The National Landscape of Residential TOU Rates

A preliminary summary

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Introduction and methodology

Introduction

- The purpose of this presentation is to summarize residential TOU rate offerings in other jurisdictions
- The presentation is organized into two sections
  - Section 1: A survey of current TOU rate offerings
  - Section 2: Emerging trends in TOU rate design

Methodology

- The survey draws upon data from three sources
  - EIA-861 data (includes data such as # utilities offering TOU, # participants)
  - OpenEI Utility Rates Database (includes TOU price ratio, # pricing periods)
  - Brattle's database of 60+ residential pricing pilots
- We have restricted the survey to US utilities
- The assessment of emerging trends is largely derived from Brattle's experience assisting utilities in ratemaking matters across North America and abroad

Key findings

The national survey of residential TOU rates

- 14% of all US utilities offer a residential TOU; roughly half of IOUs offer one
- Where TOU is available, around 3% of customers are enrolled on average
- APS has the highest enrollment, with 51% of its residential customers on a TOU
- 74% of TOU rates have only two pricing periods
- 71% of TOU rates have a price ratio of at least 2-to-1
- Half of TOU rates have a price differential of at least 10 cents/kWh
- Of the utilities offering TOU rates, roughly half offer more than one TOU option

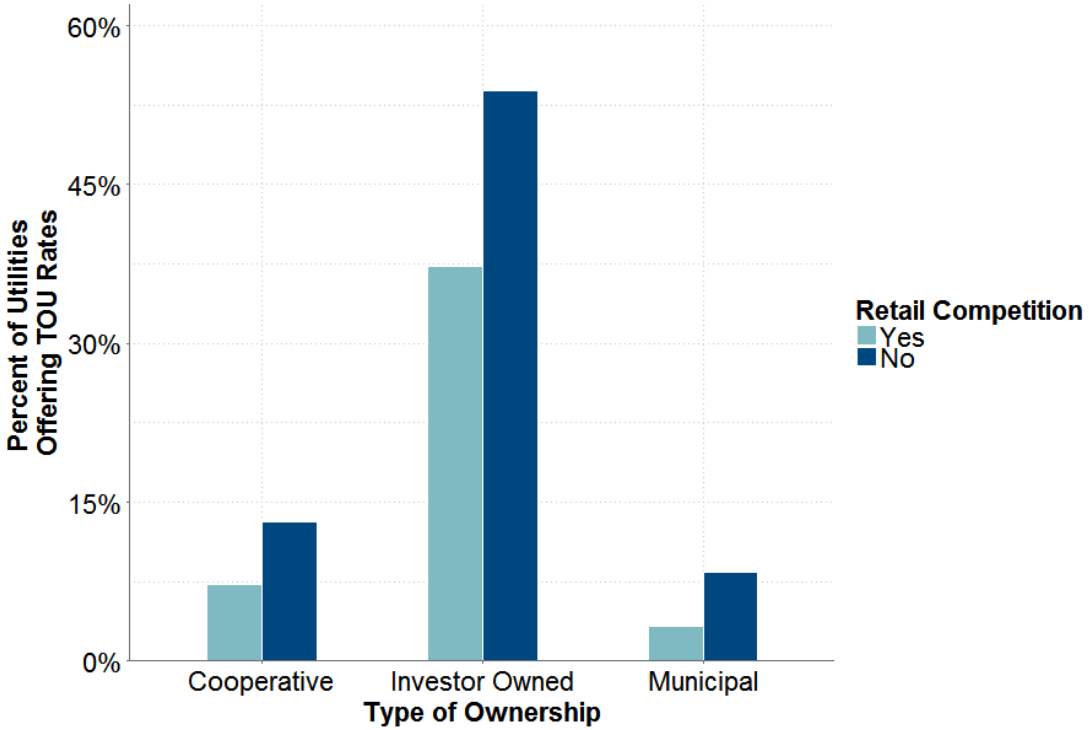
Emerging trends

- To address solar PV integration challenges, new TOU rates are being introduced with a low mid-day price and a peak period that is delayed until later in the evening
- Several utilities have recently introduced TOU rates on a default (i.e., opt-out) basis for all residential customers
- Volumetric TOU rates are increasingly being proposed by environmental advocates to address grid cost recovery issues associated with rooftop PV adoption (as an alternative to fixed charges or demand charges)
- TOU rates continue to be piloted in North America and internationally; the pilots consistently find that customers shift consumption from peak periods to off-peak periods

The survey of TOU rates

Utilities offering TOU rates

Share of Utilities Offering TOU (by Type of Utility)



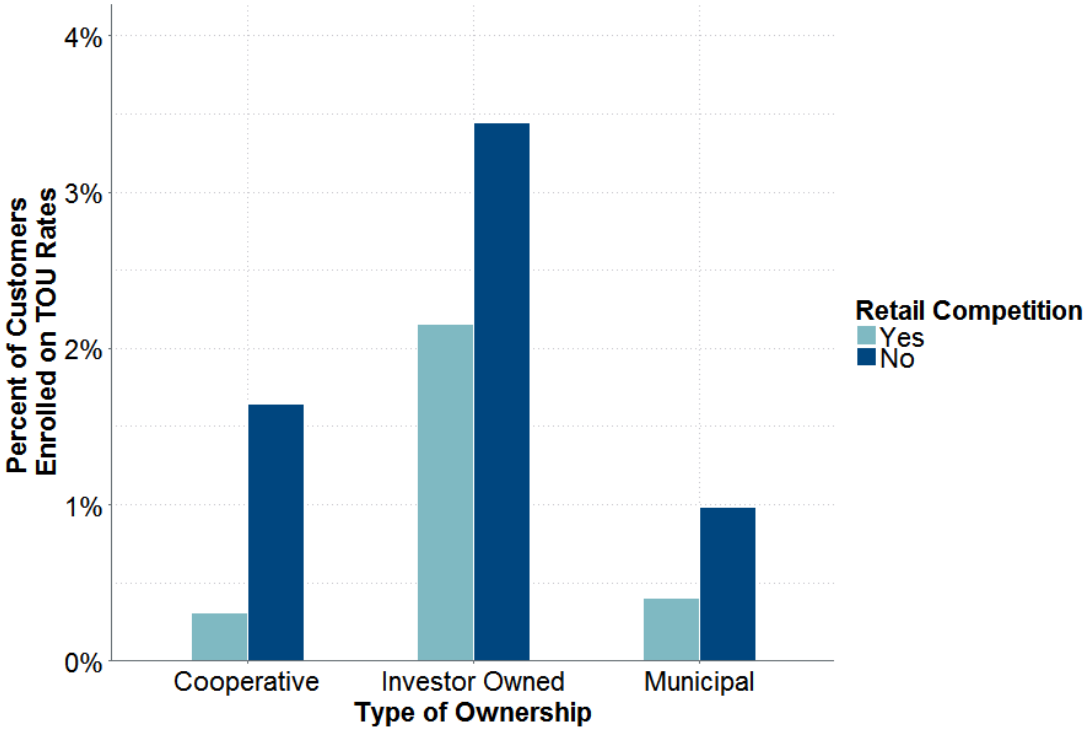
Sources and notes: Brattle analysis of 2015 EIA-861 data. Political subdivisions, retail power marketers, and other utilities are excluded in the above chart due to sample sizes less than ten.

Comments

- 14% of all utilities in the EIA-861 database offer residential TOU rates
- TOU rates are most commonly offered by IOUs; 48% of all IOUs offer a TOU rate
- 6% of all TOU rates include a demand charge (in addition to the time-varying volumetric charge)
- Utilities in states with retail competition are less likely to offer TOU rates, though TOU rate offers are still fairly common among those utilities

Average enrollment

Share of Customers Enrolled in TOU Where Available



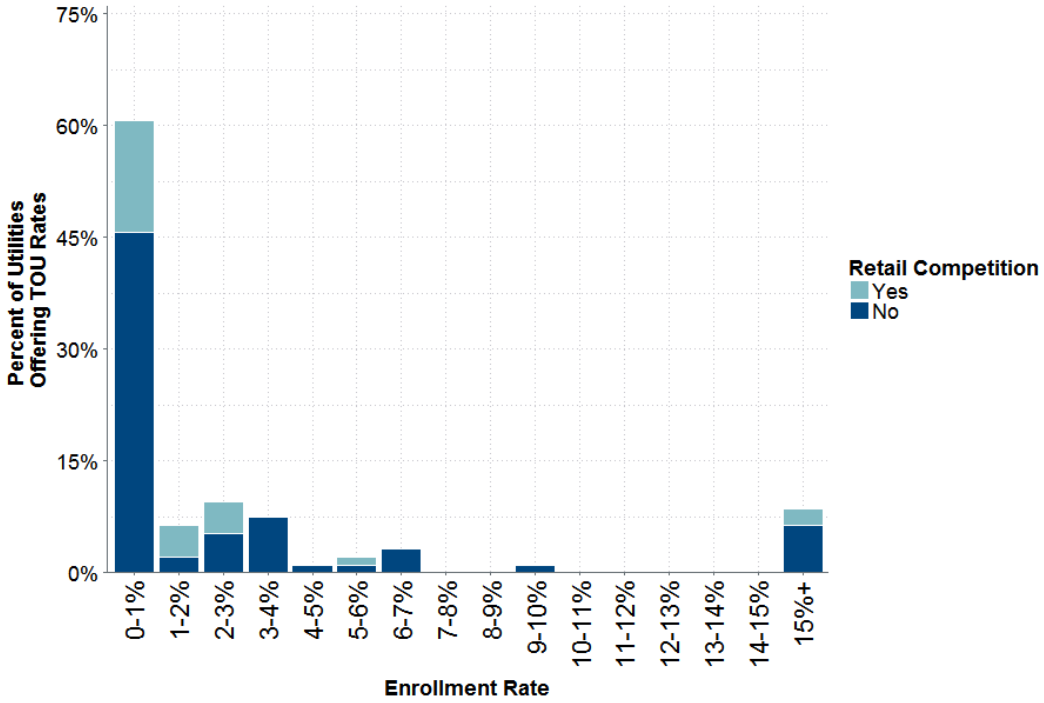
Sources and notes: Brattle analysis of 2015 EIA-861 data. Political subdivisions, retail power marketers, and other utilities are excluded from the figure. Notably, Salt River Project, a large political subdivision, has more than 30% of its residential customers enrolled in a TOU rate.

Comments

- There are 2.2 million residential customers enrolled in TOU rates in the U.S.
- This amounts to 1.7% of all residential customers, and 3.4% of those customers for which a TOU is available

Enrollment distribution across IOUs

Share of IOU Customers Enrolled in TOU Where Available



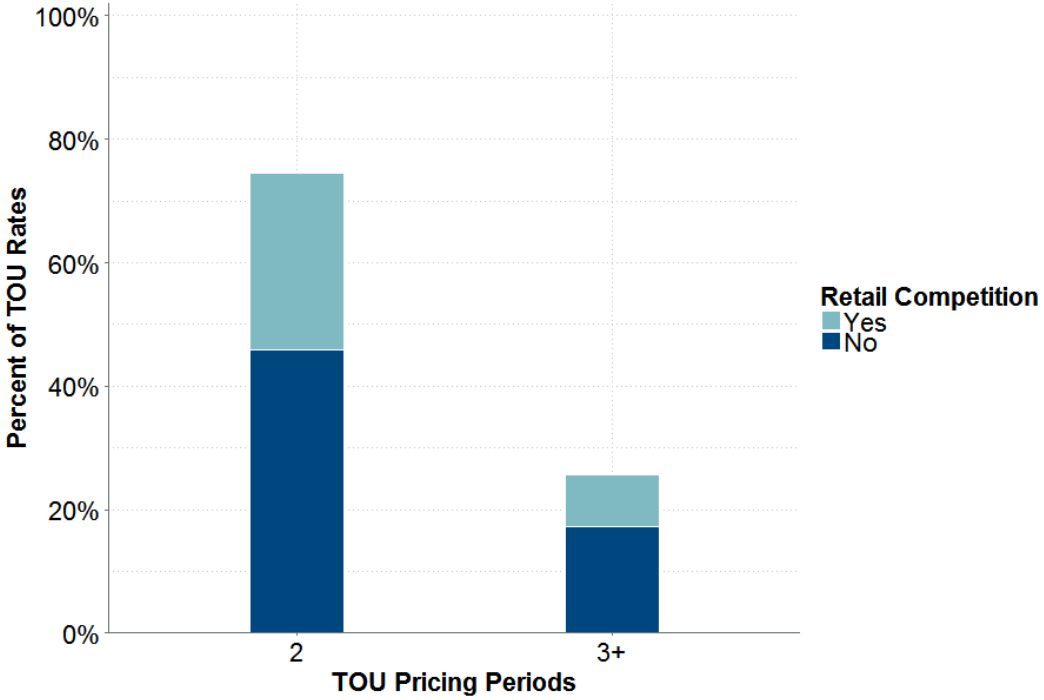
Sources and notes: Brattle analysis of EIA-861 data. Data shown for IOUs only. The EIA data does not distinguish between enrollment in static TOU versus dynamic rates, so in some cases TOU participation may be slightly overstated. We have made adjustments for this where apparent (e.g., high PTR enrollment for BGE and Pepco).

Comments

- 60% of IOUs offering TOU rates have enrollment rates of less than 1%
- A few utilities with high participation skew the average upward
- Arizona Public Service, for instance, has over half of its residential customers enrolled in TOU rates
- Reasons for low enrollment at other utilities include no marketing of the TOU rate, inconvenient design (i.e., long peak period), and/or additional charges to cover cost of TOU meter (where smart metering has not been deployed)

Number of pricing periods

Number of Pricing Periods in TOU Rates



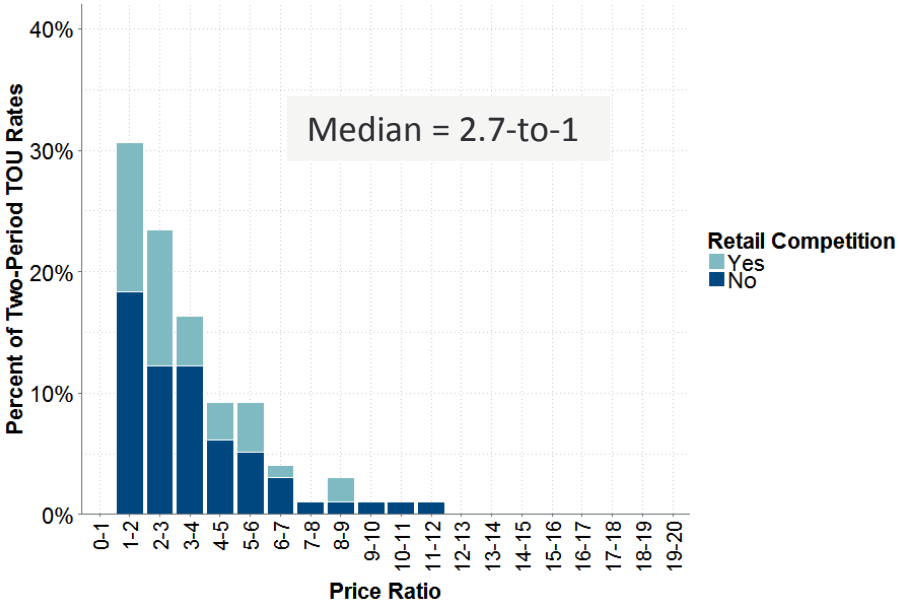
Sources and notes: Brattle analysis of OpenEI Utility Rates Database.
Data shown for IOUs only.

Comments

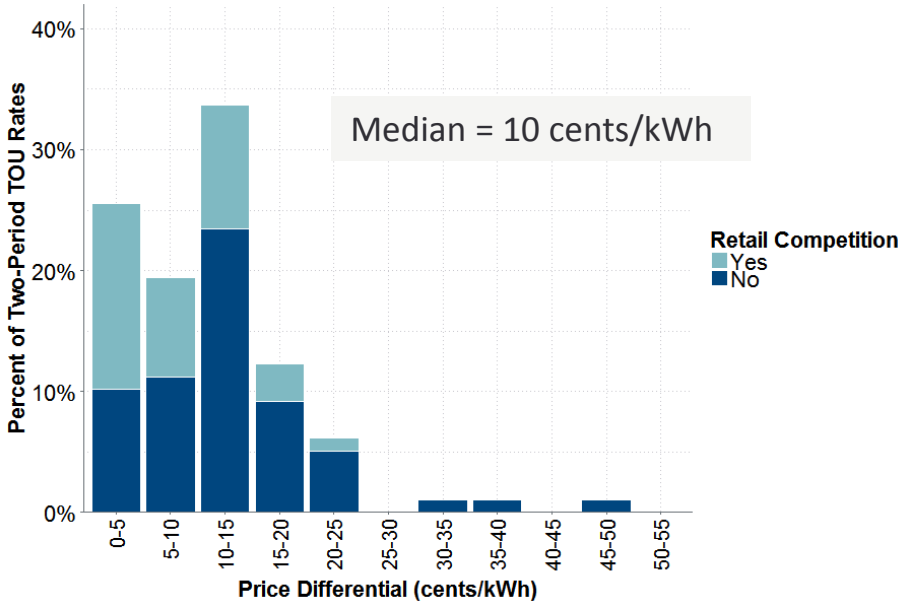
- 74% of all residential TOU rates have two periods
- Only two rates in the sample include more than three periods

Price ratio (two-period rates)

Price Ratio in Two-Period Rates



Price Differential in Two-Period Rates

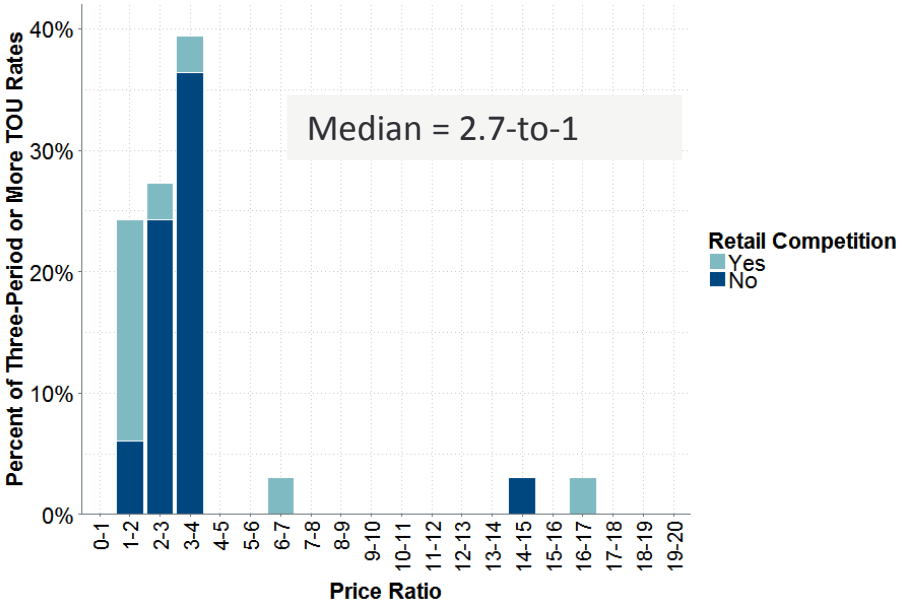


Sources and notes: Brattle analysis of OpenEI Utility Rates Database. Data shown for IOUs only.

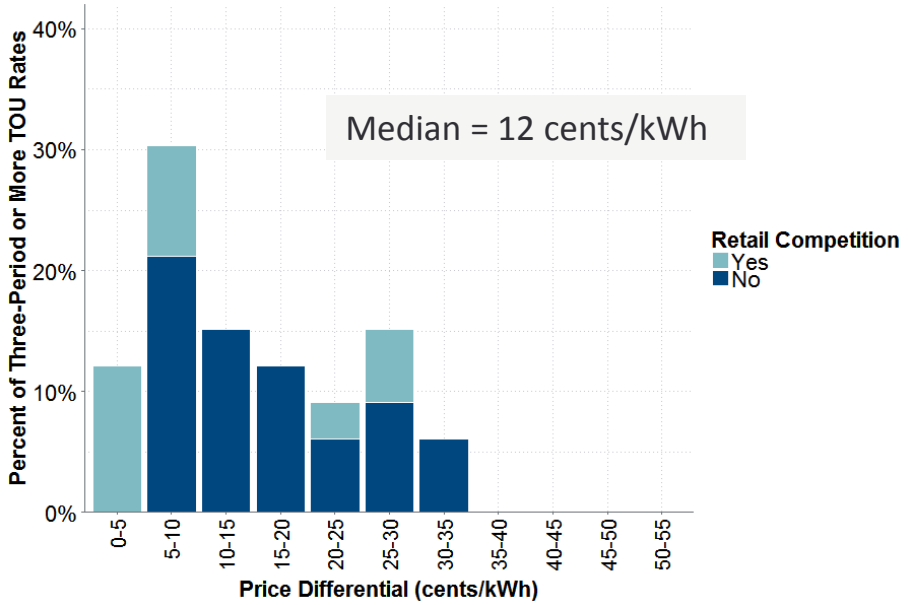
- Among two-period TOU rates, 71% have a price ratio of at least 2-to-1
- Price ratios shown are for the volumetric charge only
- The strength of the price signal will be diluted to some degree by fixed charges and/or additional flat volumetric charges

Price ratio (3+ period rates)

Price Ratio in 3+ Period Rates



Price Differential in 3+ Period Rates

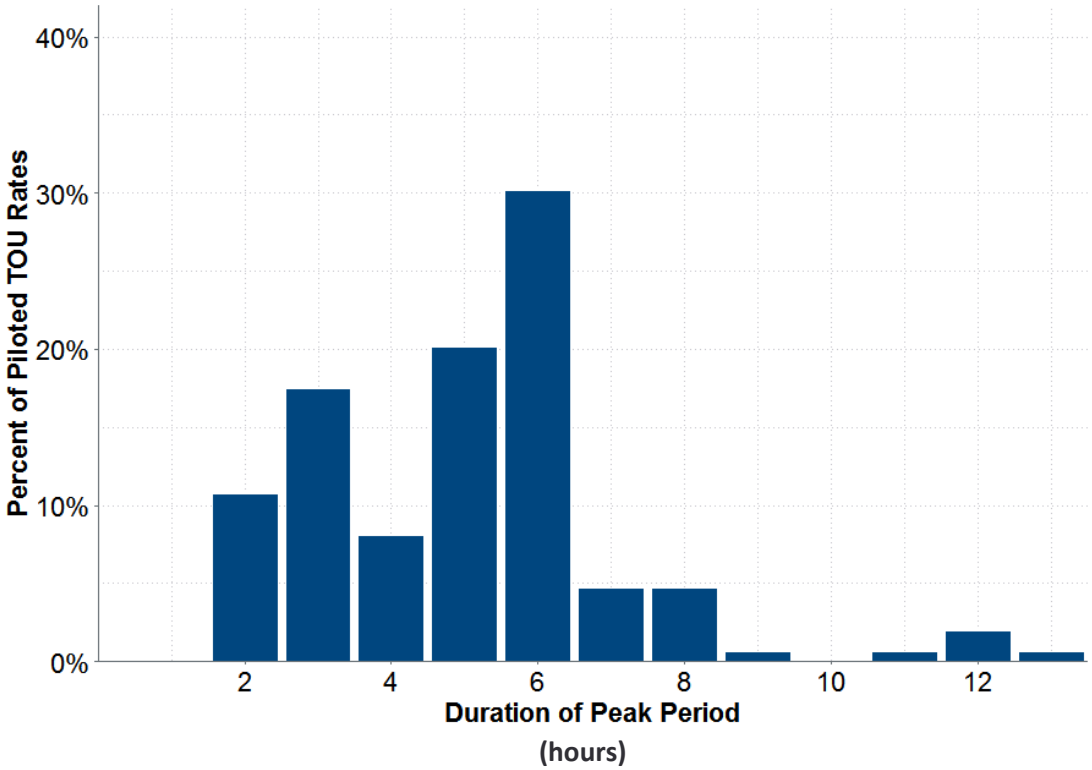


Sources and notes: Brattle analysis of OpenEI Utility Rates Database. Data shown for IOUs only.

- TOU rates with three periods have a similar price ratio as those with two periods
- The figure shows the ratio between the peak price and the super off-peak price

Duration of peak window

Peak Period Duration in Recent TOU Pilots



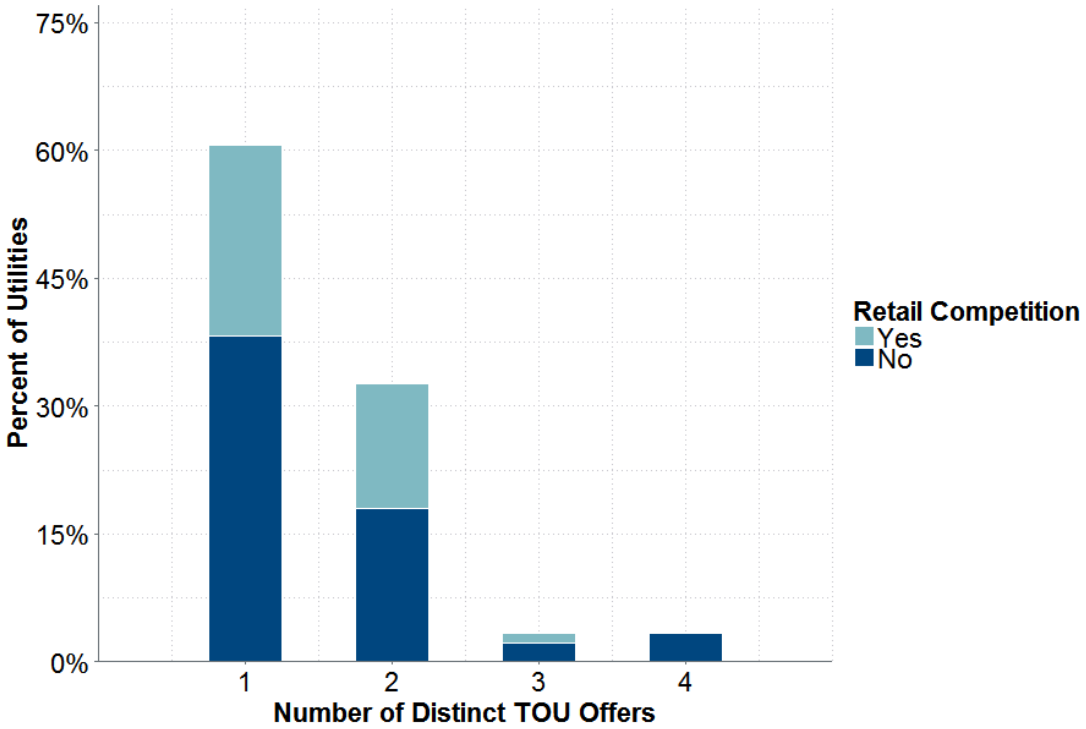
Sources and notes: Chart based Brattle database of TOU rates tested in recent pricing pilots. Includes international TOU pilots (15 of 38 TOU pilots in the database).

Comments

- TOU rates designed recently (i.e., those developed for pricing pilots in the past decade) typically have a peak period of 6 hours or less – those are the TOU tariffs shown in the figure at left
- Among the broader set of TOU rates being offered on a full-scale basis, it is common for existing TOU rates to have a peak period of 12 hours or more
- Many of those older rates have been offered for many years and have low enrollment

Distinct TOU offers per utility

Number of TOU Offers per Utility



Sources and notes: Brattle analysis of OpenEI Utility Rates Database. Data shown for IOUs only.

Comments

- Among utilities offering TOU rates, there are on average two distinct TOU options available to customers
- Features commonly differentiating the distinct TOU offers include timing of peak period, inclusion of demand charge, and applicability to specific end-uses such as electric vehicles or heat pumps

Costs recovered through TOU charge

Name of Investor-Owned Utility	State	Residential Customers	Costs Recovered under TOU Rate: Generation	Transmission	Distribution
[1] Potomac Electric Power Company	MD	496,347	✓	-	-
[2] Jersey Central Power & Light Company	NJ	977,420	✓	-	✓
[3] Arizona Public Service Company	AZ	1,046,989	✓	-	✓
[4] NSTAR Electric Company	MA	1,063,565	-	✓	✓
[5] Connecticut Light & Power Company	CT	1,117,897	✓	-	-
[6] Baltimore Gas & Electric Company	MD	1,132,934	✓	-	-
[7] San Diego Gas & Electric Company	CA	1,266,249	✓	-	-
[8] Ohio Power Company	OH	1,276,363	✓	-	✓
[9] Consumers Energy Co	MI	1,577,087	✓	-	-
[10] Virginia Electric & Power Company	VA	2,150,818	✓	-	✓
[11] Southern California Edison Company	CA	4,381,511	✓	-	✓
[12] Pacific Gas & Electric Company	CA	4,749,486	✓	-	✓
Average		**1,769,722**	**92%**	**8%**	**58%**

- We reviewed the tariffs of large utilities that offer a TOU
- Generation costs are almost always recovered on a time-differentiated basis
- Distribution costs are recovered through a time-varying charge in roughly half of the cases
- Transmission costs are recovered through a time-varying charge in only one case
- Ten other TOU rates offered by large IOUs were researched, though information on the unbundled costs was not available

Emerging trends

Design

Solar PV adoption is causing some utilities to rethink the design of residential TOU rates

The "duck curve" introduces a need for:

- Increased load during mid-day hours when there is excess solar PV output; and
- Reduced load during late evening hours when PV output drops and generation must otherwise ramp up quickly to balance the system

As a result, the TOU peak period price is being shifted later in the evening and/or the price is being reduced during the middle of the day

- APS: Revised TOU design to include a super-off-peak winter price between 10 am and 3 pm, and shifted the peak period from noon-7 pm to 3-8 pm
- Hawaii: Piloting a TOU rate with discounted mid-day price (9 am to 5 pm) and delayed peak period (5 pm to 10 pm)
- California: Delaying start of peak period by five hours (new peak period definition will be 4-9 pm in San Diego, previously started at 11 am)
- SW England: Distribution utility piloted TOU rates with low mid-day price to relieve distribution system constraints caused by high PV output

Deployment

Historically, TOU rates have been offered to residential customers on an opt-in basis

However, with the deployment of smart metering, there has been a gradual shift toward default or mandatory TOU offerings

- SMUD: Transition to be complete by end of 2019
- California IOUs: Transition to begin in 2019 (SCE proposed expedited rollout)
- Ontario, Canada: Province-wide rollout of default TOU was initiated for all utilities in 2012
- Ireland: TOU variable charges will be a required feature of competitive retail suppliers following the deployment of smart metering (by 2020)
- Italy: Default TOU with modest price differential has been in place for many years
- Other: Spain and Maryland, USA offer default time-varying rate structures that are dynamic in nature rather than static TOU rates

Motivation

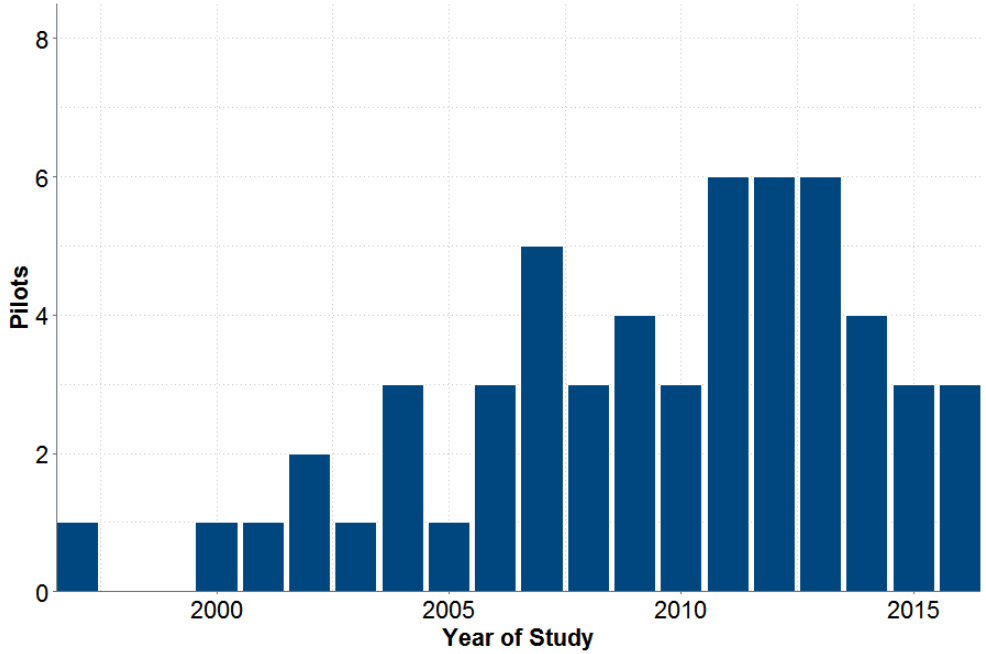
Historically, the primary motivation for offering TOU rates has been to introduce a more cost-reflective rate that provides customers with an incentive to reduce consumption during higher-cost times of day

Recently, intervenors in DG rates proceedings have proposed TOU rates as a solution to the challenge of recovering grid costs from customers with rooftop solar

- Volumetric TOU rates are commonly proposed by solar advocacy organizations as an alternative to higher fixed charges or the introduction of a demand charge
- Sometimes the rate proposals include a dynamic price signal which is combined with the static TOU price signal (i.e., CPP/TOU combo)
- Arizona, Nevada, Kansas, and Colorado are just a few examples of states where TOU rates have been proposed by intervenors for this reason

TOU pilots

Number of Residential TOU Pilots Initiated, by Year



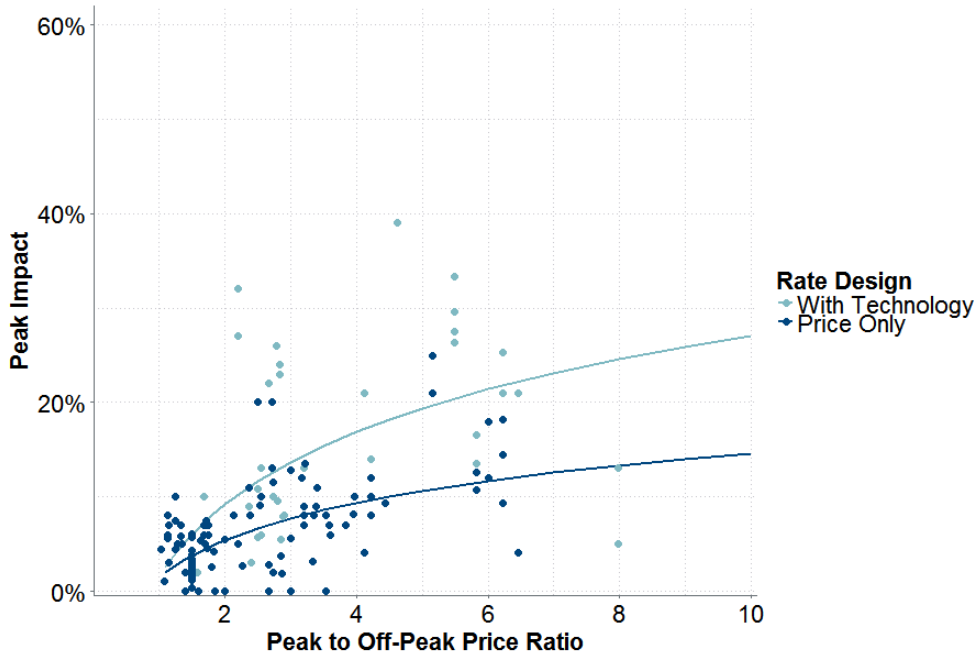
Sources and notes: Chart based Brattle database of TOU rates tested in recent pricing pilots. Includes international TOU pilots (15 of 38 TOU pilots in the database).

Comments

- 38 TOU pilots have been conducted over the past two decades
- The pilots have tested 153 different TOU rates
- There was a surge in pilot studies in the 2011-2013 timeframe driven by US DOE stimulus funding, but TOU rates have continued to be piloted since

Price response

Relationship Between Price Response and Price Ratio



Sources and notes: Chart based Brattle database of TOU rates tested in recent pricing pilots. Includes international TOU pilots (15 of 38 TOU pilots in the database).

Comments

- Results of the recent TOU pilots demonstrate that customers respond to time-varying rates by shifting their on-peak usage to off-peak hours
- As the price ratio increases, customers shift usage in greater amounts, but at a declining rate
- When offered with enabling technology, the effect is stronger

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