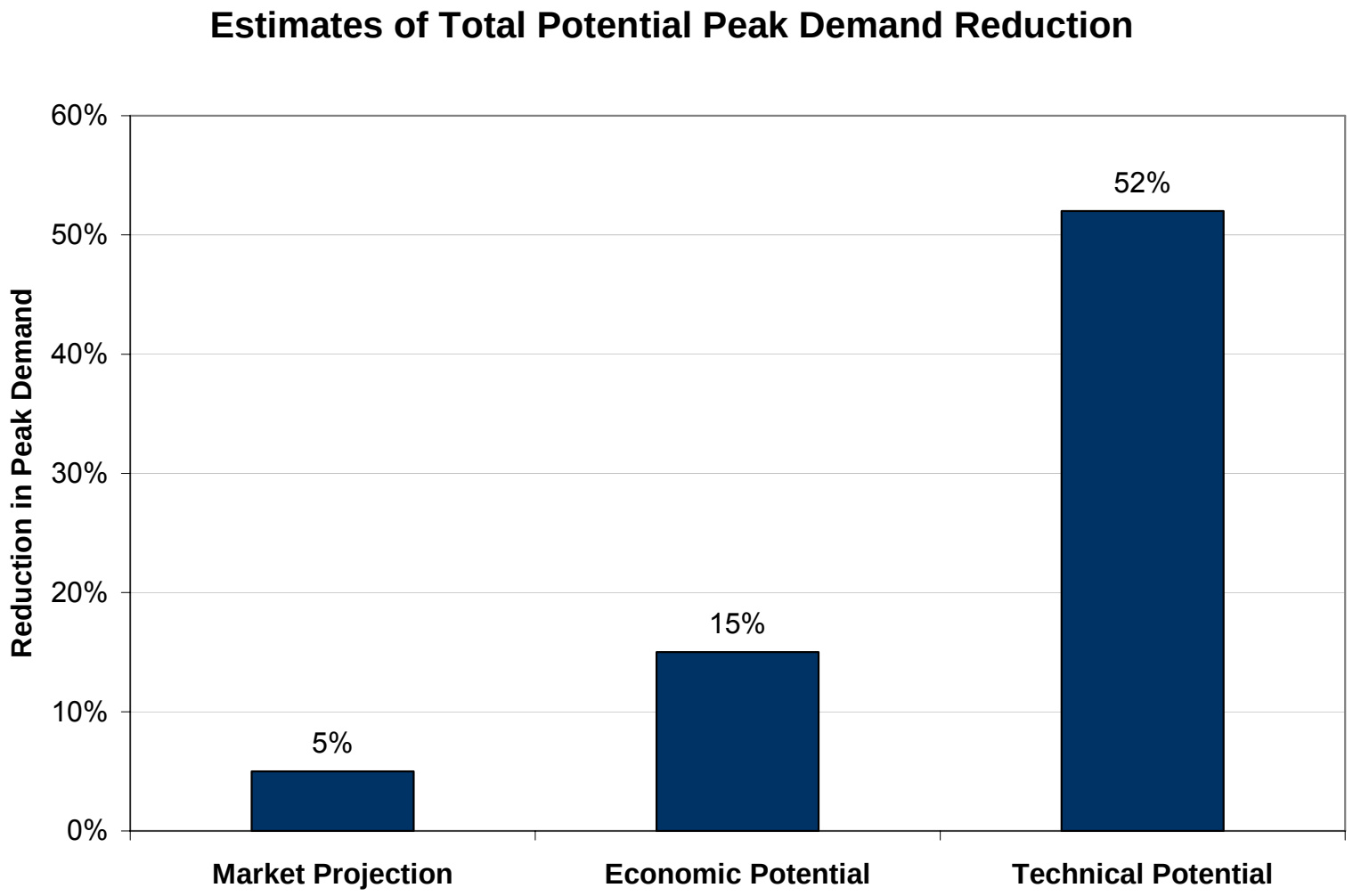
Can you make use of the SPP results?

- All three utilities in California have used the results in their filings with the California PUC
- The SPP has yielded a public domain software (PRISM) that allows you to tailor the California results to your service area (see next slide)
- This information can be used to carry out an initial analysis
- For a definitive assessment, you may wish to conduct your own pilot

Five questions that will shape the future of dynamic pricing

1. What is the likely impact of dynamic pricing on peak demand?
2. What is the value of this demand response (DR)?
3. Does price responsiveness vary by customer and region?
4. How can we make dynamic pricing attractive to customers?
5. What is the best way forward?

#1. Dynamic pricing can lower system peak demand by 5 percent but the economic and technical potential is much higher

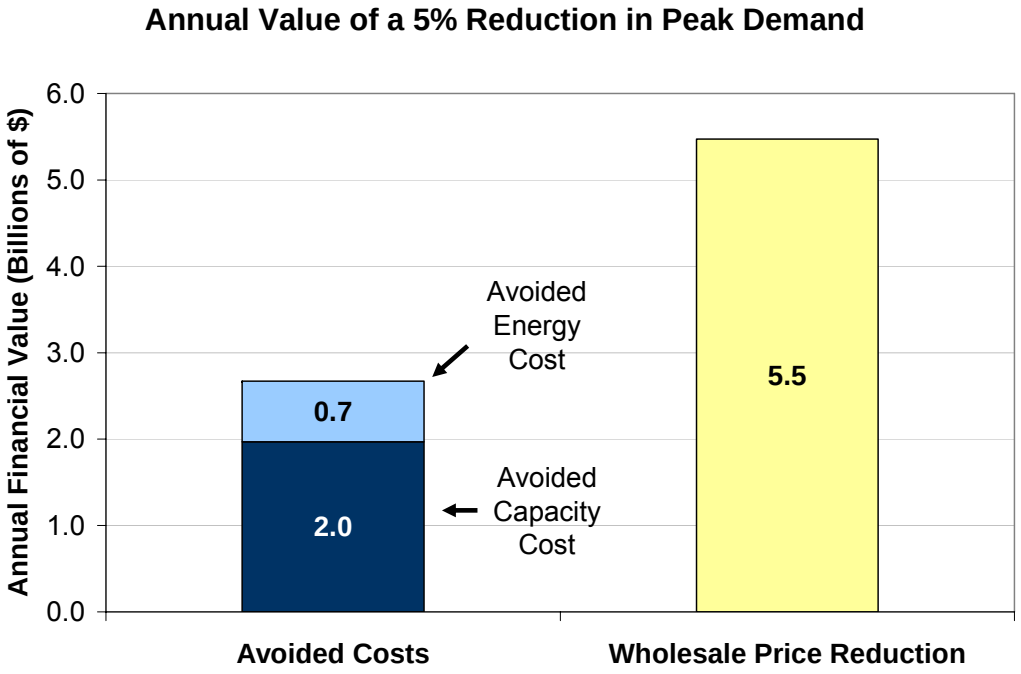


#2. A 5 percent reduction in US peak demand is worth $31 billion over a 20-year period, just based on avoided costs

Assumptions

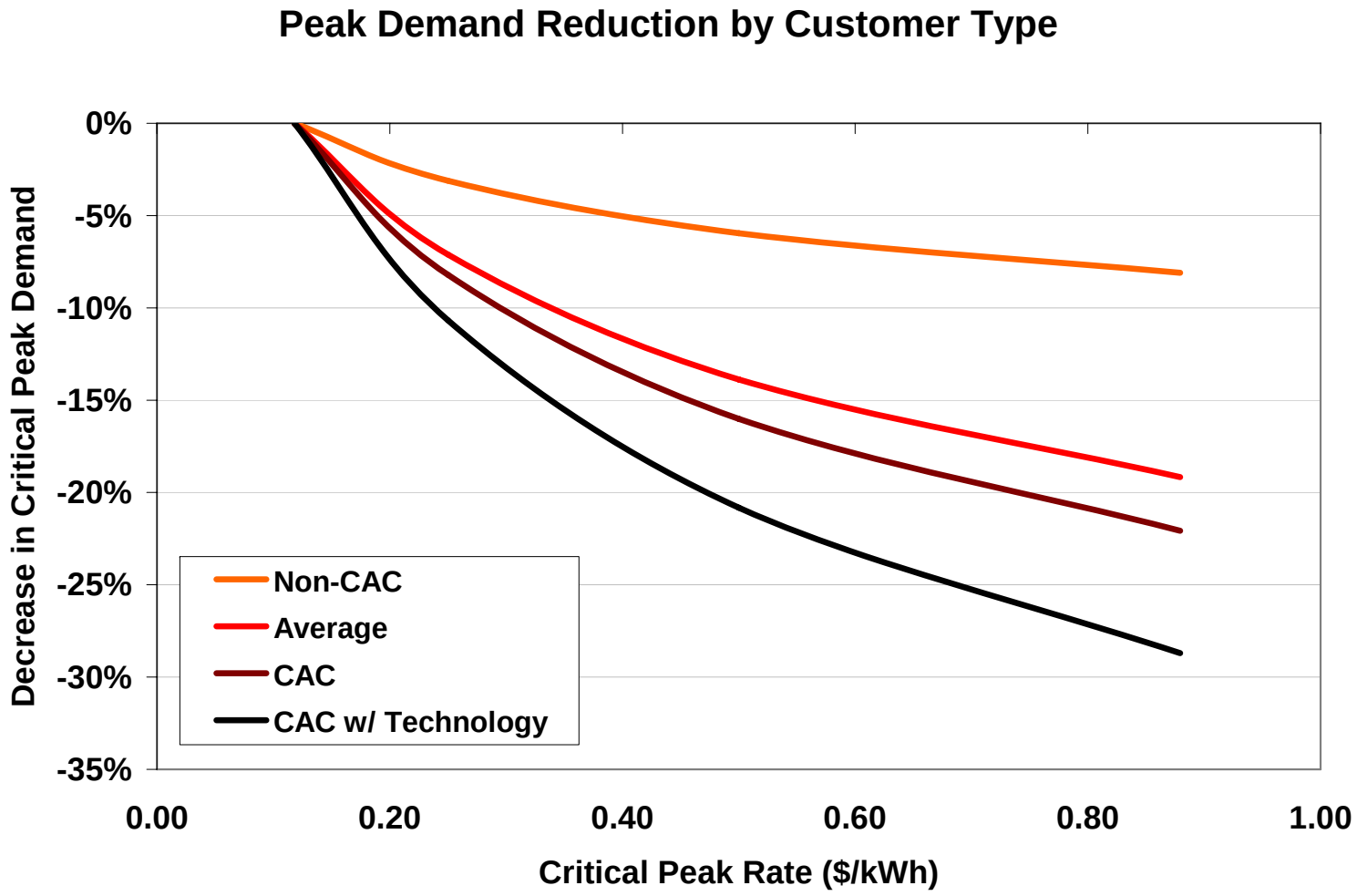
- 5% demand reduction in 757 GW
- $52/kW-year capacity price
- 20 year horizon
- 15% discount rate
- 2% peak growth rate
- Avoided cost of energy is 36% of avoided cost of capacity*
- Value of wholesale price reduction is 278% of avoided cost of capacity*

*Derived from a study on the value of DR in PJM:
The Brattle Group, 2007, *Quantifying Demand Response Benefits in PJM*, Prepared for PJM and MADRI



NPV of Avoided Costs = $31 billion

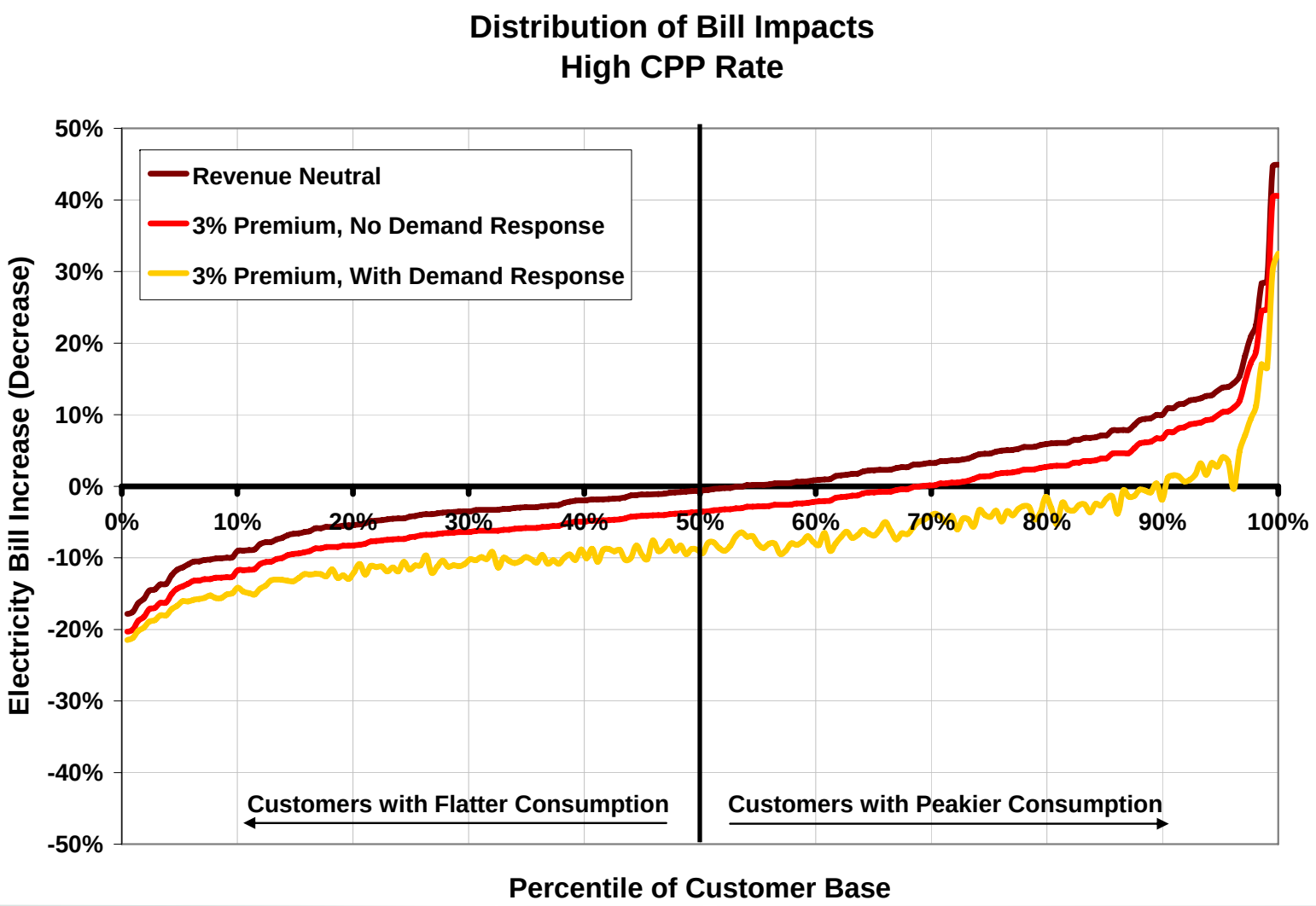
#3. Customer response in the mass market varies by end-use and enabling technologies (source: California's statewide pricing pilot)



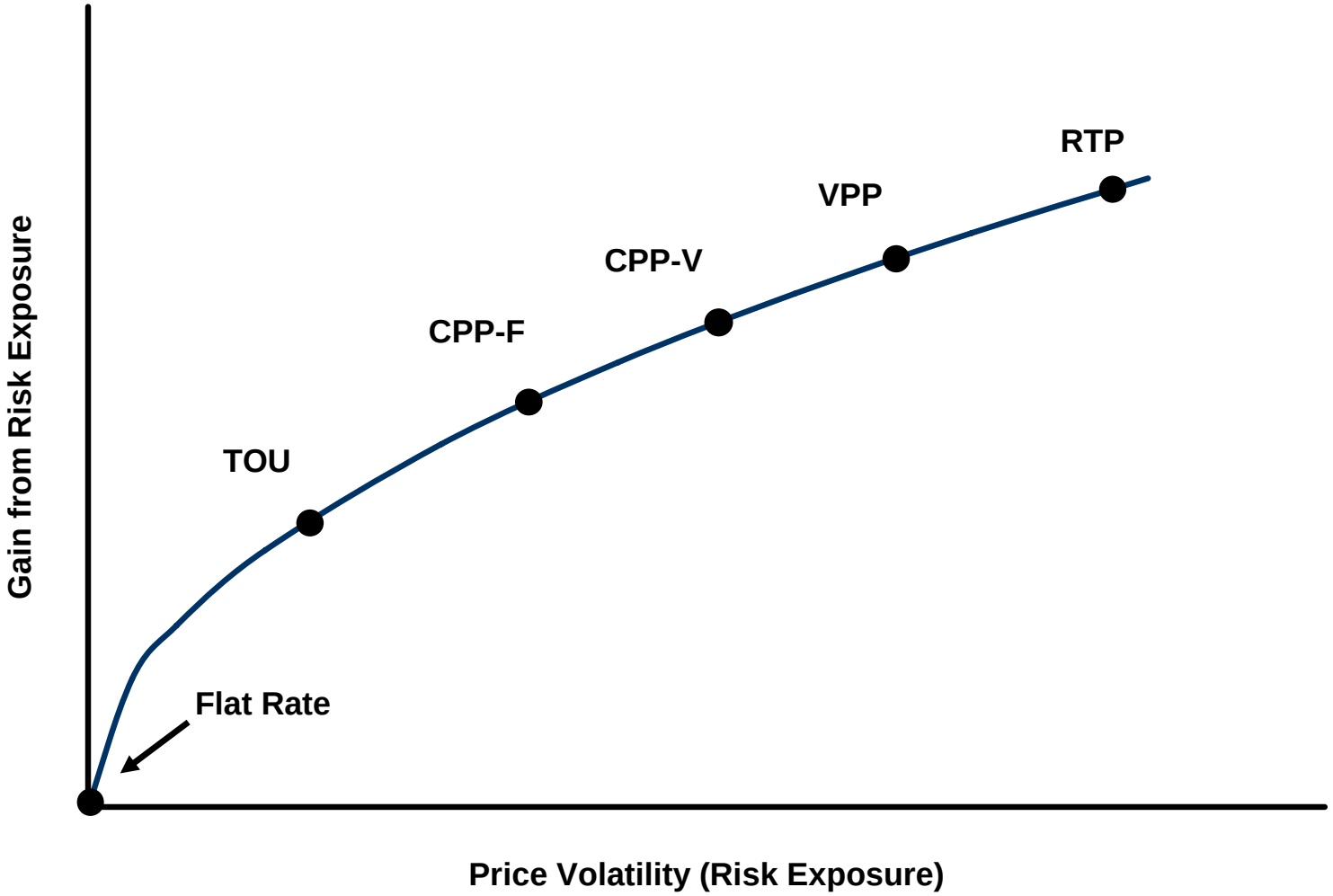
#4. By giving a credit equal to the hedging premium, dynamic pricing can be made attractive to customers

- Analysis of rates offered by competitive retailers seem to embody an implicit premium of 15-40 percent for a fully hedged service
- A recent study by ISO-NE found that risk premiums vary by pricing plan
  - Day-ahead real-time pricing (RTP): 3-5 percent
  - TOU: 8 percent
  - Flat rate: 15 percent
- Based on Monte Carlo simulations with a standard financial formula, it is reasonable to say that the hedging premium is a minimum of 3 percent

Even applying a 3 percent credit vastly expands the appeal of dynamic pricing



#5. The way forward is to offer customers a menu of dynamic pricing options, each of which reflects a credit equal to its hedging premium



Additional reading

- **Ahmad Faruqui and Lisa Wood, "Quantifying the benefits of dynamic pricing in mass markets," Prepared for Edison Electric Institute, 2007, forthcoming**

- **Federal Energy Regulatory Commission (FERC), "Demand Response and Advanced Metering," Staff Report, August 2006**

- **Plexus Research, Inc., "Deciding on Smart Meters," Edison Electric Institute, September 2006**

- **The Brattle Group, "Quantifying the benefit of demand response for PJM," prepared for PJM Interconnection LLC. and MADRI, January 2007**

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