

Smart Grids and Dumb Tariffs: Raising the IQ of Electricity Prices in the United States

James Bushnell

University of California at Davis

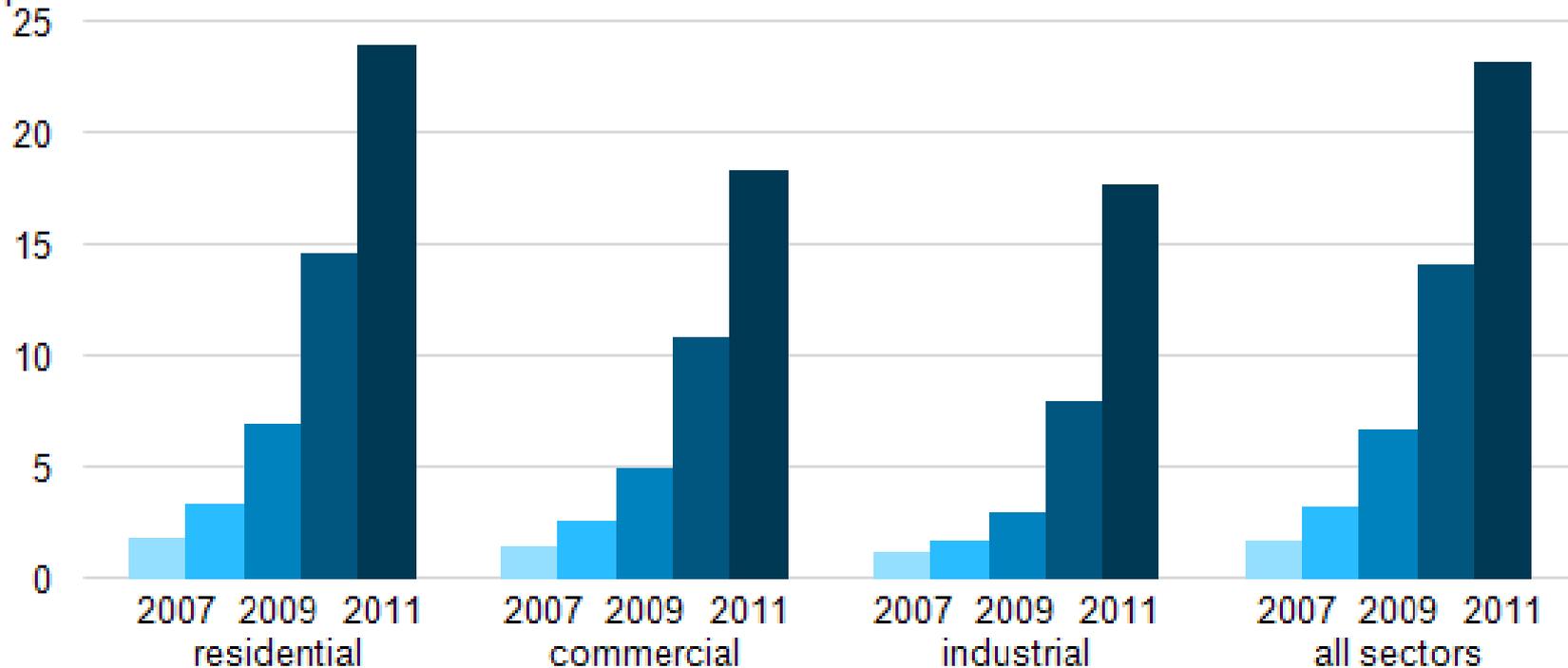
Outline

- Background
 - (almost) Everybody loves smart-meters
 - But what do we do with them?
- Models of Customer Behavior
 - Lessons learned from trials
- Wholesale Demand Response in the US

Smart-Meters are Proliferating in the US

Smart meter penetration

percent of customers with smart meters



Source: U.S. Energy Information Administration, Annual Electric Power Industry Report ([Form EIA-861](#)).

Forms of *Dynamic* Pricing

- NOT Time-of-Use: TOU is time-varying, but not dynamic
- Pay for demand reduction in emergency periods
- Interruptible tariffs
- Critical peak pricing (CPP)
- Peak-time rebates (PTR)
- Real-time pricing (RTP)
 - With hedging through customer forward power purchases
 - With compensation for lost cross-subsidy
 - With direct load control features
- CPP and PTR programs in widening use
- RTP in use some places for industrial, but rare

What Behavioral Economics Can Tell Us

- Rational Inattention
- Social Norms
- Defaults
 - Status quo bias

Rational Inattention

- There are limits on how much information the human (American?) brain can process.
- Individuals are forced to prioritize which economic decisions to focus on
 - Refinancing mortgage, where to buy petrol, brew your own coffee.
- Electricity consumption has typically been low priority in this competition for attention
 - In most cases this is “rational” given the constraints on attention.
- Periodic high prices can force customers to invest in knowing their consumption.
- Lowering the “costs” to paying attention to electricity consumption can yield large improvements in response
 - Jessee and Rapson (2013) show customers with in-home displays giving consumption information are 3 times as responsive to critical peak pricing.

Defaults

- Traditional economic view is that “the customer is always right”
 - a.k.a. *revealed preference*
 - If customers don’t buy CFL’s, its because they dislike them more than the cost savings.
- But there are many cases where choices are driven by starting points (defaults)
 - Retirement accounts, diet and nutrition, organ donations.
 - So observed choices reveal an inclination not to change more than a preference for a specific option or product.
- For electricity pricing, customers who begin *on* price incentives are much more likely to stay there than.
 - Choice-neutral defaults (“libertarian paternalism”)
 - SMUD experiment (George and Potter, 2013) finds much more participation, and aggregate reductions, amongst default “in” customers in California.

What Recent Work Tells Us About Dynamic Pricing

- Time-of-Use rates not that helpful
 - Traditional studies have overvalued their impact
- Default options are important
 - Opt-in programs yield much less participation than opt-out programs
- Information is important
 - Customers need help translating energy use to pricing
 - Reminders of price and use keep information salient
- Incentives do matter
 - Rebate programs are more popular, but more vulnerable to moral hazard (consumer manipulation)

Demand Response: U.S. Provision of Price Response at the Wholesale Level

- FERC has strongly pushed ISO's to foster "demand response" as a wholesale product.
 - Perhaps in response to frustration at lack of progress at the retail level
 - Wholesale DR aggregators are paid wholesale prices to "reduce" demand of their clients.
- Several problematic aspects to this approach.
 - Baseline problem is severe
 - Adverse selection problems with voluntary participation
- FERC's implementation of DR has made these problems even worse.

DR and FERC order 745

- Order 745 requires DR be compensated at full LMP (wholesale price).
 - This ignores the fact that *not* consuming power *saves* consumers from paying the retail price.
- Example: value of “lost load” is \$150/MWh to consumers, retail price r is \$100, wholesale price is \$125.
 - Consume and benefit is $150 - 100 = 50$
 - “Sell” to ISO (not consume) and benefit is 125.
- Order 745 encourages consumers to shed even high value load.
 - Rewards generation behind the meter with more value than in front of it.

Summary

- Mounting evidence that customers do respond to dynamic prices
 - Need not be full RTP, but what problem is being addressed?
- Participation very much depends upon default options
 - What are implications for retail choice environments with multitude of tariff options?
- A wholesale market model to DR creates incentive and measurement problems
 - At least for energy reduction, more promise for provision of ancillary services.
 - Again, what problem are we trying to solve?