



Summary of Dynamic Pricing, Demand Response, and Advanced Metering Studies

Per ALJ Ruling Following the First
Meeting of Working Group 1

California Public Utilities Commission
R.02-06-001

October 1, 2002



Overview

- Summarized over 100 reports & papers
 - Utility studies, government agency reports, peer-reviewed academic papers
 - Results summarized in attached matrices (format provided by CPUC staff)
 - Literature listed in attached Compendium
- Focus is response to dynamic pricing, especially small customers, and California
 - Includes studies for all three major IOUs
- Covers over 200 U.S. (mostly) and international utility projects and programs
 - Estimated 1,000 experimental treatments (“cells”)
- Review did **not** include at least as many utility programs as were covered due to time limits



Studies of Price Elasticity

- Scores of studies over past 3 decades
 - Many California specific
- Tested range of rate structures
 - Tiered
 - Time-of-use
 - Critical peak
 - Hourly prices
- Tested range of major variables
 - Residential, small commercial, large commercial
 - Income
 - Climate, including summer vs. winter peaks
 - Usage level within rate class
 - Short vs. long-term response
 - Mandatory vs. voluntary opt-in vs. voluntary opt-out



Results of Elasticity Studies

- Customers reduce peak demand in response to higher peak prices
 - Typical response is 10-20% for time-of-use prices
 - 15-50% for critical and real-time prices
- Customers usually, but not always, reduce total usage in response to dynamic prices
 - Typical reductions of around 3%
- There is consistency in the responses
 - Many studies compare responses and find consistency
 - Many studies successfully transferred results to other utilities and other regions for use in program design and implementation
 - Similar responses are seen across different tariff types
- Long-run elasticity higher than short run



Elasticities* by Customer Group

- Residential highest
 - Typically 0.20 to 0.35
- Small commercial lowest
 - Typically 0.03 to 0.05
- Large commercial in between
 - Typically around 0.10
 - Higher average usage leads to highest per customer demand response
- Substantial variance within commercial class

* - these are own-price elasticities; these measure the change in usage of a commodity in response to a 1% price change

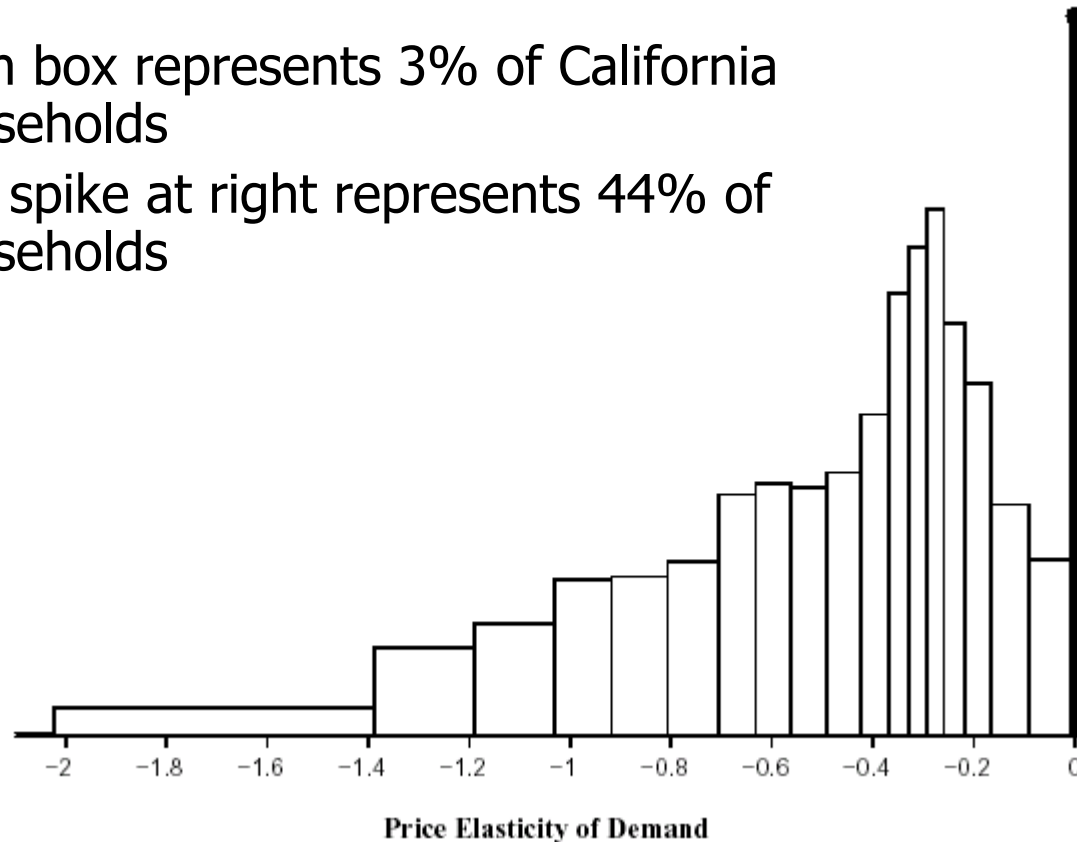
California Residential Elasticity

- Analyzes tiered rates. Very comprehensive.
- Source: Reiss and White, "Household Electricity Demand Revisited," National Bureau of Economics Research Working Paper 8687, Dec 2001

By Household Income		
1 st Quartile	Less than \$18,000	0.49
2 nd Quartile	\$18,000 to \$37,000	0.34
3 rd Quartile	\$37,000 to \$60,000	0.37
4 th Quartile	More than \$60,000	0.29
By Annual Usage Level		
1 st Quartile	Less than 4,450 kWh	0.46
2 nd Quartile	4,450 to 6,580 kWh	0.35
3 rd Quartile	6,580 to 9,700 kWh	0.32
4 th Quartile	More than 9,700 kWh	0.33
By Appliance Holdings		
No electric space heating nor air conditioning		0.08
No air conditioning		0.20
Central or room air conditioning		0.64
No electric space heating		0.20
Electric space heating		1.02

California Elasticity Distribution

- Each box represents 3% of California households
- The spike at right represents 44% of households



- Source: Reiss and White



California Customer Responses

- Residential
 - Clothes and dishwashing shifted from peak to off-peak
 - Lights, air conditioner, heating reduced during peak
- Small commercial
 - Lights turned off during peak
 - Air conditioner thermostat turned up 2 to 4 degrees
 - Higher response (41%) on critical peak days



Other Residential Research Findings

- Effect of dynamic pricing on total usage
 - Time-of-use rates and critical peak prices result in average conservation of about 3%
- Effect of automated response
 - Elasticity is often higher with automated response capability such as smart thermostats
 - Estimated own-price elasticities at Gulf Power and GPU (similar to Gulf Power) are 0.60
- Effect of information
 - Providing customers with additional information about their usage results in conservation of up to 10%
 - Less empirical data available in this area for U.S.



Customer Preference Research

- Most residential dynamic pricing programs were/are voluntary
 - Mix of opt-in and opt-out
 - “Mandatory” programs usually allowed for opt-out
- Program participation primarily a function of marketing approach
 - Opt-out programs typically have participation of over 90% (opt-out rates under 10%)
 - Opt-in programs have opt-in rates from 1 to over 30%
 - California surveys show about half of customers interested in time-of-use prices



Economics

- Various large-scale implementations have been found cost-effective
 - Some cost-justified using stand-alone time-of-use meters
 - Others rely on operating benefits of remote meter reading (AMR) for overall cost-effectiveness
 - Over 10 million advanced meters installed in U.S.
- Benefit estimates substantial
 - Annual benefits over \$1 billion in many studies
 - Net Present Value (NPV) approaches estimating several hundred million dollars in ratepayer savings



Summary

- Very rich body of experience and analysis exists
- Even more information exists to the extent more specific data is required
- The breadth of available data and analysis is very broad and extensive
- Information is available to address each of the issues identified in the various rulings in this proceeding