The Brattle Group

THE BENEFITS OF DYNAMIC PRICING IN MASS MARKETS

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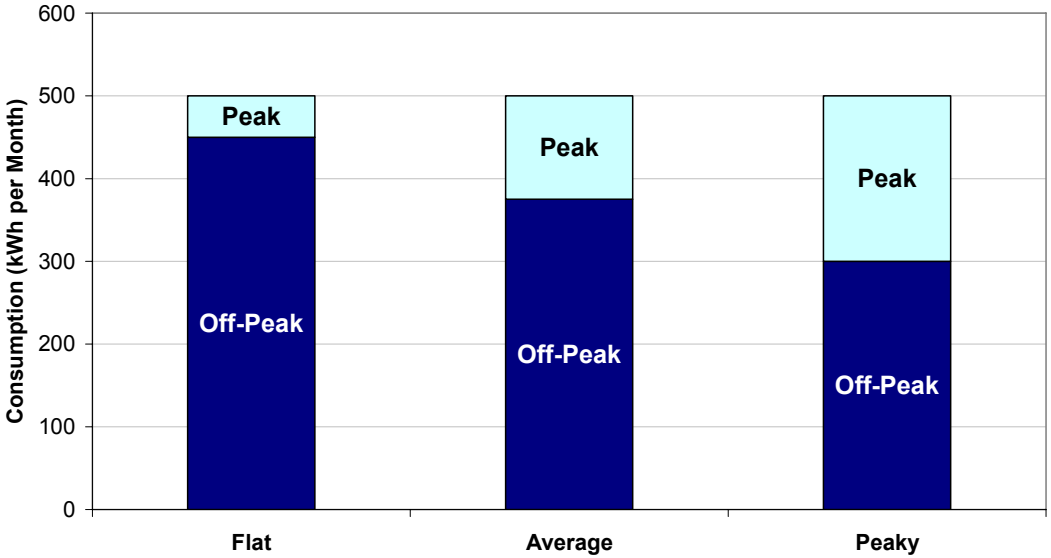
Précis

- Many utilities are considering the system-wide deployment of smart meters
  - They can improve utility operations and the cost savings can cover a substantial portion of the multi-million dollar investment
  - However, depending on the utility, the "gap" between operational benefits and AMI costs may still be quite large
- One way of bridging the gap is to use smart meters as a means of providing "smart" prices to customers that would induce demand response, obviating the need for expensive peaking capacity and energy
- As a bonus, smart pricing would eliminate an important inequity in existing rate designs
  - Consumers who use relatively less power during expensive peak periods subsidize others

The inequity in flat rates may amount to $4 billion dollars for a state with 10 million customers

Load Shapes by Customer Type
(10 million customers total)



Rates

Flat = $0.10/kWh

Peak = $0.20/kWh

Off-Peak = $0.067/kWh

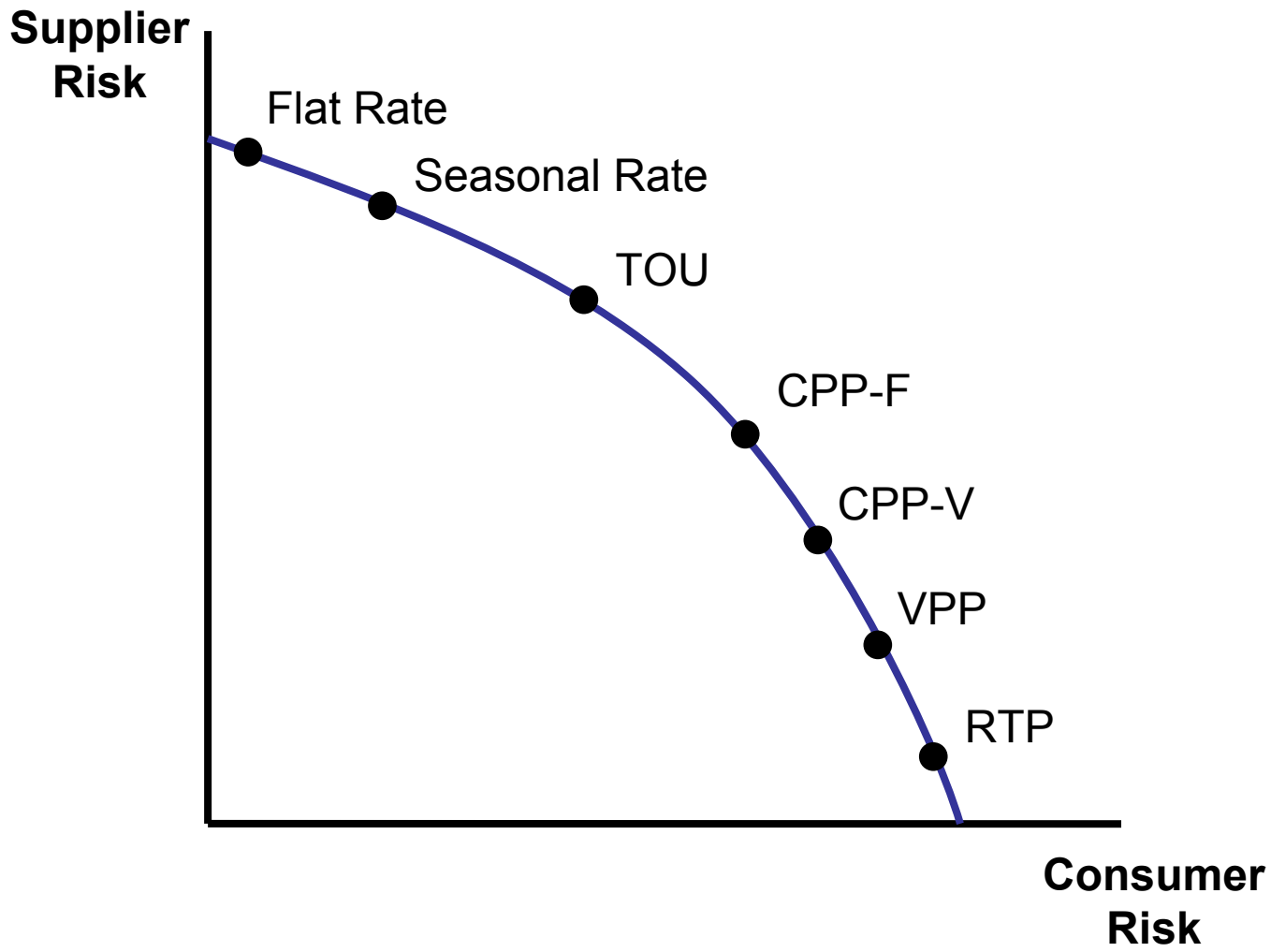
Amount of Cross-Subsidy

Per customer = **$10/month**

Total per month = **$33.3 million**

NPV (10 years) = **$3.9 billion**

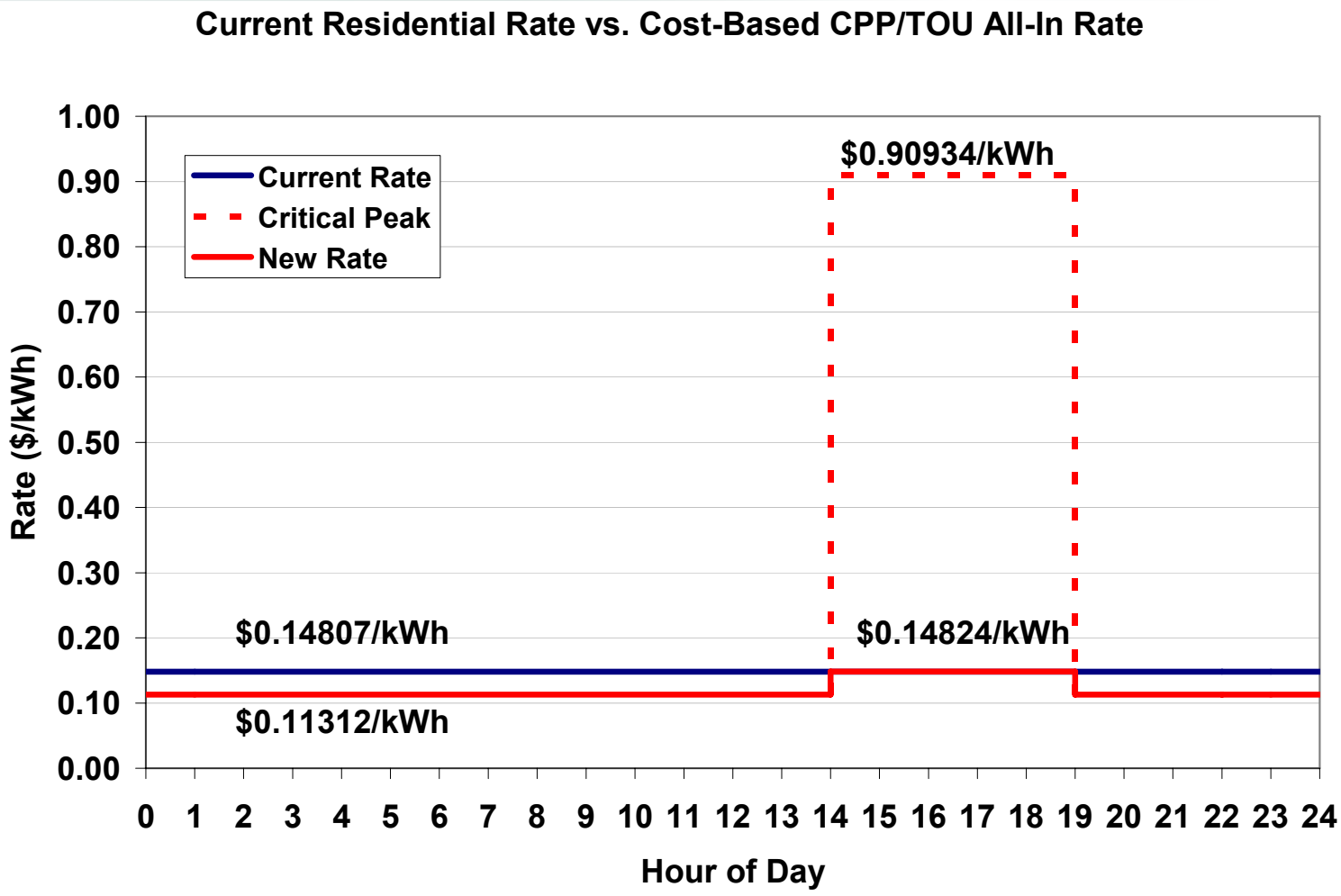
Smart prices allow for risk sharing between suppliers and consumers



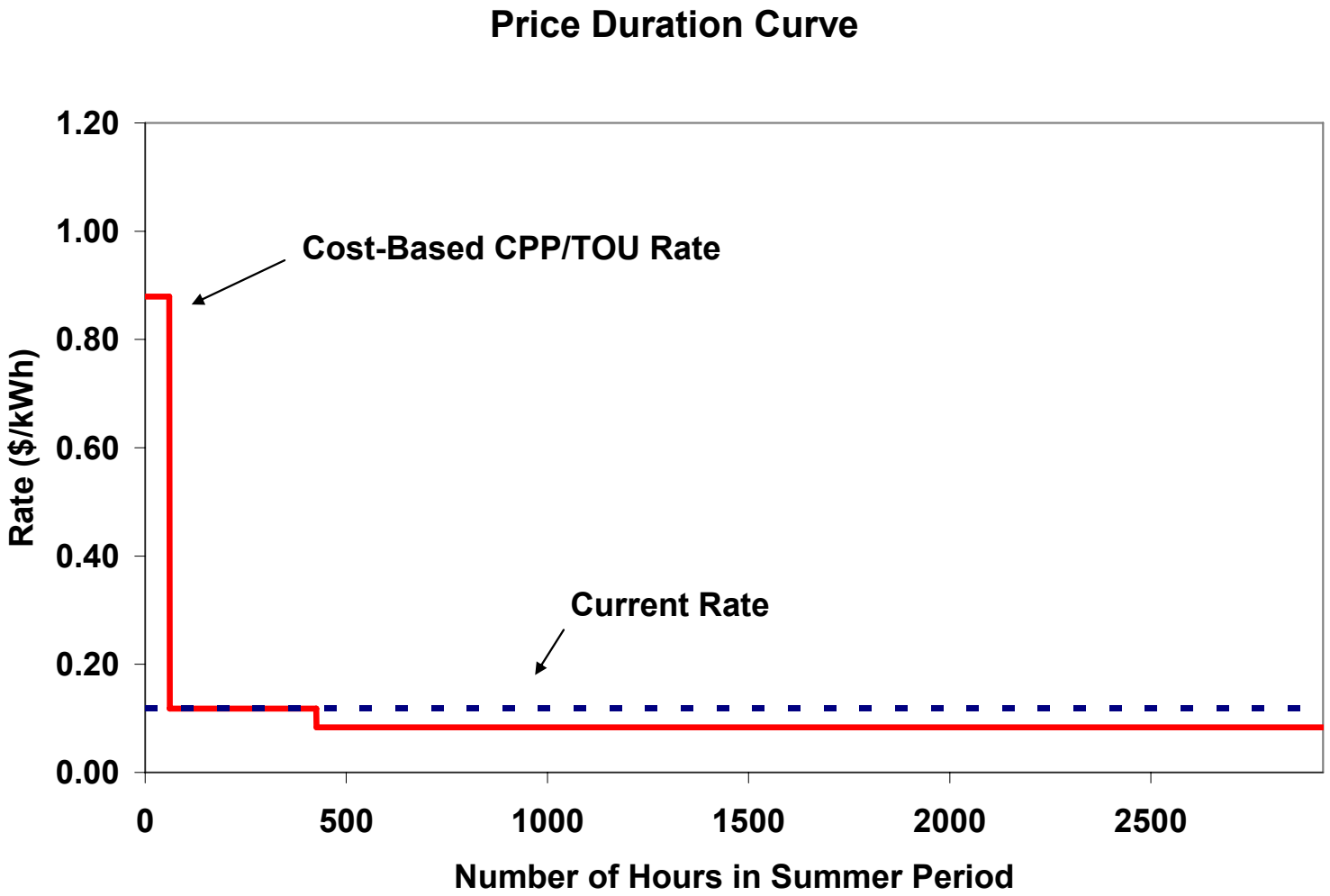
Critical-peak pricing (CPP) is by far the most popular design

- It is essentially a time-of-use (TOU) rate on most days of the year
- When the power system encounters critical conditions, the peak-period price rises to much higher but known levels, either on a day-ahead or day-of basis
- In variable critical-peak pricing (VPP), the critical-peak price rises to an unknown level that reflects actual market conditions
- Both of these rate designs approximate real-time pricing (RTP) rates and are easier for mass market customers to deal with

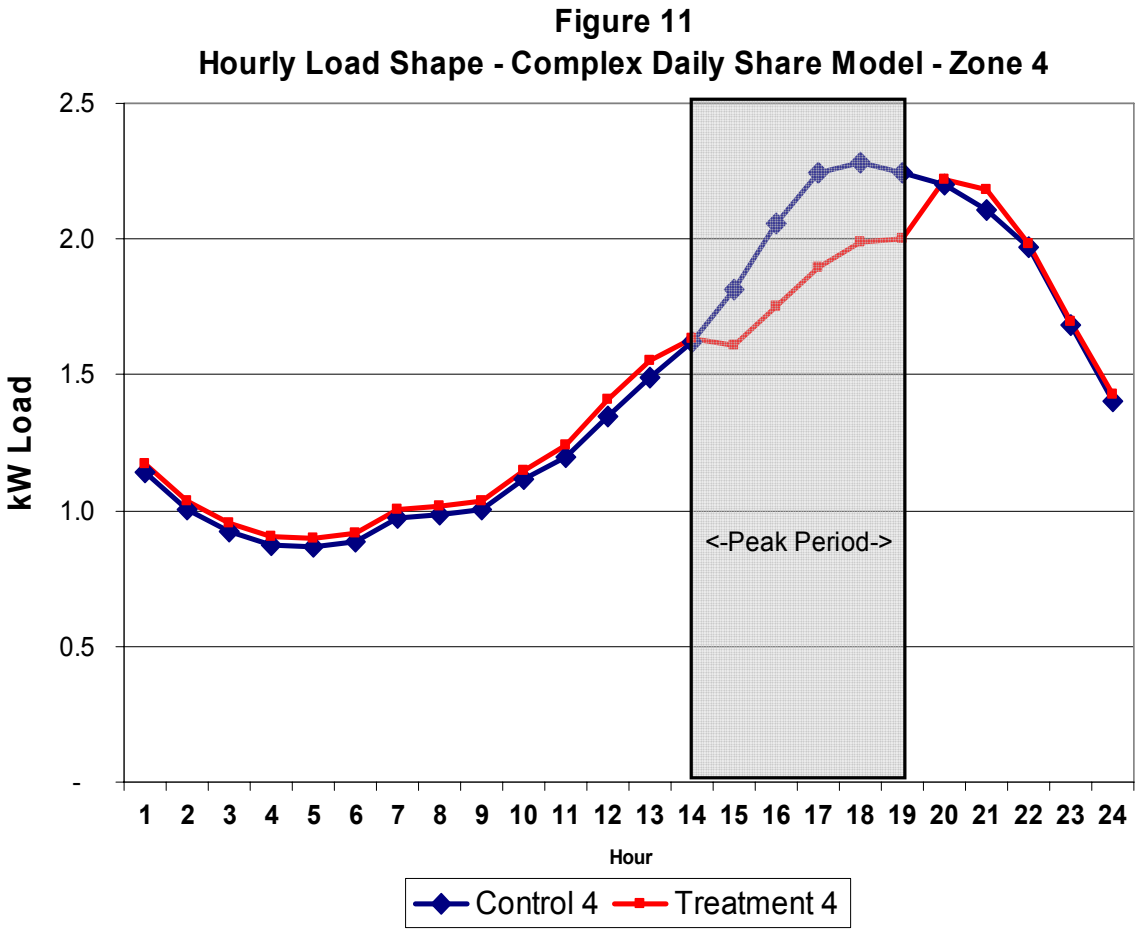
A CPP rate will provide customers with substantial opportunities to save money



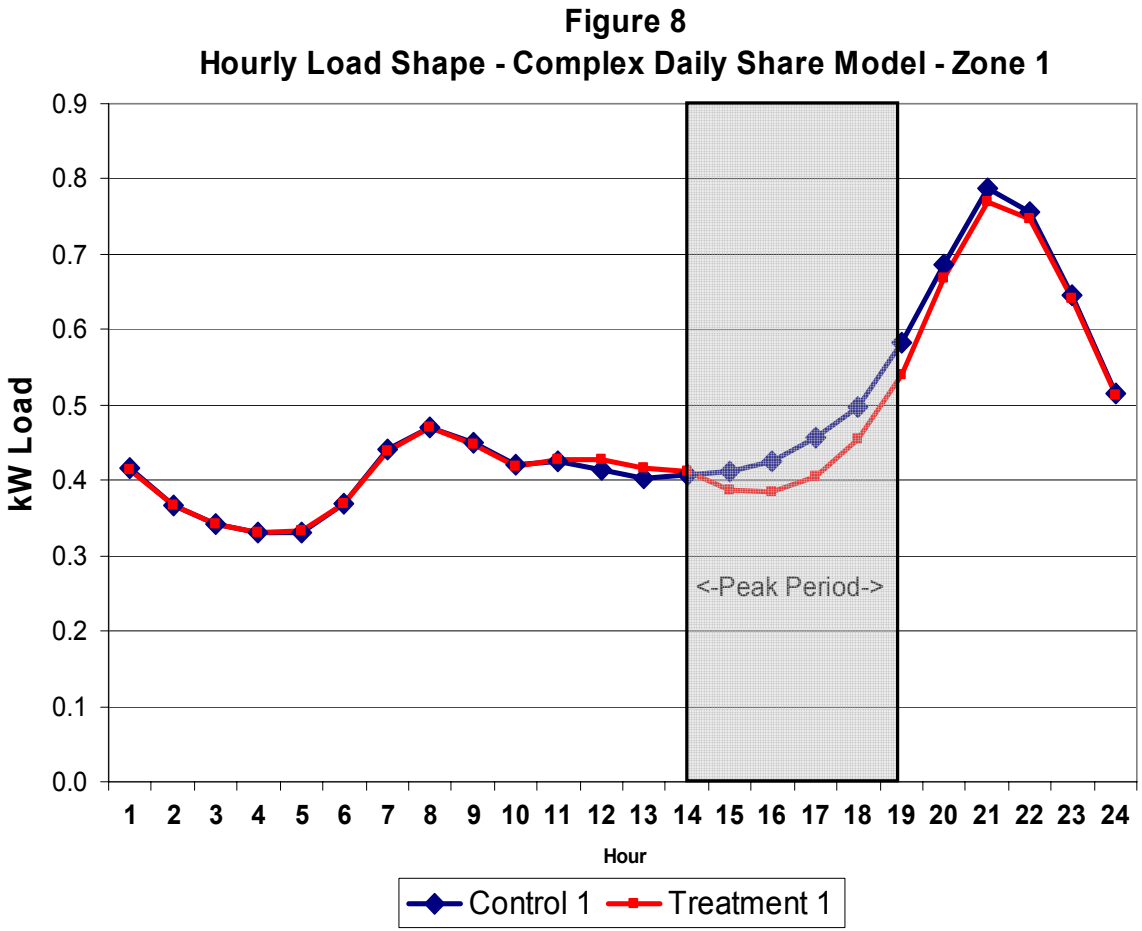
For a vast majority of summer hours, the customer will save money



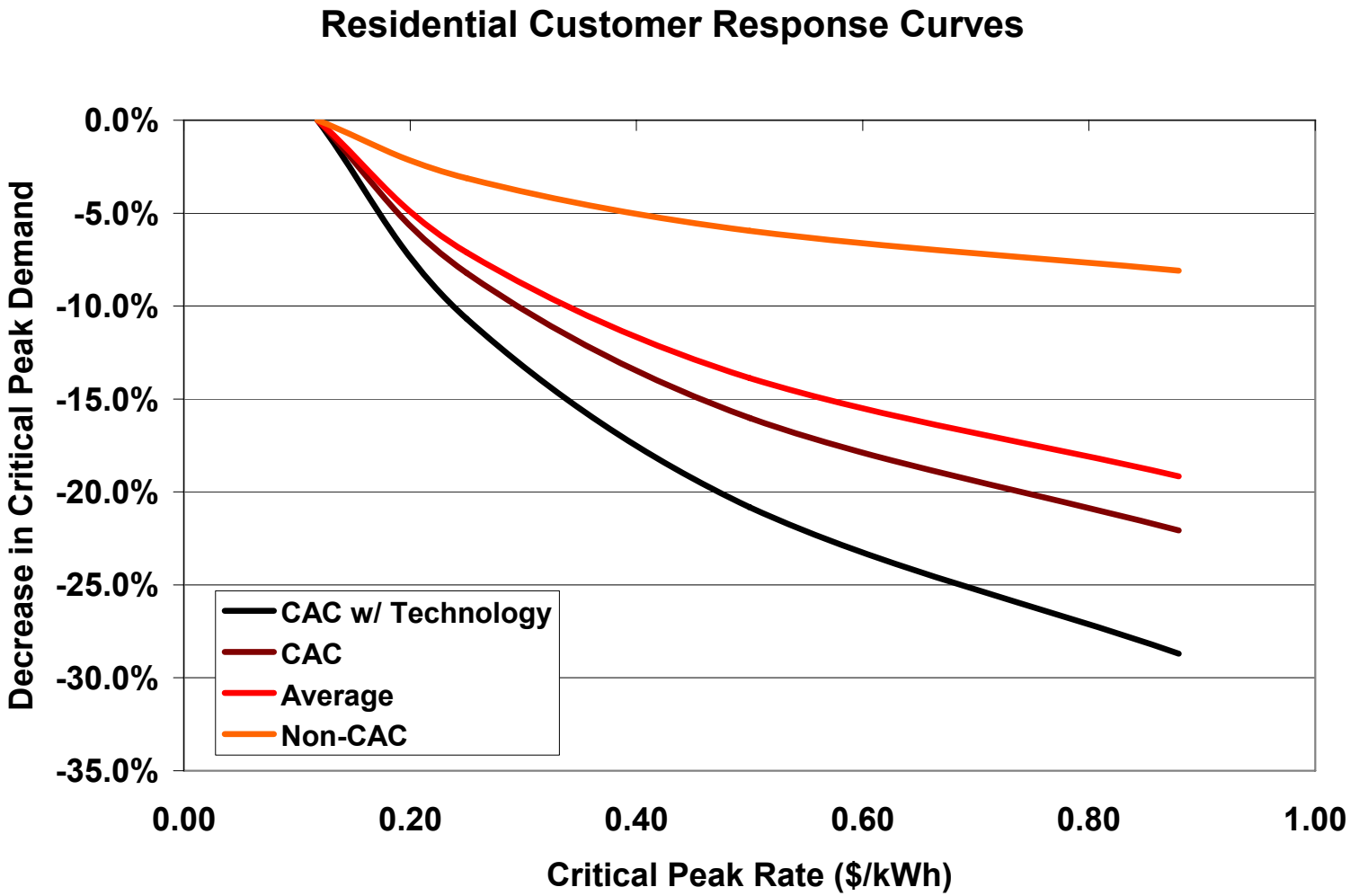
Dynamic prices have had a substantial impact in a hot climate such as California's Central Valley



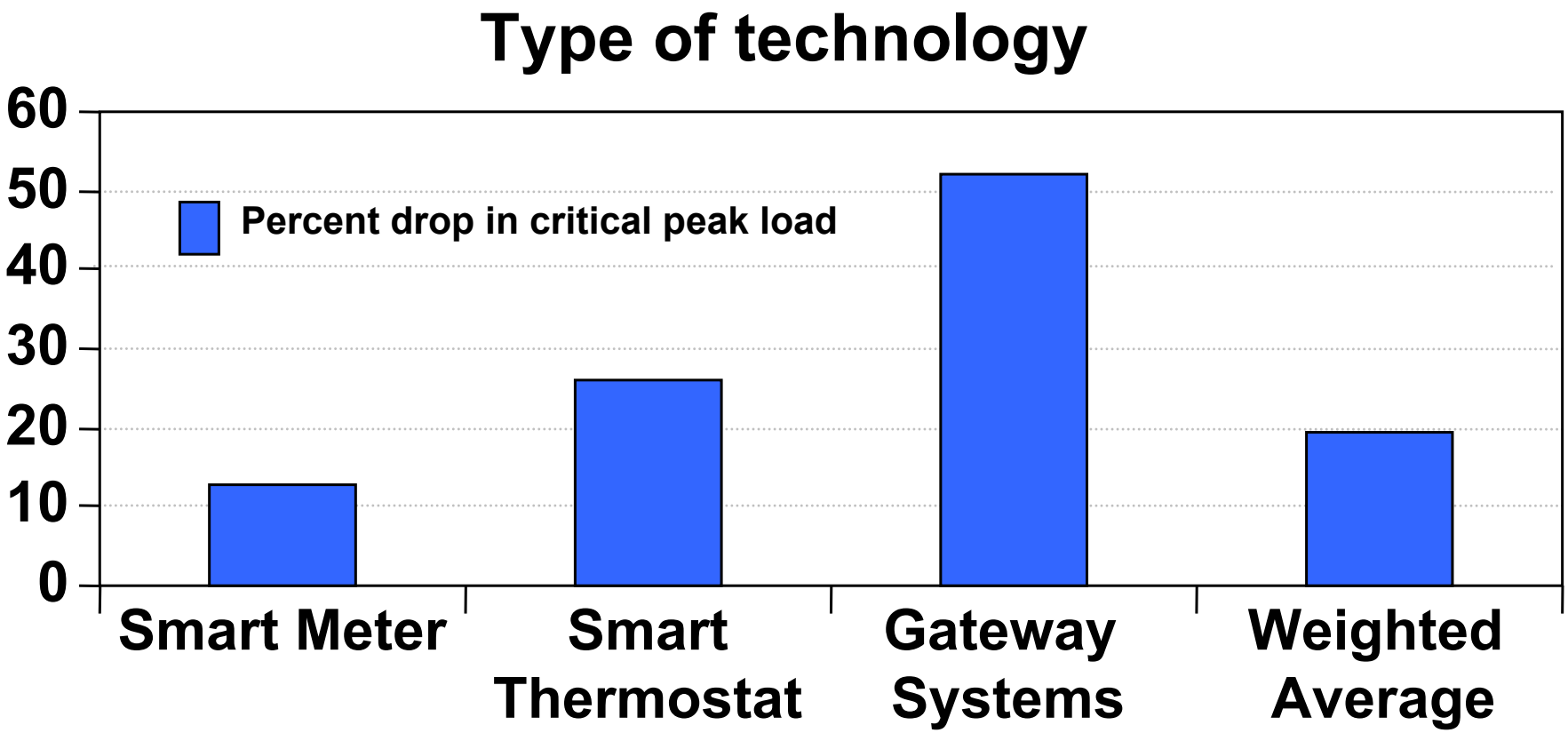
They produce an impact even in a mild climate such as San Francisco's



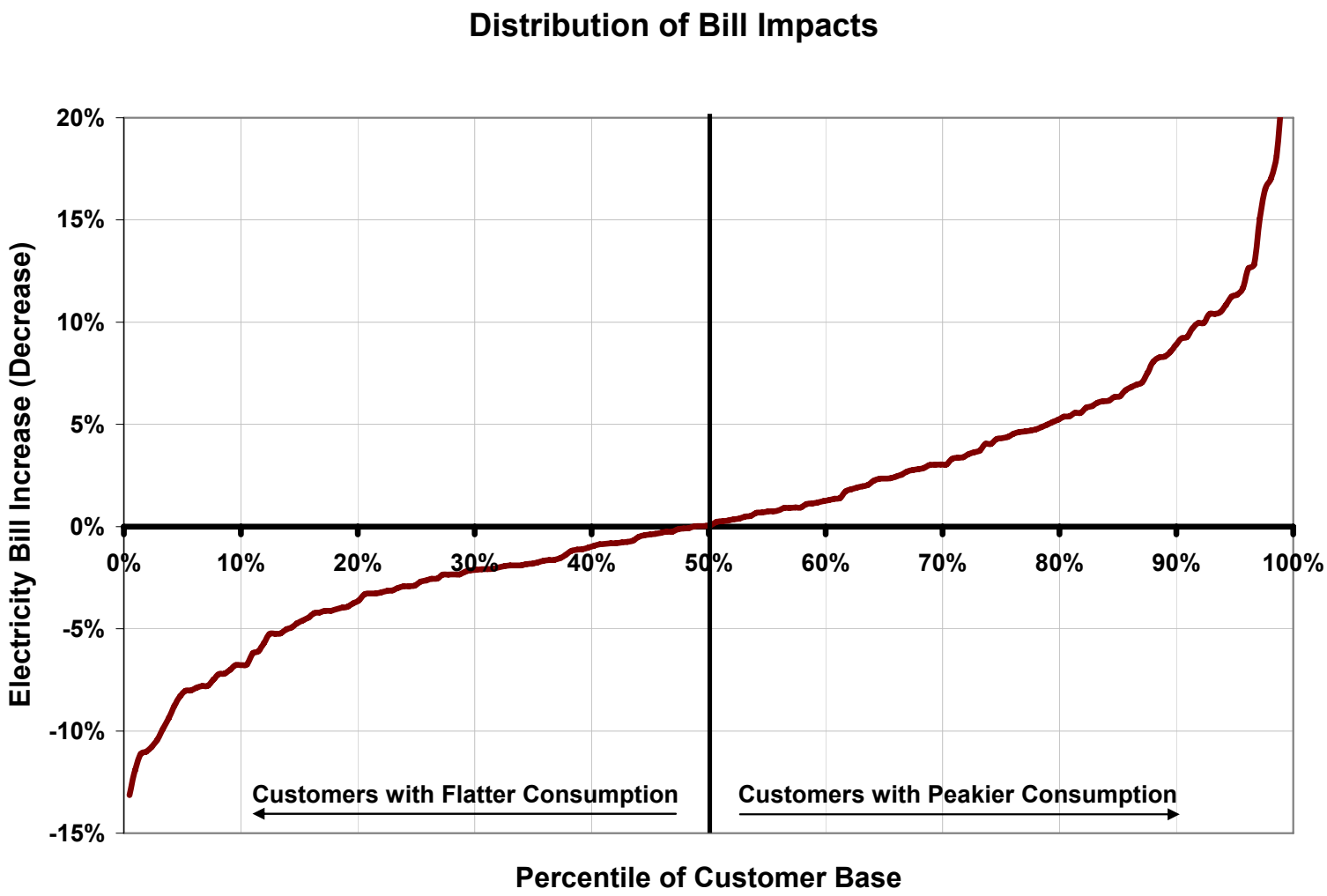
The higher the price, the greater is the drop in peak usage, with the reduction varying with market segment



Load reductions can be enhanced through enabling technologies



Under traditional ratemaking, 50% of the customers would be worse off under dynamic pricing



That fear may keep customers from even trying out the new rates

- And *fear of that fear* may keep us from even offering dynamic pricing to customers, since we are anxious to "protect the customers from themselves"
- How do we break out of this bubble?

Enter the risk premium

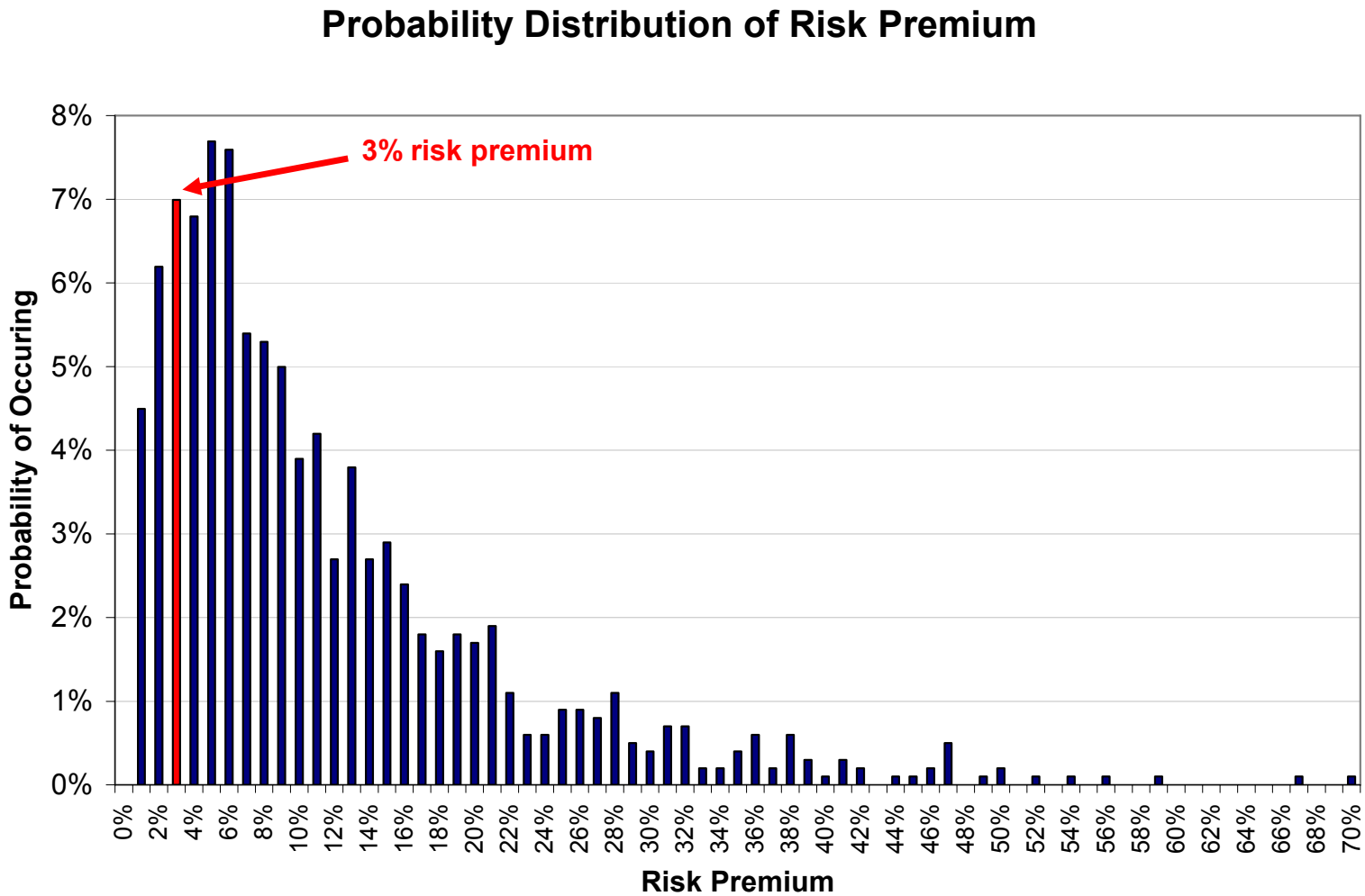
- Flat rates embody an *implicit* but very real risk premium that insures customers against price volatility
- The risk premium is proportional to the volatility of loads, the volatility of spot prices and the correlation between loads and spot prices
  - Thus, if load volatility is 0.2, price volatility is 0.6 and price-load correlation is 0.4, the risk premium is about 5%

- $\boldsymbol{\pi} = \exp(\boldsymbol{\sigma}_L . \boldsymbol{\sigma}_P . \boldsymbol{\rho}_{L,P})$

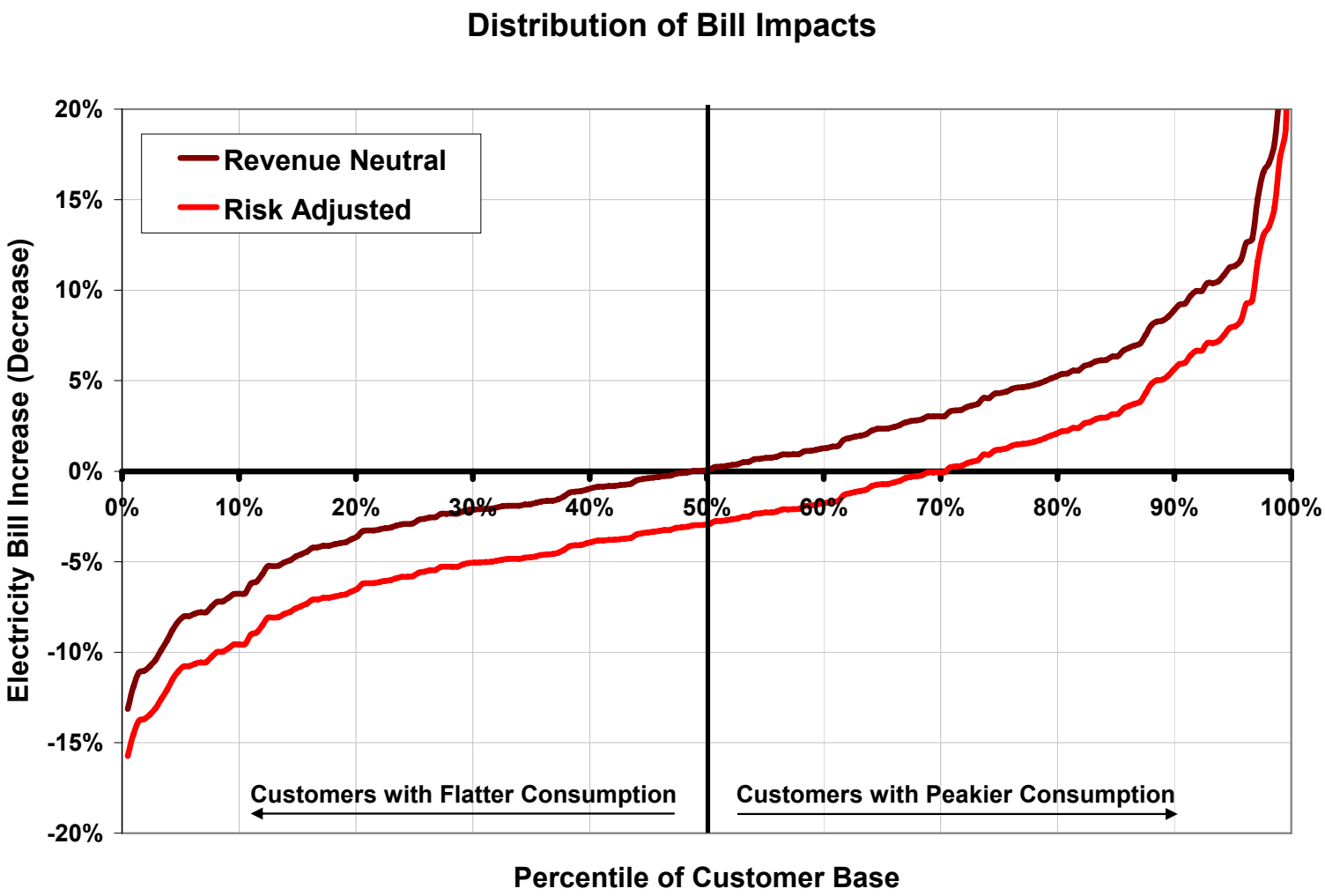
Where:

- π = Risk Premium
- σ_L = Load Volatility
- σ_P = Spot Price Volatility
- $\rho_{L,P}$ = Correlation Between Load and Spot Price

A Monte Carlo simulations suggest that a 3% risk premium is a conservative estimate



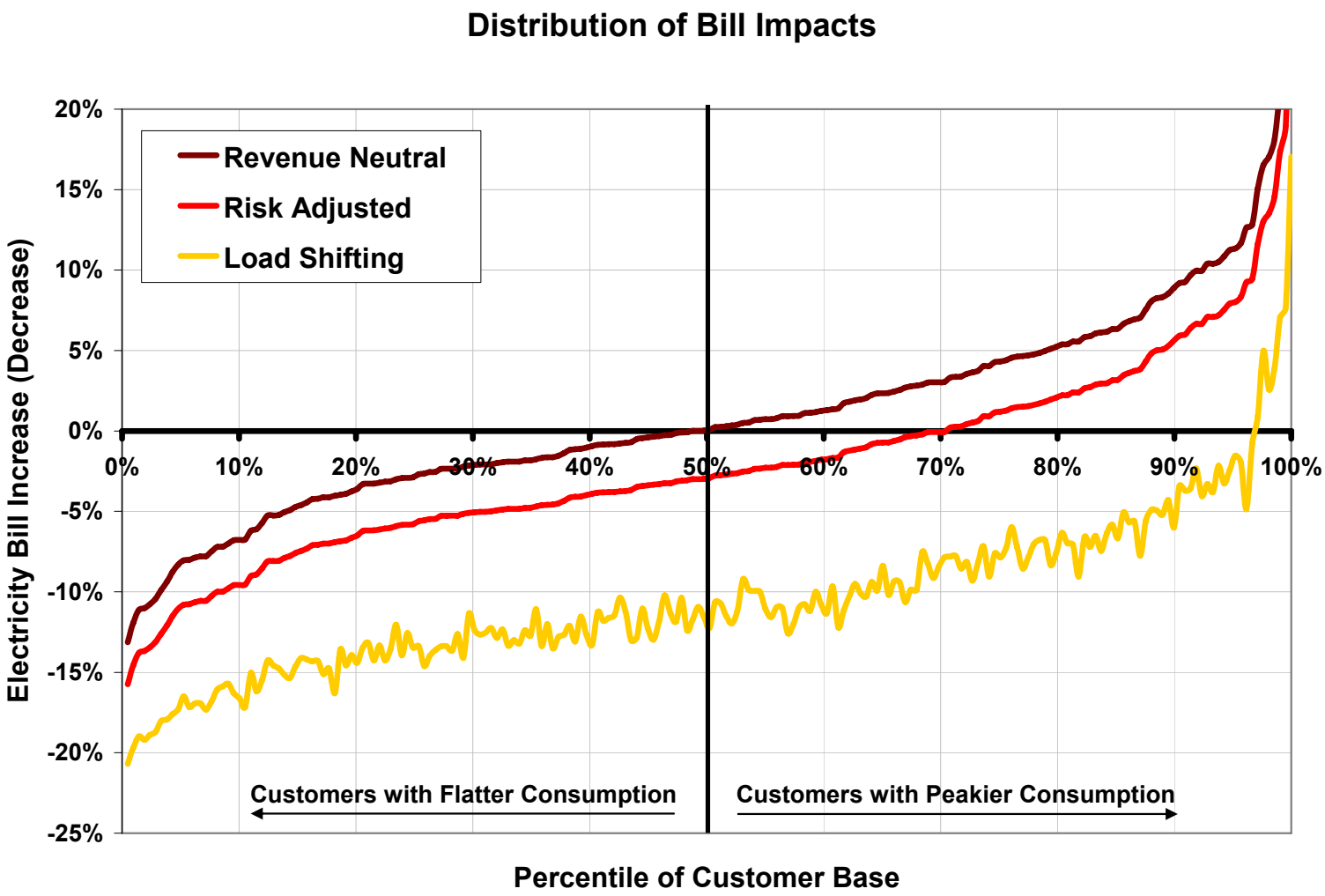
After crediting for the risk premium, dynamic pricing rates become attractive for 70% of customers



Enter demand response

- There is substantial evidence that dynamic pricing will lower critical peak loads by more than 10% per average household
- The bigger the household's monthly consumption level, the more will be the load drop
- Customers in hot climate zones will exhibit the most demand response

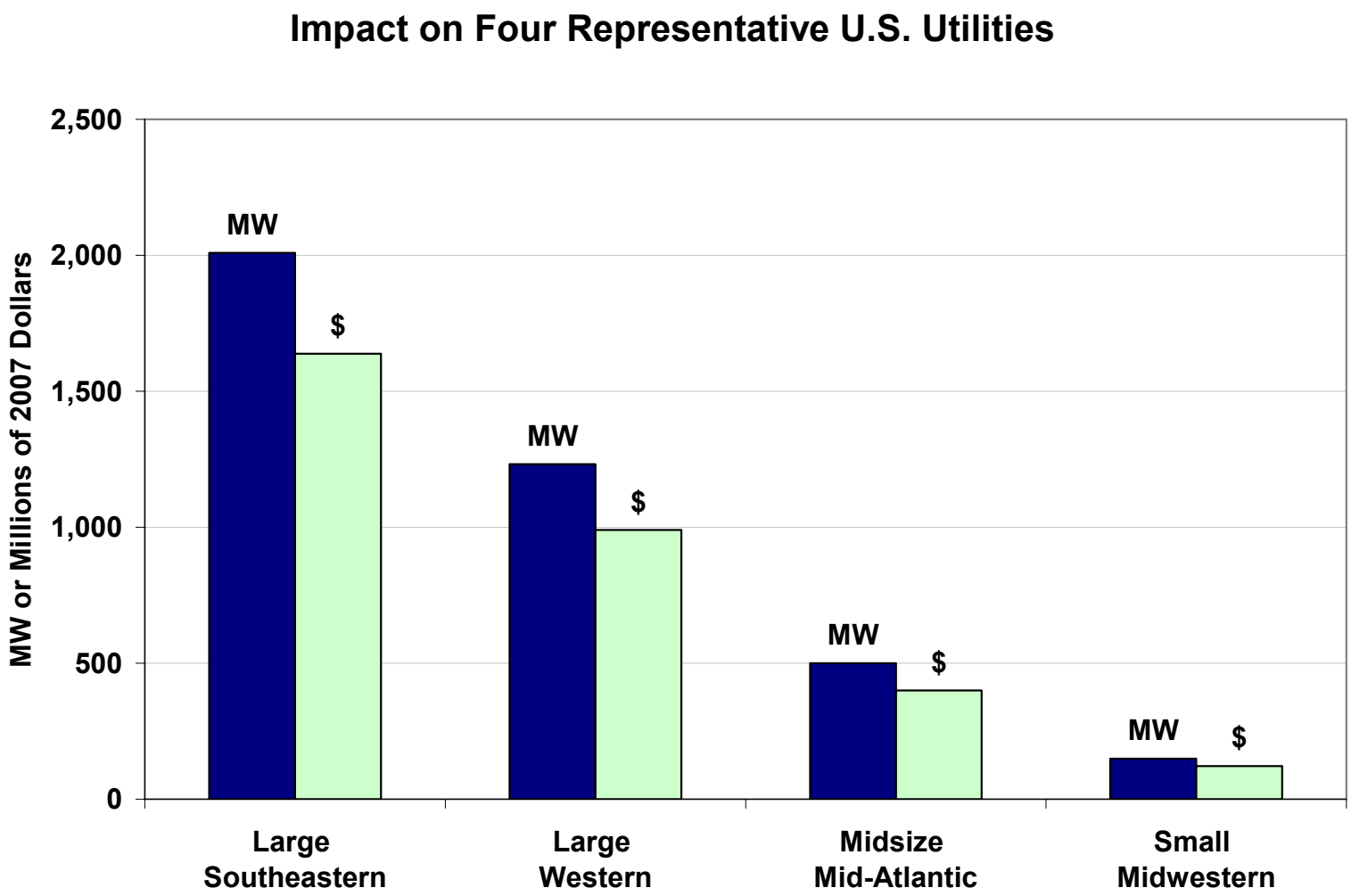
After crediting customers with the risk premium and demand response, we can attract over 95% of customers



Aggregate MW impacts and financial benefits depend on the number of participating customers

- The participation rate will depend on the deployment scenario and marketing strategy
- A mandatory scenario will generate the highest number of participants, followed by an opt-out scenario (around 70-90 percent) and finally by an opt-in scenario (from 10 to 30 percent)
- In all cases, the CPP rate needs to generate substantial bill savings for customers

Impacts vary by utility size and location



Additional reading

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- Faruqui, Ahmad. “Breaking out of the bubble: how dynamic pricing can mitigate rate shock,” Public Utilities Fortnightly, March 2007.

- Federal Energy Regulatory Commission (FERC), The US. “Demand Response and Advanced Metering,” Staff Report, August 2006

- North American Electric Reliability Corporation (NERC). “2006 Long-Term Reliability Assessment,” October 16, 2006.

- Plexus Research, Inc., “Deciding on Smart Meters,” Edison Electric Institute, September 2006.

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