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Time-Varying Rates in New England: Opportunities for Reform

A Look at New England Rate Design: Issue Brief #4

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Although some New England utilities offer modernized rates for special applications, like electric vehicles (EVs) and battery storage, there is substantial room for improvement in time-varying residential pricing (e.g., residential tariffs). Here we examine time-varying tariffs in New England and how they could be updated, consistent with ratemaking principles, to increase the benefits to both consumers and utilities. By modernized rates, we mean rates that work to realize customers' expectations, needs and requirements based on their experience as 21st century citizens. These modernized rates should be consistent with ratemaking principles, effectively tap into the benefits of advanced technology, including customer energy decisions, and accurately reflect each time-varying aspect of grid costs, from electricity supply to transmission and distribution to regional capacity and other charges.

20th Century Rate Designs Need to Evolve for 21st Century Consumers

General utility planning and prudence require that regulators expect utilities to pursue the least-cost suite of options capable of fulfilling a given set of needs. Utility grids are complex systems satisfying multiple needs — grid operations, reliability and multiple customers and customer classes. While it is tempting and all too common to view the grid's complexity from the perspective of the utility executive suite or ISO–New England's master control center, those viewpoints lead us astray of who is served. Ultimately it is customers' energy needs and use of the grid that present the requirements to be met at the lowest cost.

One way to encourage consumers to pursue least-cost options is by designing electricity prices to reflect system costs as closely as possible. In the third brief in this series, we explored several promising rate offerings in New England for electric vehicles and battery storage that reveal the grid costs and benefits of these potential investments to consumers in their pricing.

Today, the default tariff for residential customers in New England is a flat volumetric rate. A customer pays the same charge per kilowatt-hour whether the system is operating near its design limit at a daily peak, or in the middle of the night when there is plenty of unused capacity. Some utilities' residential customers have the option of adopting a time-of-use (TOU) rate, but with few exceptions, the current TOU rates in New England do not offer much incentive to switch from the flat rates. The current large utility TOU rates also do not reflect modern meters' and grid sensors' abilities to measure how customers' use of energy varies by time of day — seasonally and annually — and how this varying usage affects the costs of generation, distribution and transmission, capacity and even reliability.

In this issue brief, we explore ways that current TOU rates could be improved in a manner consistent with ratemaking principles and highlight leading examples of modern rates that work for customers in two restructured markets: New Hampshire and Maryland.

A Refresher on Time-Varying Prices

In the previous issue brief, we explored the theory behind time-varying pricing, and we'll briefly revisit that here. Rather than a flat price per kWh, a TOU rate differentiates between consumption that occurs when system costs are high (peak times) and when they are low (off-peak times). During peak times, economic theory suggests consumers should face higher electricity service prices; during off-peak times, they should face lower prices. This mirrors system costs: When consumer demand is high, it will be more costly to serve because of scarce supply; when consumer demand is low, supply and capacity will be plentiful and demand cheaper to serve. This is true not only of the cost of electricity itself, but also of its delivery; transmission and distribution (T&D) are built to serve peak. Anticipated increases in peak above a circuit's design peak require a T&D cost upgrade. When customers can more efficiently shift usage, it saves customers and the grid real dollars. Time-varying pricing is intended to capture that efficiency. A well-designed modern rate encourages consumers to reduce or shift demand from peak times, because doing so can save money for the consumer, the electricity suppliers and the T&D system.

New England's Current Large Utility Time-of-Use Tariff Designs

Large New England utilities offer six basic time-of-use tariffs, with a higher price during long peak periods and a lower price during off-peak periods. The following table summarizes these peak and off-peak prices as well as the peak periods.

Table 1. New England large utilities' time-of-use rates[1]

Utility	Rate Code	Rate		Peak Period
		Peak	Off-Peak	
Eversource Energy (CT)[2]	7	43.08	23.62	Weekdays, 12 p.m. to 8 p.m.
The United Illuminating Company (CT)[3]	RT	37.98	16.75	Weekdays, 12 p.m. to 8 p.m.
Central Maine Power Company (ME)	A-TOU[4]+ standard offer	19.03	13.47	Weekdays, 7 a.m. to 12 p.m. and 4 p.m. to 8 p.m. (excluding holidays)
	A-TOU-OPT[5]	27.21	11.64	Weekdays, 7 a.m. to 12 p.m. and 4 p.m. to 8 p.m. (excluding holidays)
Eversource Energy (NH)[6]	R-OTOD	26.07	10.83	Weekdays, 7 a.m. to 8 p.m. (excluding holidays)
Green Mountain Power (VT)[7]	11	26.77	11.41	Weekdays, 1 p.m. to 9 p.m.

[1] These numbers primarily draw from each utility's residential tariff documents effective January 14, 2019. The entities here are limited to those investor-owned utilities with at least 100,000 residential customers. Besides these seven tariffs, there are a handful of other time-varying options: for example, Green Mountain Power offers a tariff that uses critical peak pricing.

[2] Eversource Energy. (2020). *Rate 7: Residential time-of-day electric service*. https://www.eversource.com/content/docs/default-source/rates-tariffs/ct-electric/rate-7-ct.pdf?sfvrsn=8224c062_12

[3] The United Illuminating Company. (2020, July 1). *Schedule of Rates & Riders*. https://www.uinet.com/wps/wcm/connect/www.uinet.com-7188/b95cd00e-f972-4d12-a99b-88f116ed57f7/UI-Tariffs-Effective-July-1-2020.pdf?MOD=AJPERES&CACHEID=ROOTWORKSPACE.Z18_J092I2G0N01BF0A7QAR8BK20A3-b95cd00e-f972-4d12-a99b-88f116ed57f7-nc6Ooyc

[4] Central Maine Power Company. (2020, July 1). *Electric Delivery Rate Schedule*. https://www.cmpco.com/wps/wcm/connect/www.cmpco.com10190/195ca3b1-3a3a-49c4-93c6-f6c714fec3c4/atou.pdf?MOD=AJPERES&CACHEID=ROOTWORKSPACE.Z18_31MEH4C0N8JA30AVT8DPRB2O26-195ca3b1-3a3a-49c4-93c6-f6c714fec3c4-nc638ll. To make these rates comparable to other utilities' "all-in" rates, the CMP territory standard offer supply rate is added to CMP's A-TOU rate.

[5] Central Maine Power Company, 2020.

[6] Eversource Energy. (2020, August 1). *2020 Summary of Electric Rates*. https://www.eversource.com/content/docs/default-source/rates-tariffs/nh-summary-rates.pdf?sfvrsn=2947c862_6

[7] Green Mountain Power Corporation. (2020, April 1). *Residential time-of-use service rate schedule*. https://greenmountainpower.com/wp-content/uploads/2020/03/Rate-11-Residential-TOU-4-1-2020.pdf

What Should a Time-of-Use Tariff Design Look Like?

It has been long understood that, to the extent that TOU pricing better reflects the actual costs of providing service, it would prove more economically efficient than flat-rate pricing. In 1961, for instance, noted utility economist James C. Bonbright suggested that shifting residential consumers to TOU pricing — despite any necessary investments in metering infrastructure — would be well worth considering as more residential loads became electrified.[8] Economic theory and modernized rate design principles should be predominant in the design of a TOU rate, and in practice a TOU rate for residential consumers should be built around what works for customers and the grid.

Fortunately, theory is accompanied by significant real-world experimentation. At least 60 time-varying pricing pilots, covering almost 350 different tariff options, have been undertaken since 1997.[9] These pilots have consistently shown that consumers do, in fact, respond to time-varying pricing, as indicated in the figure below.

Figure 1. Customer response to time-varying pricing as shown by peak reduction percentage[10]

The results of utility pilot programs provide useful guidance for regulators on how to design an effective residential TOU rate:[11] Customers prefer a shorter peak period.[12] To illustrate, one

[8] Bonbright, J.C. (1961). *Principles of public utility rates*, p. 362. Columbia University Press. Reprinted electronically by Powell Goldstein LLP. https://www.raponline.org/wp-content/uploads/2016/05/powellgoldstein-bonbright-principlesofpublicutilityrates-1960-10-10.pdf

[9] Faruqui, A., & Bourbonnais, C. (2019, June 12). A *meta-analysis of time-varying rates: The Arcturus database*. [Presentation]. https://brattlefiles.blob.core.windows.net/files/16560_a_meta_analysis_of_time-varying_rates.pdf

[10] Faruqui & Bourbonnais, 2019.

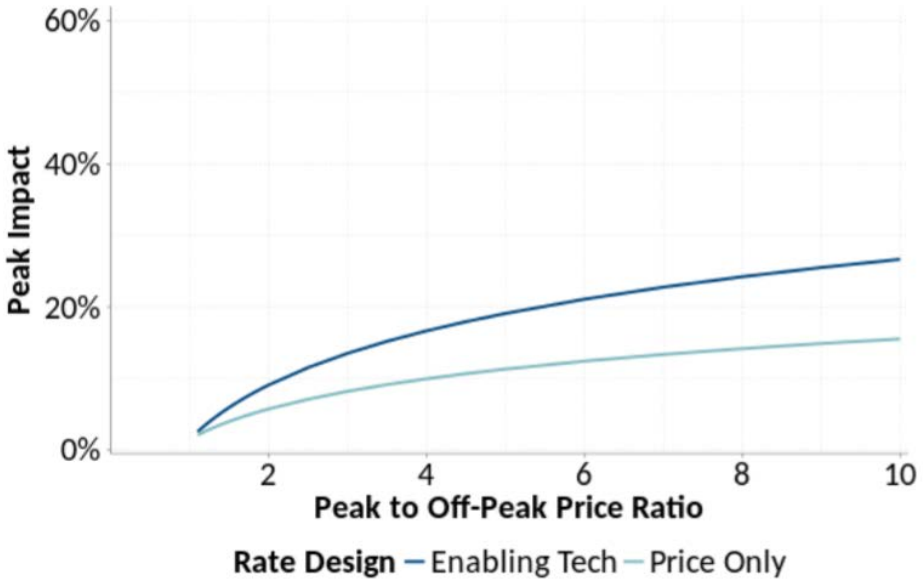
[11] For a more complete discussion of how to design time-varying tariffs, see Faruqui, A., Hledik, R., & Palmer, J. (2012). *Time-varying and dynamic rate design*, pp. 18-19. Regulatory Assistance Project. https://www.raponline.org/wp-content/uploads/2016/05/rap-faruquihledikpalmer-timevaryingdynamicratedesign-2012-jul-23.pdf

[12] Faruqui, Hledik & Palmer, 2012.

customer survey found that only half as many customers would opt into a rate with a six-hour peak versus a three-hour peak.[13] A shorter peak period makes it easier for consumers to control their energy usage, primarily through a shift in usage to off-peak times or conservation.

A second lesson from experience with TOU rates and pilots is that the peak-to-off-peak price ratio should provide a strong price signal. The higher the price ratio, the more likely pricing is to elicit a consumer response, as illustrated in Figure 2. The figure also illustrates how enabling technology, such as smart thermostats, can increase the peak use reductions of time-varying rates. The trend lines are based on actual pilot results.

Figure 2. Peak impact relative to peak-to-off-peak price ratio[14]



The price ratio of peak to off-peak tells customers how much they can save. A 2:1 price ratio can be read as a 50% discount in peak pricing to use energy off-peak. A 3:1 ratio can be read as a 66.66% discount from peak pricing. The above chart illustrates that, even without enabling technology like smart thermostats, a 2:1 price ratio can result in a peak reduction of about 5%, and a 4:1 price can result in a peak reduction of about 10%. The higher a price ratio is, the more effective the tariff is likely to be in reducing system peak.

A well-designed tariff is necessary but not sufficient for success. Experience suggests that consumer engagement and education through effective utility outreach about TOU price offerings is an important component of rate implementation.

[13] Potter, J., George, S., & Jimenez, L. (2014). *SmartPricing options final evaluation*, Prepared for U.S. Department of Energy. https://library.cee1.org/system/files/library/12202/SMUD_CBS_Final_Evaluation_Submitted_DOE_9_9_2014_FINAL.pdf

[14] Faruqui & Bourbonnais, 2019.

How Do the Large Utilities' Time-of-Use Tariffs Stack Up?

Utility experience with implementation of pilots and rates demonstrates that the peak-to-off-peak price ratio and peak period length are important rate design elements, as noted above. The following table lays out these two variables for the seven selected New England tariffs:

Table 2. Peak-to-off-peak price ratio and length of peak period(s) of large utilities' tariffs

Utility	Rate Code	Peak-to-Off-Peak Ratio	Length of Peak Periods (Hours)
Eversource Energy (CT)	7	1.82	8
The United Illuminating Company (CT)	RT	2.27	8
Central Maine Power Company (ME)	A-TOU	1.41	5 and 4 (total 9)
	A-TOU-OPTS	2.34	5 and 4 (total 9)
Eversource Energy (NH)	R-OTOD	2.41	11
Green Mountain Power (VT)	11	2.35	8
Average (Mean)		2.53	8.83
Average Excluding CMP Split Peaks		2.16	8.75

New England's time-varying rates generally have a peak-to-off-peak ratio around 2:1 and a peak period length of about nine hours. One outlier is Central Maine Power Company's A-TOU-OPTS rate, which has a higher price discount and two peak periods rather than one long one. Excluding the outlier rate, the average peak period length increases to almost 10 hours.

As we note above, numerous studies show that time-varying rates send more effective pricing signals to customers when off-peak discounts are higher and the peak period is less than five hours long, making it easier for customers to lower usage during that time. Unfortunately, this body of rates and studies suggests that almost all of the large-utility TOU rates we've examined here have a peak period that is longer than customers like, and a peak-to-off-peak price differential that is not large enough to prompt customers to adjust day-to-day energy usage. The one outlier offering from Central Maine Power Company is somewhat better, with a higher price ratio and two shorter peak periods instead of one long one. Shortening the peak periods and increasing the price ratio based on actual system peak costs are the two primary tools that New England utilities have to increase the customer effectiveness of their TOU tariffs.

An Innovative 21st Century Approach in New Hampshire

New Hampshire's Liberty Utilities is an example of a smaller utility in the region that has recently bucked the large-utility trend of TOU rates with undesirable long peaks and shallow pricing. In response to customer interest in advanced technologies, Liberty has offered two new rates: a battery storage rate and an electric vehicle charging rate. Both rates offer customers the option of realizing the time value of their energy usage by shifting EV and home battery charging to off-peak hours.

Table 3. Liberty Utilities' time-of-use rates for New Hampshire

Rate Code	Rate			Mid-Peak Period	Critical Peak Period(s)
	Critical Peak	Mid-Peak	Off-Peak		
EV Plug-In Electric Vehicle[15]	30.43	13.97	8.54	Weekdays, 8 a.m. to 3 p.m.; holidays/ weekends 8 a.m. to 8 p.m.	Weekdays 3 p.m. to 8 p.m. excluding holidays
D-11 Battery Storage Pilot[16]	30.43	13.97	8.54	Weekdays, 8 a.m. to 3 p.m.; holidays/ weekends 8 a.m. to 8 p.m.	Weekdays 3 p.m. to 8 p.m. excluding holidays

The battery storage rate is associated with a pilot program in which Liberty will install home storage batteries and assess customers' usage, experience and the ability to save regional ISO–New England capacity costs. After the utility assesses Phase I of the program, the rate will be deployed in Phase II. The EV plug-in rate is permanent; the New Hampshire Public Utilities Commission (PUC) adopted it in Order No. 26,376, and it went into effect on July 1, 2020.

As Table 4 shows, both rates set a five-hour critical peak period during weekday afternoons and early evenings, during which time customers will pay 30.43 cents per kWh to charge vehicles or home batteries. The mid-peak rate is only about half that price, but still higher than the off-peak rate. Finally, the off-peak rate, 8.54 cents per kWh, runs from 8 p.m. to 8 a.m., allowing 12 hours of charging time at the lowest price. The ratio between the critical peak and off-peak rates is 3.56 to 1 — a price signal that most studies have shown is more than sufficient to move significant charging off-peak, reducing grid demands and the cost of supply and capacity.

[15] Liberty Utilities (Granite State Electric) Corp. d/b/a Liberty Utilities. (2020). *Electricity delivery service tariff -NHPUC No. 21*, p. 123. https://www.puc.nh.gov/regulatory/Tariffs/Liberty%20-%20GSE%20Tariff.pdf

[16] Liberty Utilities, 2020, pp. 124-125.

Table 4. Peak hours and price ratios for Liberty Utilities' TOU rates[17]

Rate Code	Critical Peak to Off-Peak Ratio	Length of Critical Peak Period (Hours)	Length of Mid-Peak Period (Hours)	Length of Off-Peak Period (Hours)
EV Plug-In Electric Vehicle[18]	3.56	5 hours weekdays except holidays	7 hours weekdays; 12 hours weekdays and holidays	12 hours every day 8 p.m. to 8 a.m.
D-11 Battery Storage Pilot[19]	3.56	5 hours weekdays except holidays	7 hours weekdays; 12 hours weekdays and holidays	12 hours every day 8 p.m. to 8 a.m.

Notably, there are no critical peaks at all on weekends and holidays. The off-peak periods for both rates are likewise consistent in terms of timing, so that customers can easily remember or program their EVs and storage batteries to charge overnight and get the lower rate, which is more than 70% lower than the critical peak rate. Without such an obvious price signal for EV charging in particular, most drivers would arrive home in the middle of the critical peak period and plug in, adding to grid demands and power supply costs.

These Liberty rates followed a statistical methodology submitted to and accepted by the New Hampshire PUC. The methodology looks at Liberty's and New England data to statistically divide the costs of all grid costs — transmission, distribution, capacity and electricity supply into these periods derived from a cost and usage analysis.

Are Customers in New England Participating in TOU Tariffs?

Before drawing any final conclusions, we need to know if customers served by utilities offering TOU rates have found these tariffs useful. TOU rates are now voluntary in all New England states, so customers can opt in or stick with a utility's standard offer flat rate. Have significant numbers of New England customers opted in to a TOU rate where available?

Ideally, one could study actual participation and measure consumer and grid savings to examine the effectiveness of different rate designs over an extended time period. But those data are not made readily available. In the absence of that data, participation data from the U.S. Energy Information Administration (EIA) serve as a substitute.

EIA data for New England TOU rates show low participation rates for four of five utilities, with the

[17] Liberty Utilities, 2020, pp. 123-125.

[18] Liberty Utilities, 2020, p. 123.

[19] Liberty Utilities, 2020, pp. 124-125.

exception being the United Illuminating RT rate in Connecticut.[20] These data are illustrated in the following table.

The table shows that more than a third of United Illuminating's (UI) customers participate in the utility's TOU rate — a phenomenon we'll explore in more detail below — but for the other utilities, very few consumers are opting in.

Table 5. Residential participation rates in time-varying tariffs[21]

Utility	Participating Residential Customers	Total Residential Customers	Participation (Percentage)
Eversource Energy (CT)	426	850,728	0.05
The United Illuminating Company (CT)	72,183	206,251	35.00
Central Maine Power Company (ME)	2[22]	486,410	0.00
Eversource Energy (NH)	39	336,976	0.01
Green Mountain Power (VT)	5,338	221,911	2.41

These participation rates suggest that, for whatever reason, consumers are either unaware of the offerings or do not find the offerings attractive for rates other than UI's rate. Liberty's rate is too new to draw any conclusions on customer interest or acceptances, but it should be noted that the New Hampshire PUC recognized the lack of customer interest in Eversource's current TOU rate being offered in Connecticut, suggesting it may be inadequate for EV charging.[23] The PUC's observation drives the point home that New England's large utility TOU rates are not designed to reflect well-known design principles that make those rates work for customers.

Why Is United Illuminating's Participation Rate High?

United Illuminating has a participation rate more than 10 times greater than the other utilities suggesting a closer look at UI's rate history. The rate is not any more well designed than other rates discussed in this issue brief (e.g., UI's rate has a long peak period and low price discount). So why is

[20] U.S. Energy Information Administration. (2020). *Annual electric power industry report, form EIA-861 detailed data files*, Dynamic pricing and Sales to ultimate customers sheets, data year 2018, https://www.eia.gov/electricity/data/eia861/

[21] Liberty Utilities' EV rate is newly available to ratepayers as of July 1, 2020, and only battery pilot participants can be put on the battery storage rate, so we do not have comparable data yet on those new offerings.

[22] CMP listed just two residential customers as participating in its TOU rate, down from just over 5,000 customers in the EIA 2017 data.

[23] The New Hampshire PUC went on to observe that Eversource declined to revise its residential time of use rate offering in New Hampshire "despite advice from its own cost of service consultant to the contrary." New Hampshire Public Utilities Commission. (2020, August 18). Order 26,394. *Determining the appropriateness of rate design standards for electric vehicle charging stations pursuant to SB 575*, p. 16. https://www.puc.nh.gov/Regulatory/Docketbk/2020/20-004/ORDERS/20-004_2020-08-18_ORDER_26394.PDF

the participation rate so high? The answer appears to lie in the history of this tariff: It was previously mandatory for customers.

In 2006, the utility requested mandatory time-varying prices for high-usage residential consumers. United Illuminating stated then that its consumers would readily understand and adapt to time-varying pricing, because other products like phone service and airline travel reflect peak pricing structures.[24] The utility reported that an "educational effort need not be extensive."[25] Regulators approved UI's request, and consumers who fell into the high-usage category (residential usage of 3,000 kWh for June through September were automatically put on the rate. At the time, and still, this was New England's only mandatory time-varying rate.

A decade later, in 2016, United Illuminating requested that they be allowed to eliminate the mandate,[26] saying that the rate was unpopular with residential consumers.[27] The Connecticut regulators agreed but set a requirement for UI to engage in more educational outreach to consumers before letting them transition back to non-time-varying pricing.[28] Today, United Illuminating's residential consumers have the choice of being on a time-varying tariff or not. Yet more than 35% remain on the time-varying rate.

The high UI participation rate suggests that consumers have had sufficient exposure and education to stay with the program, either through choice or inertia, sometimes referred to as "customer stickiness." Shortening the peak period and increasing the price ratio based on a firm cost-causation basis would enhance customer responsiveness and grid efficiency.

Rates That Work From Maryland

Outside New England, other restructured jurisdictions and utilities have had success implementing time-varying rates. Maryland utilities have leveraged advanced metering data to offer time-of-use and peak-time rebates to its customers across its largest utilities. The Maryland Public Service Commission (PSC) conditioned approval of advanced meter infrastructure on implementation of a time-variant, peak-time rebate program where customers receive rebates for reducing usage when notified of grid peak events. In response to this initial requirement and subsequent grid modernization initiatives, Baltimore Gas and Electric (BGE), Delmarva Power & Light, and Pepco have shown flexibility in working with the Maryland PSC and stakeholders in designing by consensus and implementing new rates and peak-rebate programs.

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[24] Connecticut Department of Public Utility Control (DPUC). (2006, August 30). Docket No. 05-06-04. *Application of The United Illuminating Company to increase its rates and charges: Supplemental decision*, pp. 11-12, 30. http://www.dpuc.state.ct.us/DOCKHISTPre1900.NSF/8e6fc37a54110e3e852576190052b64d/43c5637b29af7897852582c70066cce8/$FILE/050604-083006.doc

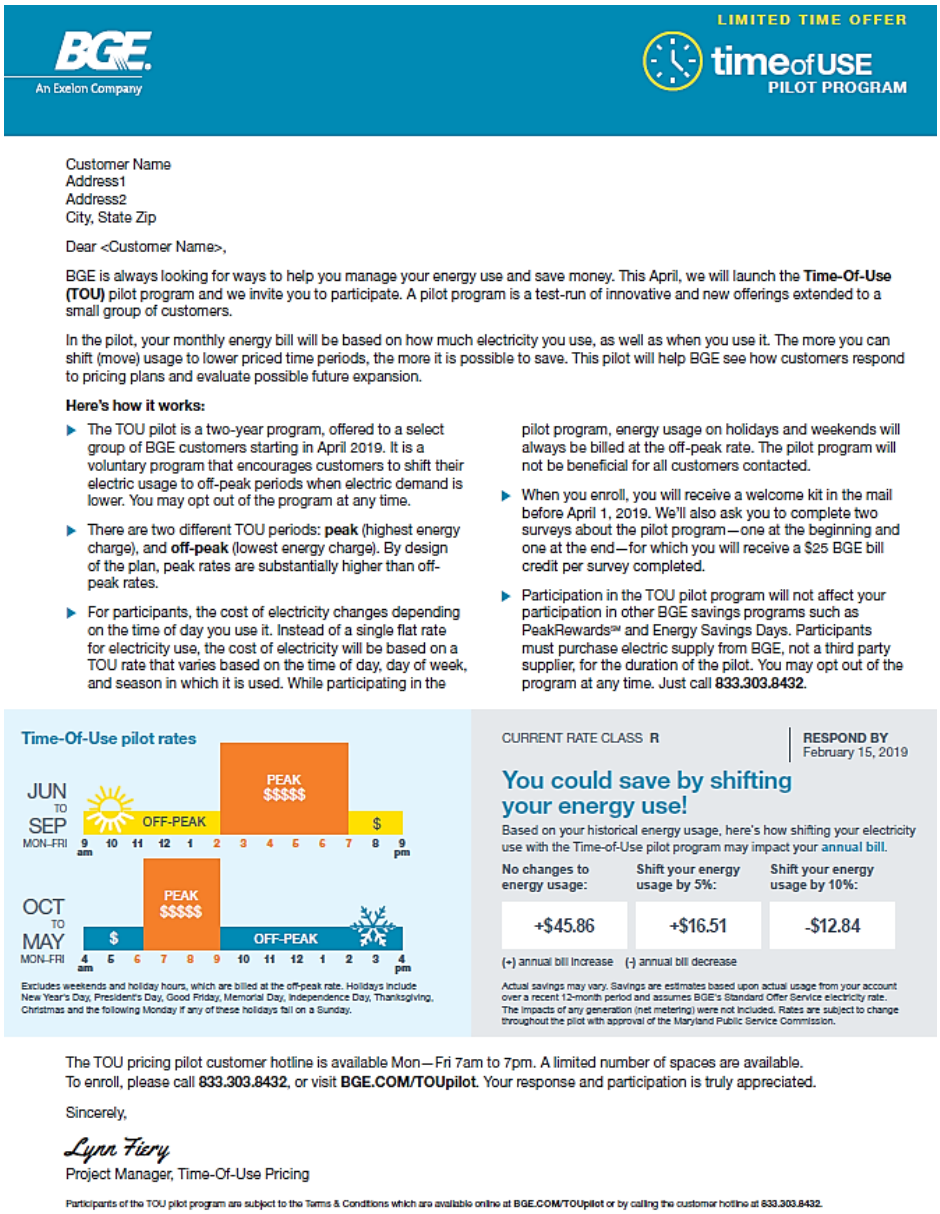
[25] Connecticut DPUC, 2006.

[26] Connecticut DPUC. (2016, December 14). Docket No. 16-06-04. *Application of The United Illuminating Company to increase its rates and charges: Decision*, pp. 101, 105. https://avangridinc.gcs-web.com/static-files/ae20f598-896f-4472-9b47-2c78772c87ad

[27] Connecticut DPUC, 2016, p. 101.

[28] Connecticut DPUC, 2016.

Figure 3. BGE brochure describing the Maryland utilities' TOU pilot rate



BGE
An Exelon Company

LIMITED TIME OFFER
timeofUSE
PILOT PROGRAM

Customer Name
Address1
Address2
City, State Zip

Dear <Customer Name>,

BGE is always looking for ways to help you manage your energy use and save money. This April, we will launch the **Time-Of-Use (TOU)** pilot program and we invite you to participate. A pilot program is a test-run of innovative and new offerings extended to a small group of customers.

In the pilot, your monthly energy bill will be based on how much electricity you use, as well as when you use it. The more you can shift (move) usage to lower priced time periods, the more it is possible to save. This pilot will help BGE see how customers respond to pricing plans and evaluate possible future expansion.

Here's how it works:

- The TOU pilot is a two-year program, offered to a select group of BGE customers starting in April 2019. It is a voluntary program that encourages customers to shift their electric usage to off-peak periods when electric demand is lower. You may opt out of the program at any time.
- There are two different TOU periods: **peak** (highest energy charge), and **off-peak** (lowest energy charge). By design of the plan, peak rates are substantially higher than off-peak rates.
- For participants, the cost of electricity changes depending on the time of day you use it. Instead of a single flat rate for electricity use, the cost of electricity will be based on a TOU rate that varies based on the time of day, day of week, and season in which it is used. While participating in the pilot program, energy usage on holidays and weekends will always be billed at the off-peak rate. The pilot program will not be beneficial for all customers contacted.
- When you enroll, you will receive a welcome kit in the mail before April 1, 2019. We'll also ask you to complete two surveys about the pilot program—one at the beginning and one at the end—for which you will receive a $25 BGE bill credit per survey completed.
- Participation in the TOU pilot program will not affect your participation in other BGE savings programs such as PeakRewards℠ and Energy Savings Days. Participants must purchase electric supply from BGE, not a third party supplier, for the duration of the pilot. You may opt out of the program at any time. Just call **833.303.8432**.

Time-Of-Use pilot rates

JUN TO SEP MON–FRI: OFF-PEAK 9 am–2 pm; PEAK $$$$$ 2 pm–7 pm; $ 7 pm–9 pm

OCT TO MAY MON–FRI: $ 4 am–9 am; PEAK $$$$$ 9 am–2 pm; OFF-PEAK 2 pm–4 pm

Excludes weekends and holiday hours, which are billed at the off-peak rate. Holidays include New Year's Day, President's Day, Good Friday, Memorial Day, Independence Day, Thanksgiving, Christmas and the following Monday if any of these holidays fall on a Sunday.

CURRENT RATE CLASS **R**

RESPOND BY February 15, 2019

You could save by shifting your energy use!

Based on your historical energy usage, here's how shifting your electricity use with the Time-of-Use pilot program may impact your annual bill.

No changes to energy usage:	Shift your energy usage by 5%:	Shift your energy usage by 10%:
+$45.86	+$16.51	-$12.84

(+) annual bill increase (-) annual bill decrease

Actual savings may vary. Savings are estimates based upon actual usage from your account over a recent 12-month period and assumes BGE's Standard Offer Service electricity rate. The impacts of any generation (net metering) were not included. Rates are subject to change throughout the pilot with approval of the Maryland Public Service Commission.

The TOU pricing pilot customer hotline is available Mon—Fri 7am to 7pm. A limited number of spaces are available. To enroll, please call **833.303.8432**, or visit **BGE.COM/TOUpilot**. Your response and participation is truly appreciated.

Sincerely,

Lynn Fiery
Project Manager, Time-Of-Use Pricing

Participants of the TOU pilot program are subject to the Terms & Conditions which are available online at BGE.COM/TOUpilot or by calling the customer hotline at 833.303.8432.

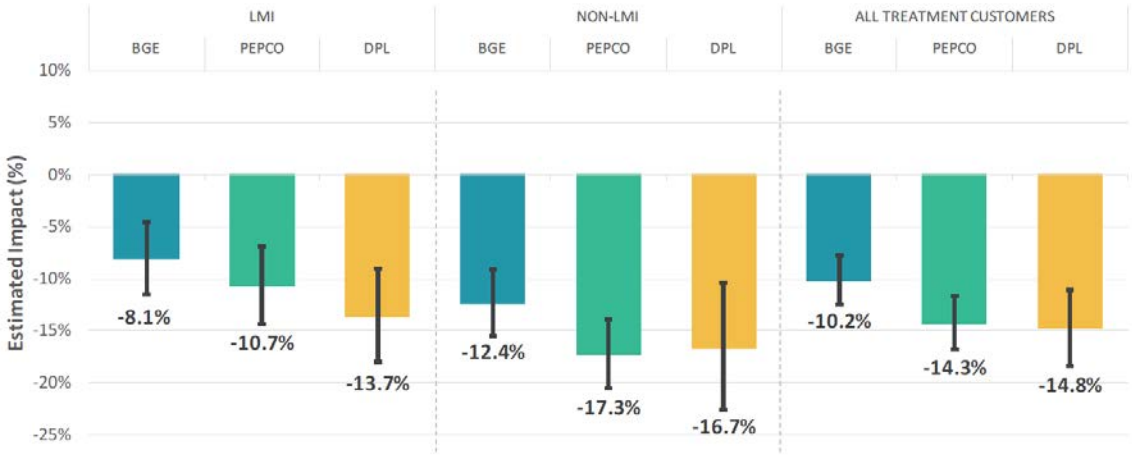
As described in the previous issue brief in this series, Baltimore Gas and Electric offers an EV time-varying rate with a peak to off-peak ratio of 3.2 to 1 (12.285:3.867), which is substantially higher than the ratio for BGE's general TOU rate of 1.5 to 1 (8.458:5.737).[29] BGE is now piloting a TOU rate, for any consumer, with an even higher ratio of 5.4 to 1 (23.262:4.311). The Maryland rates are notably based on all grid costs, not just electricity supply costs. In designing the rates, the Maryland utilities and stakeholders unanimously agreed that the capacity charges and transmission charges (both peak-oriented) of the PJM regional transmission organization should be allocated to the peak

[29] Baltimore Gas and Electric. (2020, July). *Current Market-Priced Service Rate Components*, p. 77-A. https://www.bge.com/MyAccount/MyBillUsage/Documents/Electric/Rdr_1.pdf.

periods, along with the primary distribution system capacity costs. The rationale for this is that these costs largely relate to meeting transmission and distribution system peak demand, and thus are appropriately allocated to peak periods.

The first year of the Maryland TOU pilot resulted in substantial weekday peak reductions by all customer groups in all utilities, including notably for low and moderate-income ratepayers (LMI). The successful implementation of these pilots by the Maryland PSC and the state's utilities demonstrates how well-designed rates work for the grid, effectively reducing peak usage and shifting usage to off-peak hours, and help customers reduce their bills.

Figure 4. Maryland TOU pilot results — summer weekday peak reductions[30]



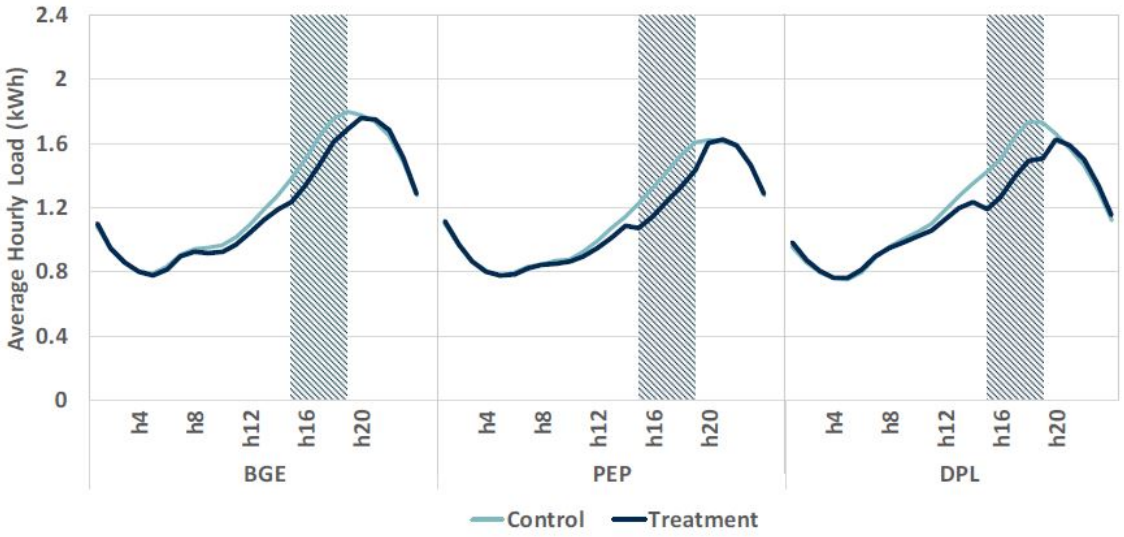
The Year 1 results of Maryland's pilot show that LMI customers' peak usage was reduced by 8.1% to 13.7% across the three Maryland utilities (Baltimore Gas and Electric, Pepco and Delmarva). Non-LMI customers saw peak-usage reductions of 12.4% to 17.3%. The combined customer peak-usage reductions for all groups are 10.2% to 14.8%.[31]

The weekday load shapes for the customers in this pilot, graphed in Figure 5, show both that (1) the TOU customer peak is shifted outside the peak period and (2) the overall peak for these customers was slightly reduced overall while being shifted outside the system peak.

[30] Sergici, S., Faruqui, A., & Powers, N. (2020). *PC-44 time of use pilots: Year one evaluation*, Figure ES.1. The Brattle Group. Prepared for the Joint Maryland Utilities. https://www.brattle.com/news-and-knowledge/publications/pc44-time-of-use-pilots-year-one-evaluation

[31] Sergici, Faruqui & Powers, 2020.

Figure 5. Maryland TOU pilot results — comparison of customer load shapes[32]



Note: The shaded regions indicate peak hours. The control load profile has been adjusted to remove pre-pilot differences between treatment and control groups' load profiles.

Although the grid benefits from peak reductions, the Maryland PSC also wanted to know if customers benefit, too, and in particular whether LMI customers see benefits from the TOU rate. The Year 1 results answer that question with a definitive yes: All customer groups benefitted from bill reductions. TOU-participating customers saw overall average bill reductions ranging from 5% lower for BGE customers to 10% lower for Pepco customers, and within that overall average, LMI customers saved between 4.4% and 9.6%.

Figure 6. Maryland TOU rate pilot — annual average bill reductions[33]

	BGE	Pepco	DPL
All Customers	-5.0%	-10.1%	-5.6%
LMI Customers	-6.4%	-9.6%	-4.4%
Non-LMI Customers	-3.7%	-10.6%	-7.5%

These results show that TOU customers benefited from lower bills. The Maryland pilot also establishes that LMI customers respond to TOU prices at comparable magnitudes to non-LMI customers and benefit from bill savings too. With the full range of benefits from utility capacity tag

[32] Sergici, Faruqui & Powers, 2020.

[33] Sergici, Faruqui & Powers, 2020.

reductions, avoided T&D and supply costs not yet analyzed, the results in now show that Maryland customers respond to well-designed rates by shifting and reducing peak usage, consistent with the large body of studies on TOU rates to date. The Maryland pilot adds to the prior studies a separate focus on LMI customers showing LMI customers similarly benefit from bill reductions.

A Path Forward for New England on Modern Rates That Work for Consumers

Time-varying and dynamic tariffs have the potential to dramatically reduce costs for consumers and utilities in a manner that reflects actual grid costs, but only if they are well designed (that is, reflective of the underlying time-differentiated costs of serving load) and communicated clearly to consumers. Once customers understand through clear price signals they can shift or reduce their consumption to produce least-cost results for themselves and the grid. Clear price signals allow customers to modify their own usage by using advanced technologies in ways that also reduce grid costs.

The New Hampshire PUC provides a straightforward critique of its large utility time-of-use rate: There were 4,200 EVs registered in the state in December 2019, yet fewer than 1% of them were enrolled in New Hampshire's largest utility's TOU rate.[34] To improve on this underwhelming statistic, the PUC has adopted residential EV charging rate guidance that articulates a set of principles for modern rate design:

1. Rates should be based directly on cost causation.
2. Rates should incorporate time-varying energy supply, transmission and distribution components.
3. Rates should have three periods (e.g. off-peak, mid-peak, and peak).
4. Rates should be seasonally differentiated (e.g. summer and winter).
5. Rates should have an average price differential between off-peak and peak of no less than 3:1 in an annual yearly average (not necessarily for each season).
6. Rates should have a peak period of no longer than five hours in duration.[35]

These principles recognize the capabilities of modern technology to differentiate time-varying cost causation for each element of rates, and they also set guidelines for designing rates that customers will respond to by adjusting their usage.

Maryland's most recent TOU pilot is groundbreaking in showing both all customer groups, including low and moderate-income ratepayers, can reduce their energy bills and grid peak demands with well-designed TOU rates. Customers can save money while saving the grid operators and utilities money, too.

Advanced technology increases the effectiveness of TOU offerings by making it easier for

[34] New Hampshire PUC, Order 26,394, p. 16.

[35] New Hampshire PUC, Order 26,394, pp. 15-17.

consumers to adjust their consumption. Utilities in other restructured jurisdictions pair their TOU offerings with technology to enable customer savings or allow customers to take advantage of additional energy services (for example, an EV charger with programmable or set interval charging, or a pre-programmed smart thermostat that customers can reset themselves). Well-designed TOU rates, combined with advanced technology and outreach with real options, will enhance engagement, produce customer savings, provide better customer service and lead to an efficient and clean power system.

Energy Solutions for a Changing World

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