Rate Design 3.0 and The Efficient Pricing Frontier

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PRESENTED BY
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Principal
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Two-part rates are the norm for residential customers, but they are misaligned with the utility cost structure.

<table>
<thead>
<tr>
<th>Cost categories</th>
<th>Utility’s Costs</th>
<th>Customer’s Bill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable ($/kWh)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fuel/gas supply</td>
<td>Variable = $60</td>
<td>Variable = $115</td>
</tr>
<tr>
<td>- Operations &amp; maintenance</td>
<td>Fixed = $10</td>
<td>Fixed = $5</td>
</tr>
<tr>
<td>Fixed ($/customer)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Metering &amp; billing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Overhead</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size-related (demand) ($/kW)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Transmission capacity</td>
<td>Demand = $50</td>
<td></td>
</tr>
<tr>
<td>- Distribution capacity</td>
<td></td>
<td></td>
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<tr>
<td>- Generation capacity</td>
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</tbody>
</table>
Three-part rates are the norm for commercial and industrial customers

They reflect the utility cost structure, unlike residential rates

Bonbright’s principles of rate design apply to all classes

- All customers, regardless of class, are served by the same power plants and the same grid

Why have residential rates have been misaligned with the cost structure?

- The often cited reasons include lack of metering, customer distaste for demand charges and time-varying energy rates, and adverse impact on low and medium income customers
Smart meters are now deployed to 70 million residences and may be deployed nationwide in the next decade.

This has generated interest in new rate designs, which feature energy-only time-varying rates, sometimes coupled with a fixed charge; let’s call them Rate Design 2.0.

Rate Design 2.0 does a better job of transmitting the time-varying costs of energy than uniform, volumetric structures (Rate Design 1.0)

- But it has not been an easy task to move from Rate Design 1.0 to Rate Design 2.0.

After much hemming and hawing, quasi-academic deliberations on the “ethics of dynamic pricing,” scientific trials and experiments, Rate Design 2.0 has begun to be deployed in several jurisdictions.
349 experiments have shown that customers respond to price and smart technologies lead to higher elasticities.

RD 2.0: Oklahoma has rolled out variable peak pricing (VPP)

OGE rolled out VPP coupled with a smart thermostat to its residential customers a few years ago

- “Smart Hours” features variable peak pricing, which has five levels of peak pricing

Some 130,000 customers (or 20% of the total) are on VPP; they control their thermostat setting, not OGE

- Average peak load has dropped by ~40%
- Average bill savings amount to ~20% of the customer’s bill
RD 2.0: Maryland has rolled out peak-time rebates (PTR)

Both BGE and PHI offer dynamic pricing rebates of $1.25/kWh to their customers in Maryland (~ 2 million households), and bid in the load reductions into the PJM market.

At BGE, about 80% of its customers have taken advantage of the rebates and saved $40 million in utility bills since the program began in 2013.

In 2015, BGE’s PTR customers showed an average demand reduction of 16.2%, up from 14.5% in 2014, and 13.7% in 2013.

The Maryland Commission has just authorized new TOU pilots.
RD 2.0: Ontario (Canada) has rolled out TOU rates to all residential and small commercial customers

For the past five years, some 90% of Ontario’s 4 million residential customers have been buying their energy through a regulated supply option, which features a three-period TOU rate

- The TOU rates have reduced their peak demand by ~3%, based on a three-year analysis that we carried out for the IESO

Knowing the limitations of TOU rates, the Ontario Energy Board (OEB) has authorized dynamic pricing pilots that would allow those rates to be offered as supplements to the TOU rates

The OEB has ruled that distribution charges will be collected through a fixed monthly charge
RD 2.0: California, after piloting several time-varying rates, is preparing to deploy TOU on a default basis

Opt-in CPP has been offered for some time

Default TOU coming to SMUD in 2019

Default TOU coming to the three investor-owned utilities in 2019/2020
RD 2.0: The UK is piloting PTR and new TOU rates

UK Power Networks (London) is piloting PTR targeted specifically at low income customers

A couple of pilots have tested time-varying rates

13% of customers are on a TOU rate (Economy 7) designed for customers with thermal energy storage

A start-up retailer has introduced a TOU tariff with a strong price signal

British Gas offers a FreeTime tariff, which allows customers to pick one weekend day during which their electricity is free

A pilot tested the “Sunshine Tariff,” which charged a lower price during mid-day hours
The Regulatory Commission (CRU) would like retail electricity suppliers to offer a generic, simple to understand TOU tariff

- The CRU will not specify the specific prices, just the structure

Retailers can also offer other TOU tariffs

Smart electricity meters will be rolled out starting in Q4 2019 on customer request.

- Once the meters are switched on, the suppliers will be obligated to provide the smart tariff within 14-16 months after the ‘switch-on’
RD 2.0: Australia is beginning to experiment with PTR

A distribution network in Victoria is offering significant rebates for dynamic demand curtailment during peak times (~ $5/kWh curtailed)

- Avoiding costly upgrade on low load factor feeder
- Electricity rules say networks must consult alternative resources before building
RD 2.0: Hong Kong is moving ahead with PTR

Pilot with ~2,000 customers on PTR was carried out a few years ago

- It showed a peak reduction in the 15-20% range attributable to the dynamic rebate

The rollout of PTR is being expanded to some 27,000 customers
We are on the cusp of Rate Design 3.0

Capacity charges based on the size of the connection are mandatory for residential customers in France, Italy, and Spain.

Demand charges are being offered in the United States in increasing numbers but most of them do not combine them with TOU energy charges:

- 52 demand charges (9 mandatory)
- 44 utilities (18 investor-owned)
- 22 states (see map)

In Arizona, two utilities already offer demand charges for capacity costs and TOU rates for energy costs.
22 states are offering demand charges to residential customers

States with Residential Demand Rates
- Yes
- No

You can design your own Rate Design 3.0

<table>
<thead>
<tr>
<th>Parts</th>
<th>Cost Category</th>
<th>Rate Design Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Meter, Line drop, Transformer, Billing, Customer care</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Distribution capacity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transmission capacity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Generation capacity</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Energy</td>
<td></td>
</tr>
</tbody>
</table>
Here is one proposed design

<table>
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<tr>
<th>Parts</th>
<th>Cost Category</th>
<th>Rate Design Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Meter Line drop Transformer Billing Customer care</td>
<td>Monthly service charge</td>
</tr>
<tr>
<td>2</td>
<td>Distribution capacity</td>
<td>Non-coincident peak (NCP) demand charge</td>
</tr>
<tr>
<td></td>
<td>Transmission capacity</td>
<td>Mix of NCP demand charge and coincident peak (CP) demand charge</td>
</tr>
<tr>
<td></td>
<td>Generation capacity</td>
<td>CP demand charge and/or time-varying energy charge</td>
</tr>
<tr>
<td>3</td>
<td>Energy</td>
<td>Time-varying energy charge</td>
</tr>
</tbody>
</table>
Of course, customers have diverse preferences

Some want to save money and want the lowest price
- They are willing to be flexible in the manner in which they use electricity

Some want to lock in a guaranteed bill
- They are willing to pay a premium for peace-of-mind

Many others are in between these two bookends
- Some might want a guaranteed bill, but may be willing to lower it if rebates are offered for reducing demand during peak periods
- Others may wish to subscribe to a given level of demand

All customers want choice, but they only want what they want
These are a few of the rate designs that accommodate the diverse preferences of customers

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Guaranteed bill (GB)</td>
</tr>
<tr>
<td>B</td>
<td>GB with discounts for demand response (DR)</td>
</tr>
<tr>
<td>C</td>
<td>Standard tariff</td>
</tr>
<tr>
<td>D</td>
<td>Increased fixed charge (IFC)</td>
</tr>
<tr>
<td>E</td>
<td>Demand charge</td>
</tr>
<tr>
<td>F</td>
<td>Time-of-Use (TOU)</td>
</tr>
<tr>
<td>G</td>
<td>Critical peak pricing (CPP)</td>
</tr>
<tr>
<td>H</td>
<td>Peak time rebates (PTR)</td>
</tr>
<tr>
<td>I</td>
<td>Variable peak pricing (VPP)</td>
</tr>
<tr>
<td>J</td>
<td>Demand subscription service (DSS)</td>
</tr>
<tr>
<td>K</td>
<td>Transactive energy (TE)</td>
</tr>
<tr>
<td>L</td>
<td>Real-time pricing (RTP)</td>
</tr>
</tbody>
</table>
These rate choices span the savings-risk space, generating an “efficient pricing frontier.”
Utilities can modernize their rates in five easy simple steps

Step One: Identify customer needs and preferences through interviews, focus groups and surveys

Step Two: Develop new cost-based rates by leveraging or updating your cost-of-service studies

Step Three: Engage in a broad-scale customer outreach program and educate them about the new rate choices

Step Four: Make it clear that Rate Design 3.0 will become the default rate in the near future, but it will be accompanied by other rate choices

Step Five: Assist customers in picking the rate they want
Primary references


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Secondary references II


Ahmad Faruqui’s consulting practice is focused on the efficient use of energy. His areas of expertise include rate design, demand response, energy efficiency, distributed energy resources, advanced metering infrastructure, plug-in electric vehicles, energy storage, inter-fuel substitution, combined heat and power, microgrids, and demand forecasting. He has worked for nearly 150 clients on 5 continents. These include electric and gas utilities, state and federal commissions, independent system operators, government agencies, trade associations, research institutes, and manufacturing companies. Ahmad has testified or appeared before commissions in Alberta (Canada), Arizona, Arkansas, California, Colorado, Connecticut, Delaware, the District of Columbia, FERC, Illinois, Indiana, Kansas, Maryland, Minnesota, Nevada, Ohio, Oklahoma, Ontario (Canada), Pennsylvania, ECRA (Saudi Arabia), and Texas. He has presented to governments in Australia, Egypt, Ireland, the Philippines, Thailand and the United Kingdom and given seminars on all 6 continents. His research been cited in Business Week, The Economist, Forbes, National Geographic, The New York Times, San Francisco Chronicle, San Jose Mercury News, Wall Street Journal and USA Today. He has appeared on Fox Business News, National Public Radio and Voice of America. He is the author, co-author or editor of 4 books and more than 150 articles, papers and reports on energy matters. He has published in peer-reviewed journals such as Energy Economics, Energy Journal, Energy Efficiency, Energy Policy, Journal of Regulatory Economics and Utilities Policy and trade journals such as The Electricity Journal and the Public Utilities Fortnightly. He holds BA and MA degrees from the University of Karachi, an MA in agricultural economics and Ph. D. in economics from The University of California at Davis.

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