Regulated Utility Rate Design and Its Effects on DER Adoption Rates

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Introducing RAP and Rich

• RAP is a non-profit organization providing technical and educational assistance to government officials on energy and environmental issues. RAP staff have extensive utility regulatory experience. RAP technical assistance to states is supported by US DOE, US EPA and foundations.

  – Richard Sedano directs RAP’s US Program. He was commissioner of the Vermont Department of Public Service from 1991-2001 and is an engineer.
Multiple Objectives in Utility Regulation (and Rate Design)

- DER deployment may be one, and is one in many states
Do DER Adoption Rates Matter?

• If Distributed Energy Resources are RESOURCES, then society should want them to fulfill their value
  – Value may be defined as economic system value
  – Value may be defined broadly for societal value
  – Price trends and environmental value are promising

• DERs represent customer choice
  – Customer choice inherently valued
  – Regulation should enable, not obstruct customer choice
  – Customer choice should avoid undue adverse effects on others
    • Adverse: economic, aesthetic, inter-generational
DER

• OK, it’s a Resource, at least in some states
  – Language of NY REV Track 1 order Feb 2015
  – Language of CPUC loading order July 2005
  – Some state energy plans

• Are we taking the DER “resource” seriously?
  – The politics (and business) of resources in state capitols can fog the conversation, divert attention from “value”
  – Are utilities changing their investment plans?
Rates and DER Deployment: It’s about consumers

- Consumers’ motivation to consume energy, conserve it or find alternatives
- Price Elasticity
- Barriers to alternatives
- Tools to find alternatives
Motivation from Rates
and a departure from the same rate for all energy units

- **Block** rates
  - Declining blocks suitable for another time
  - Inclining blocks suitable for a resource constrained situation

- **Time** based rates communicate value

- **Place** based overlay to rates convey added value

- Avoid more **complexity** than needed to convey
  - Pursuit of precision vs. sufficient accuracy
Motivation for Customer-sourced Ancillary Services

• Can you get those from customers?
  – Yes, for example,
    • From CHP systems
    • From PV with advanced inverters

• What is a customer’s motivation to invest in systems that produce useful ancillary services if there is no compensation?
  – Non-trivial rate design since grid need is finite, so a standard offer may be inapt
Price Elasticity

• Marginal consumption and investment choices matter
  – So marginal price signals matter

• A design criterion to consider: convey to consumer and to utility similar investment signal
  – Promote optimal investment, by whomever
  – Requires distribution resource planning in a manner not commonly done

  • See CA DRP, NY REV, RI D.4600 for examples
Elasticity—price change produces consumption change (e≈-0.2)

<table>
<thead>
<tr>
<th>Customer Charge</th>
<th>$5.00</th>
<th>$20.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Charge</td>
<td>$0.12</td>
<td>$0.09</td>
</tr>
<tr>
<td>Change in Price/kWh</td>
<td></td>
<td>-25%</td>
</tr>
<tr>
<td>Predicted Change in Usage</td>
<td></td>
<td>+5%</td>
</tr>
</tbody>
</table>
Elasticity: Well-studied, What do we really know?

• It is real
  – The population doesn’t just consume, price matters

• It is hard to calculate, but maybe getting easier
  – Because econometrics is hard, there are many variables that require judgment
  – There is more data now from pricing experiments

• It changes depending on circumstances
  – “own” (consumption vs. price)
  – “cross” (ditto, and also for alternatives)
  – Circumstances are getting more diverse with DER options for customers
Literature Review

There is a large economic literature on electricity demand in the US and other countries. Using data on US residential electricity demand for 1949–1993, Silk and Joutz (1997) find that a 1% increase in electricity prices reduces electricity consumption by -0.62%. With respect to disposable income, they find a 1% increase in income leads to a 0.82% increase in electricity consumption. Using data on residential demand for electricity in the US, Dergiades and Tsoulfidis (2008) find short- and long-run price elasticities of demand to be -0.386% and -1.065%, respectively. With regard to income, they find short- and long-run income elasticities of demand to be 0.101% and 0.273%, respectively. Paul, Myers, and Palmer (2009) find US short-run price elasticities of demand ranging between -0.04 and -0.32 (depending on customer class and region of the country), and long-run price elasticities of demand ranging between -0.02 and -1.15 (depending on customer class and region of the country). In the same paper, they summarize the results from previous studies, which I summarize below in Table 1.

<table>
<thead>
<tr>
<th>Customer Class</th>
<th>Reference</th>
<th>Short Run</th>
<th>Long Run</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>Bohi and Zimmerman (1984) (consensus)</td>
<td>-0.2</td>
<td>-0.7</td>
</tr>
<tr>
<td></td>
<td>Dahl and Roman (2004)</td>
<td>-0.23</td>
<td>-0.43</td>
</tr>
<tr>
<td></td>
<td>Supawat (2000)</td>
<td>-0.21</td>
<td>-0.98</td>
</tr>
<tr>
<td></td>
<td>Espey and Espey (2004)</td>
<td>-0.35</td>
<td>-0.85</td>
</tr>
<tr>
<td></td>
<td>Bernstein and Griffin (2005)</td>
<td>-0.24</td>
<td>-0.32</td>
</tr>
<tr>
<td>Commercial</td>
<td>Bohi and Zimmerman (1984)</td>
<td>0</td>
<td>-0.26</td>
</tr>
<tr>
<td></td>
<td>Bernstein and Griffin (2005)</td>
<td>-0.21</td>
<td>-0.97</td>
</tr>
<tr>
<td>Industrial</td>
<td>Bohi and Zimmerman (1984)</td>
<td>-0.11</td>
<td>-3.26</td>
</tr>
<tr>
<td></td>
<td>Dahl and Roman (2004)</td>
<td>-0.14</td>
<td>-0.56</td>
</tr>
<tr>
<td></td>
<td>Taylor (1977)</td>
<td>-0.22</td>
<td>-1.63</td>
</tr>
<tr>
<td>All</td>
<td>Dahl and Roman (2004)</td>
<td>-0.14</td>
<td>-0.32</td>
</tr>
</tbody>
</table>

Source: Paul, Myers and Palmer (2009), Table 5

Finally, using data from the Korean service sector, Lim and Lim (2014) find the short-and long-run price elasticities of electricity demand to be -0.421 and -1.002, respectively, and find short- and long-run income elasticities of electricity demand to be 0.855 and 1.090, respectively.

With regard to the impact of electricity competition, a number of studies are focused on the wholesale sector but few studies focus on the retail sector. Regarding the former, Kleit and Terrell (2001) find that by eliminating technical inefficiencies, gas-fired generation plant could reduce costs by up to 13%. Fabrizio et al. (2007) found evidence of reduced fuel and nonfuel expenses in fossil-fueled plants in states that restructured their wholesale markets. Zhang (2007) finds that, in states that have restructured nuclear-fueled plants, utilization is higher and operating costs are lower.
Dynamic Rates: Opt in and Opt out

- Deployment of DER has an investment horizon
- Opt in dynamic rates are easy to ignore
- Opt out dynamic rates cannot be ignored

- Opt out dynamic rates will tend to promote DER deployment because it will promote more thought by more consumers about options
Disconnect? Net Metering and Resource Procurement

• Net metering: successful at nurturing an infant industry

• If Solar PV is a resource, net metering is a rough, open-ended approximation of value
  – Prediction: States will be motivated to do better as PV becomes a more significant resource
    • Note CA IDER proceeding and NY REV for previews
    • Both address ideas for more value based procurement while net metering continues
    • Some states considering ending net metering w/o a suitable replacement, risking stifling deployment
Rate Design Barriers to DER Deployment

• Mass market rates that undervalue customer alternatives
  – Some customers do not see the benefit of the bargain and do not invest

• Undue interconnection fees

• Undue stand by charges (based on inaccurate costs to provide back up service)
  – Incorrect probabilistic analysis is often at the root of this problem
Unintended Consequence

• Rate design that drives a customer from the grid to self-supply
  – What could do that (called “load defection”)?
  – A very high customer charge could do that

• This outcome would promote DER, but not grid connected DER, losing some social value, especially from potential demand response
Customer Deployment Tools

• Deployment programs
  – Including fiscal incentives
• Net metering
• Resource standards
• Competitive procurement
• Consumer support and protection
Competitive Procurement
Utility or Something Else

• Realization of the “resource” quality of DER
  – Motivating and compensating the “best” DER (societal/system)
  – NY REV and CA docket
    • Individual customer investment in DER will replace utility (all customers) investment, lowering utility cost

• Rate design will guide consumer side of the market to make DER more or less available
  – If we want this effect of individuals’ investing, the rates we present to them are important
Recovering Prudent Utility Costs

• Yes, this is necessary and righteous
• Regulatory process is set up to assure this
  – Worry about “death spiral” overblown?
    • Based on inadequate appreciation for capacity of the regulatory process to adapt
    • One idea: new earning paths not based on volume
• No need to disrupt price signal for investment
• Utility important agent for DER and other goods, best to organize alignment of interests
Witchcraft, Wizardry and Rate Design

• Reapply **traditional methods** that classify and allocate costs

• Recognize societal importance of **investment signal** to customers to DER deployment

• Resist conjuring result oriented rate design

• Resist impression that a small group of wizards understands and everyone else cannot
Bottom Line

• Recognize connection between regulated price and consumer choices to use and invest
• Price accurately with nod to the art of it
• Apply policy to accurate prices
• Result will be investment signals that represent principles of fairness and directions of policy
About RAP

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power sector. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

Learn more about RAP at www.raponline.org

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