PLMA™
Load Management Leadership

Practitioner Perspectives™

Why is Electricity Pricing So Difficult?

Between a Rock and a Smart Meter

An Excerpt from
PLMA's Industry Viewpoints
Compendium

Introduction

This document, which presents the contents of one of PLMA's most popular webcasts hosted in 2020, provides an engaging and easy-to-understand perspective on electricity pricing from two industry experts, Dr. Ahmad Faruqui of the Brattle Group, and Mr. Bill LeBlanc, Chief Instigation Agent at E Source. Together with moderator Derek Kirchner of Consumers Energy, who also serves as a member of PLMA's Executive Committee, their discussion provides additional insight about the ever-changing landscape of electricity pricing.

Ahmad Faruqui
The Brattle Group

Bill LeBlanc
E Source

Derek Kirchner
Consumers Energy

Ahmad Faruqui: I am going to begin by sharing some perspectives from the field on why pricing is so difficult. I'm calling these perspectives the "Five Immortal Objections to Time-of-Use Rates." I'm using the term "time-of-use rate" very broadly here to refer to any kind of rate that varies across time, whether it is simply a seasonal rate, a time-of-day rate, or a critical peak pricing rate. In other words, some kind of dynamic element could be present in the time-of-use rates, or they could even be full-fledged real-time pricing rates.

I am calling them "immortal" objections because they have been around forever, and I suspect they are not going away, not even for another 10 to 20 years. They are deeply rooted in human psychology and when I say human psychology, I'm referring here not just to the utilities that obviously have to design and offer these rates, and I'm not just referring to the commissions and boards that have to review and approve them. I'm also referring to the customers who will ultimately be on those rates, and to all the stakeholders in the rate-making process.

Of course, there are more than five objections, but let's start here. Interestingly enough, even though my career in rate design began in 1979, I can tell you that these five objections pre-date me. My father was an electrical engineer and my mom was an economist, so I ended up becoming an electrical economist, so to speak. In my father's collection of books, there was one book written in 1938 that caught my attention.

It's a British publication called "Costs and Tariffs in Electricity Supply" by D.J. Bolton. In it, the author states, "There's never been any lack of interest in the subject of electricity tariffs. Like all charges upon the consumer, they are an unfailing source of annoyance to those who pay, and an argument among those who levy them," and then comes the punchline: "There is general agreement that appropriate tariffs are essential to any rapid development of electricity supply and there is complete disagreement as to what constitutes an appropriate tariff." If this sounds to you like something that might be debated in today's British House of Commons (or in any U.S. rate-making process), we are on the same page!

Of course, this was written in England in 1938 before the Second World War. Here we are in the United States, a former British colony, in the year 2020, far into the 21st century, and Bolton's assertion is still correct. But why? Looking at Figure 1 which presents the time-of-use rates currently in place in the Canadian province of Ontario, it shows that for more than a decade, Ontario has had default, or opt-out, time-of-use rates.

Ontario's rates apply seasonally, and they apply within the day. There are three pricing periods: Off-peak, mid-peak, and on-peak. Weekends and statutory holidays are entirely off-peak, and then there are periods at different times of day when there are different prices that apply, as shown in the figure. This is just one very simple way to look at time-of-use rates. And because we now have digital technologies, including smart thermostats, digital appliances, smartphones, and smart consumers, we also have many more interesting possible combinations.

But for now, let's focus on Ontario as a point of reference because it make sense to first agree on whether we

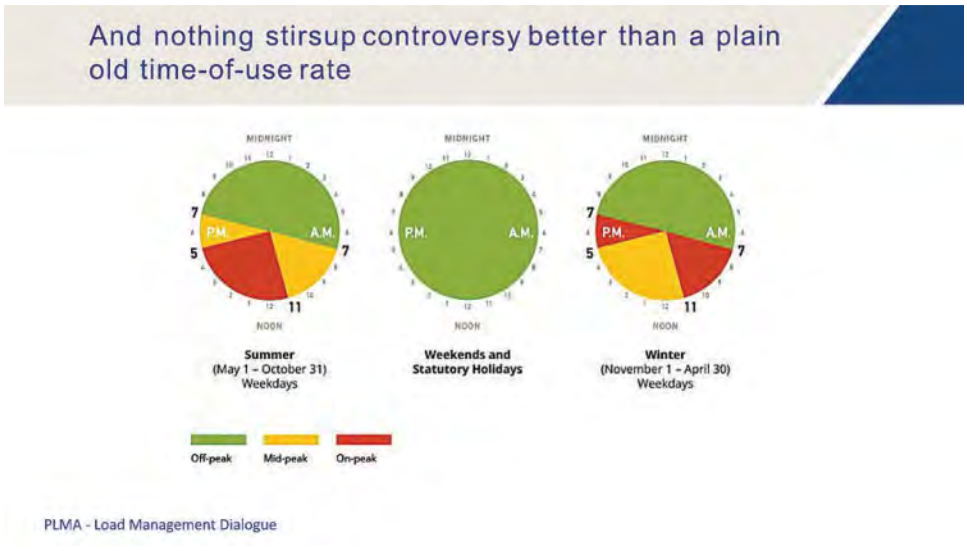


FIGURE 1: View this slide at: https://bit.ly/3iAVyoS

should have a simple plan or time-of-use rate before we move on to more complex pricing possibilities. For 10 years in Ontario, time-of-use has been the default rate available through regulation and there has been retail choice. A resident of Ontario can pick any other rate that retailers provide. But 90 percent of customers have preferred the TOU rate. When COVID-19 arrived, Ontario's leader, Premier Doug Ford, who was elected in 2018 and who had previously said he did not like time-of-use rates, got his chance to make history.

He said, "I don't like the TOU rate because my wife has to time her laundry for the off-peak rate, which is very inconvenient for us." He said this six months ago but once the pandemic arrived in March, Ford commented, "We're all at home now so I'm just going to set all electricity prices equal to the off-peak rate so as to give everyone a nice discount, and peace of mind." Clearly, he doesn't like time-of-use rates, and he has essentially suspended what many believed was one of the best TOU programs in North America. So why did he do this and why is his decision proving to be popular?

The answer lies in the five immortal objections. There is a mountain of empirical evidence that customers accept and respond to TOU rates, but skeptics continue to assert the contrary. That's why today in the United States only four percent of customers are on these rates, mostly simple time-of-use rates, but 80 percent of customers have smart meters. The point of smart meters is to provide customers with the price signals they need to make efficient energy buying decisions.

There's a huge gulf between the 80 percent and the four percent. But when this year ends, if things go as planned, the nearly 80 percent of customers with smart meters will rise to 85 percent, but the four percent on TOU rates might still be stuck at four percent.

I got into a debate with a very respected and seasoned regulator about this when I wrote to him to ask why Ontario was going backwards in time when everyone else was going forward. This regulator said, "TOU rates are an exercise in modifying behavior with little chance of success. Even if successful, they will not yield any tangible reduction in electricity cost." I showed his quote to a former utility vice-president, and I said, "You know, I'm really disappointed in the regulators for taking this perspective. What do you make of this as a utility executive?" The utility exec said, "Well, I think dynamic pricing is just a fantasy."

There you go, right? One utility comment, one regulator comment. Now just by way of perspective, I have been keeping track of these frequently voiced objections to time-of-use rates since I joined the EPRI Rate Design Study in 1979. In those days, the big issue was lack of metering, but at some point, that problem was overcome. Now we have 80 percent of customers on smart meters, so I have removed the metering objection from my list, but there are five objections that remain.

Objection #1:

While time-of-use rates might reduce peak load, they will not lower customer bills.

Every customer says, "This is the utility's problem. Why are you making my life difficult? I only care about having a lower bill."

Here's my response: A well-designed time-of-use rate will yield savings to customers, even in the short term, as customers will reduce peak loads and shift their peak usage to off-peak periods. Off-peak periods are the chance to buy electricity on sale. People love to shop when there is a sale, and the off-peak period is exactly that – a sale! That's when we all need to focus our consumption and reduce our peak load as much as possible. Not everybody will do it, but those who do will come out ahead. In the long run, the savings will be even greater as customers install new digital devices, such as smart thermostats.

By the way, these days you can't even buy a dumb thermostat! You can't even buy a dumb dishwasher. Even the dishwasher has a four-hour push button, so you can set it at 8 pm when dinner is over, and it will run at midnight, if that's when your off-peak period begins. That's what I do with my dishwasher. Additionally, as peak demands fall as more and more customers reduce their peak load, there will be less need for utilities to invest in peaking capacity, which will further reduce customer costs over the long run. With some minor modifications to your lifestyle, most of which can be assisted with enabling technology, you can really come out ahead on your electricity bill.

Objection #2:

Lower peak demand will not lower transmission and distribution costs.

This is because T&D do not depend on load, and this is where the T&D folks come in. Congestion is rising on distribution circuits. There are more and more people buying electric cars, installing solar panels, and lots of new big homes; some net zero, some not net zero. There are challenges now at the distribution circuit level, and you can relieve those by targeted time-of-use pricing. In addition, well-designed time-of-use rates can lower the need for T&D investments over the long run.

You can also encourage customers to charge their electric cars when there is no distribution peak. Right now, we have a million and a half EVs in the U.S., and that number could rise to as many as 20 million by 2030. Who knows? But we will need time-of-use pricing to

manage EV charging, and I'm sure that most ISOs and RTOs would welcome the demand response created by time-of-use rates.

Objection #3:

Ongoing pilots with time-of-use and other time-varying rates show minimal customer reaction to price signals. Their load profiles remain unaffected.

Now this is hardwired into the DNA of many people and they will not accept any evidence to the contrary. We all tend to reject evidence that contradicts what we deeply believe. Psychologists call this cognitive dissonance. I have shared with PLMA and other audiences the evidence from almost 400 deployments of time-of-use rates around the globe. Every single one of them shows the same customer response: If the price ratio is two to one, you get a drop of five percent in your peak.

If the price ratio for critical peak pricing with dynamic tariff is much higher, like 10 to one, you'll get a much higher response. Customers do respond to time-of-use rates and lower their peak demands while shifting some of their load to off-peak periods. That's an empirical fact.

Objection #3 has no basis in fact, but that doesn't mean it doesn't exist. It's an emotional objection. One commissioner even said to me during a conference that if he ever moved his home to a time-of-use rate, his wife would divorce him. I looked at the respected commissioner and I said with a smile, "Your wife's probably going to divorce you anyway, so why are you blaming the TOU rate for your pending divorce?"

Objection #4:

Residential customers are apathetic about TOU rates.

It's said that families are too busy seeing their kids off to school in the morning, commuting to work, returning home to make dinner, et cetera, et cetera. Residential customers have no interest in TOU rates. My response is that while this is true of a third of customers, sound scientific research shows that on average, time-of-use pricing motivates many customers to modify their lifestyles in order to save money.

Oklahoma Gas and Electric has signed up a fifth of their customers for an opt-in program under dynamic pricing, which is mostly enabled with smart thermostats. On average, these customers are reducing their peak demand by 40 percent! Not 4 percent, but 40 percent, and as a result, they are lowering their bills by 20 percent. I have been to Oklahoma twice. Even the taxi driver and the man sitting next to me on the plane said they were on TOU rates, and they were positive and enthusiastic about it. Both were normal human beings. SMUD in Sacramento deployed default time-of-use rates without any hitch last year. Only one percent have opted out.

Fort Collins in Colorado decided to go to whole hog and they have mandatory time-of-use pricing. No revolt, no riots, no objections.

From what I understand, Consumers Energy is going to begin deploying TOU rates in June 2021. Xcel Energy in Colorado has filed to deploy default time-of-use rates this year in a case that's still pending. San Diego Gas and Electric has already done it. They have close to 900,000 customers on default time-of-use, and PG&E and SCE, the two big IOUs in California, will begin deploying TOU rates this October.

Objection #5:

In the developing world, people are too poor to support TOU pricing.

Many people in developing countries eke out a meager existence, and are so intent on making ends meet that they don't have time to focus on responding to time-of-use rates. But here's an interesting riddle: The less money you have, the more important it is for you to save money! So the argument that low-income customers, whether in the U.S. or abroad, have no interest in wanting to save money is just not reasonable.

People want to lower their energy bills regardless of where they live, and the lower their income, the more they want to save money. While I cannot share with you much experiential evidence from developing countries on the efficiency of time-of-use rates, I can tell you there is a lot of evidence that a program funded by the World Bank and the International Monetary Fund (IMF) to improve energy efficiency in developing countries (in order to lower customer bills) continues to be very popular with customers. Clearly a time-of-use rate, if marketed properly and well-designed to lower customer rates, appeals to people in the developing world too.

Bill LeBlanc: My title is Chief Instigation Agent at E Source and that means I do a lot of product development. I have to figure out what's going to happen in the future and bring that back to E Source and say, "If we help our customers in these areas, I think we'll be in good shape." As you might expect, we get lots and lots of questions from our utility members.

Our work is primarily focused on helping utilities engage more effectively with their residential and commercial customers, where ever they interact. I have some questions that dovetail well with Ahmad's five immortal objections: Are the price signals right to create grid efficiency? Do retail prices reflect all the costs they really should? We also have the people side of the equation to consider: Do they perceive their electricity prices to be fair? I use the word "perceive" because it doesn't matter if the price is fair; it matters whether customers think it's fair. The number one thing we have discovered customers want most is fairness in their price rates.

If the net benefit to the grid of changing someone's rate is $50, but somehow the inconvenience for the customer exceeds $50, we have to ask, is that good for society or not? That's a policy question. Not all people want the same rate. One size does not fit all customers, and that's

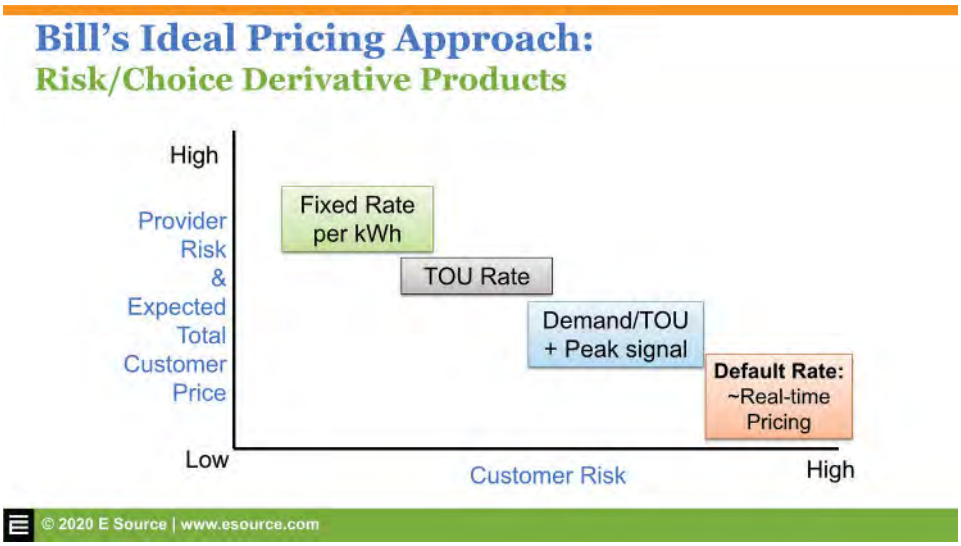


FIGURE 2: View this slide at: https://bit.ly/31XP91m

not what choice means. But customers do have to understand electricity rates in order to be able to perceive them as being fair and act on them accordingly. However, we've also got to consider policy, and this is where the arguments begin in earnest!

Does the rate meet equity goals? Does it meet the fairness goals that regulators or city council have set? Is it cost-based or goal-based? I'll use that as an example. In the case of a cost-based rate, if you're offering a time-of-day rate and the differential doesn't come up as big enough to drive and motivate any behavioral change, do you then move to a goal-based rate to make that differential big enough? That's a policy decision. You have to change the economics and you have to change the equations. You might then consider environmental goals, and that's where solar pricing comes in to create another big debate.

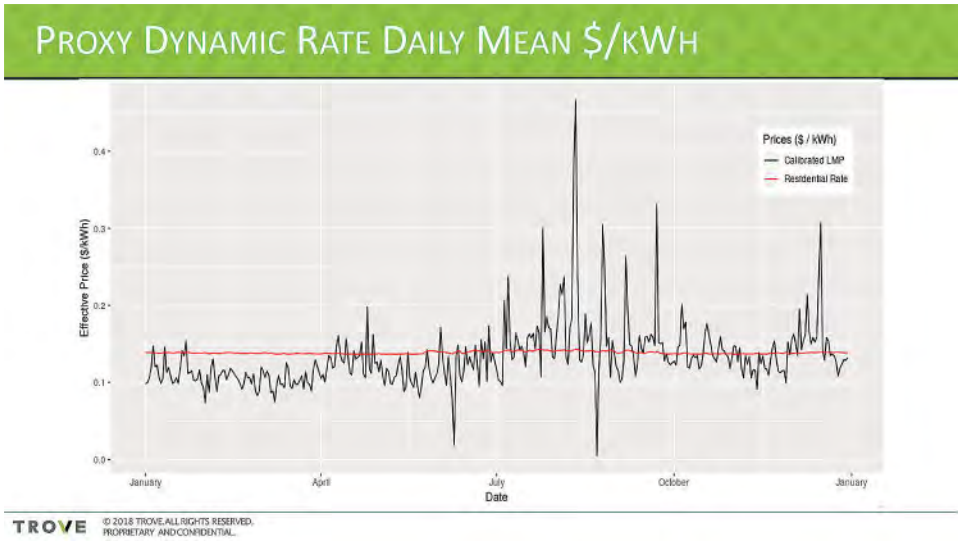
Does the rate enable customer choice and does it encourage the right investments by the customer? Meaning, does it help them to make good long-run investments – investments that are good for them and also good for the grid? We don't want customers to buy an expensive battery just because there's a new rate in place.

I've thought about pricing throughout my career and I've concluded that if I had the power to create rates, I would probably make the default rate something that looks a lot like real-time pricing. I would actually not expect very many residential or small business customers to stay on their rate because then, we would have what are called derivative products based upon risk and choice.

If you consider Figure 2, the X axis shows customer risk becomes greater as you move to the right, while provider risk and expected price both increase as you go up the Y axis. If you wanted the lowest possible price, you'd stay on real-time pricing, and you'd deal with it. However, many customers prefer to exchange a lower electricity price for pricing certainty. They want to trade off the risk. If they chose a TOU with a peak signal, or a demand rate with a peak signal, their risk would increase, but their price would decline. And, the utility would also end up with less risk. But instead, what we mostly see across the country is fixed rate pricing, which is the costliest pricing for the customer, and the highest risk for the utility.

E Source recently acquired a data science company called Trove. Trove did some analysis with a large utility based in the Midwest. The analysis showed the RTO price in that region and compared it to what people pay for electricity on the residential side. In Figure 3, you can see the variations are all over the place, and in summer, you can see the peaks. You can also see how short the duration of these peaks are, and you can feel that the flat rate pricing isn't following any trend in particular.

Trove then did something really interesting: they clustered residential customers based upon their similar



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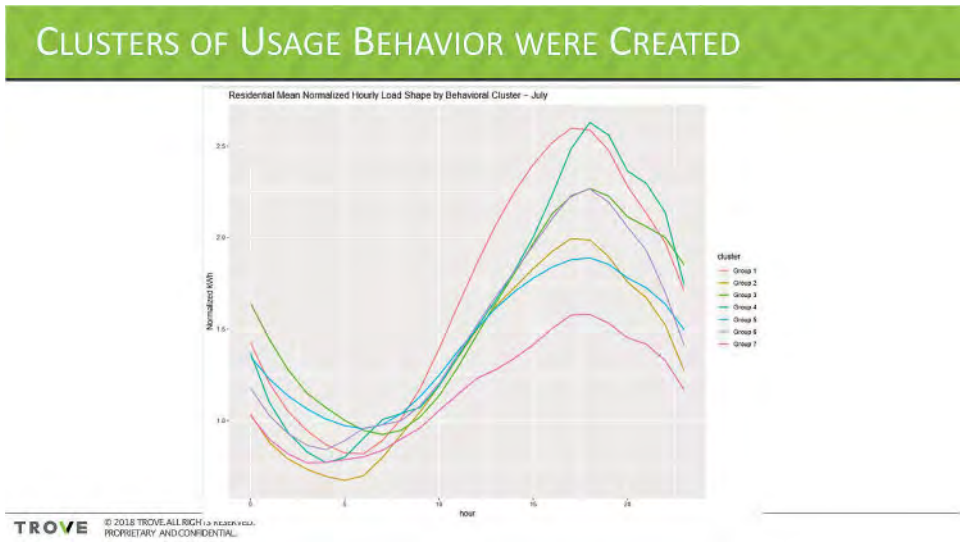

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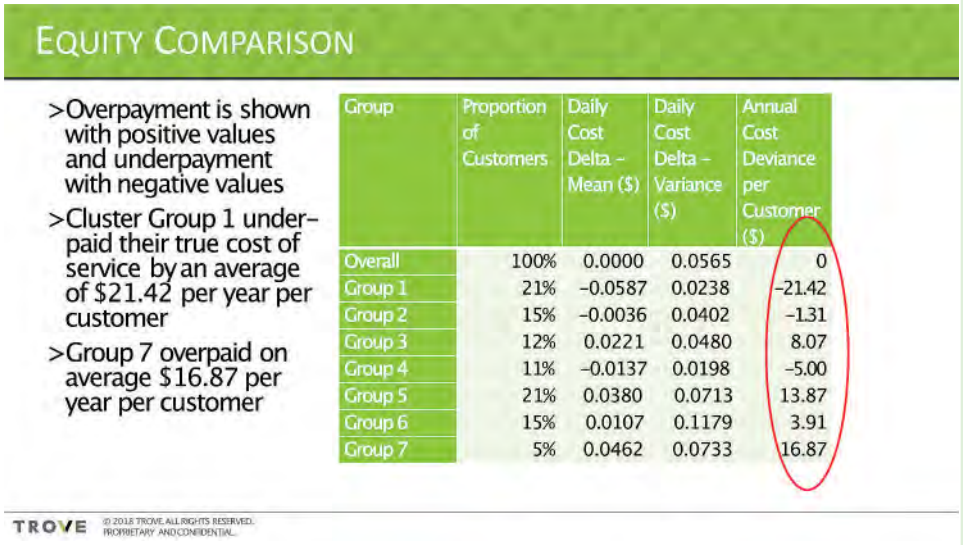
In my power-walking video "research" some interesting observations emerge. When I ask a person on the street, "How much does a gallon of gas cost?", I get a fairly accurate response. But when I ask how much a unit of electricity costs, that is, one kilowatt hour, the range of responses runs from a few dimes to a few dollars. One woman told me she tries not to use electric appliances from the early afternoon to the early evening because she thinks that saves her money. However, she and her friend disagreed on whether they are charged more during those periods of time than they are at other times. She went on to say that when she looks at her bills, she doesn't really understand the usage graphs or how to interpret them. Interestingly, it turns out she was not on time-of-use rates, but she believed she was.

load shapes, and this resulted in seven different clusters that behaved in similar ways in their peakiness. This analysis, shown in Figure 4, leads us to conclude that these customers are either overpaying or underpaying. If the customer is super peaky, then they are probably paying not enough, and if the customer has a pretty good load shape, then they are probably paying too much. Sure enough, this is correct as you can see in Figure 5, which shows that on average, the customers with the decent load shape are paying almost $17 extra per year, while the peaky customers are underpaying their true cost of service by more than $21 per year.

The good news is that the differential over the course of the year in dollar amounts isn't that much. But then let's go back to the policy considerations around how and why we do customer segmentation. What this shows is that current rates are not fair because some people are over-paying and some people are under-paying. Unfortunately, we can't start with that argument! Let's move instead to the people side of the equation. We've done a lot of ethnographic research with residential customers, small business customers, and low income customers. We have had lots of conversations and one thing these customers never say is, "Hey, I wish my utility could give me more differentiated pricing on my electricity." No one ever says that! We have to remember that "differential pricing" is a utility construct; all our customers want is to save money.

E Source did some market research a few years ago on rates and pricing within the residential sector. One of the segmentations we included was based on five different customer groups: cost conscious, convenience focused, quality focused, environmentally focused, and technology focused, as shown in Figure 6. We asked customers if they were interested in a time-of-day rate, and we describe what the time-of-day rate was in some level of detail. Interestingly, once they understood what a time-of-day rate is, a remarkable number no longer reject this pricing approach. As a result, we can conclude TOU rates are not something that people hate automatically, especially after they learn what these are and how they work. In fact, in this research study, about



Group	Proportion of Customers	Daily Cost Delta – Mean ($)	Daily Cost Delta – Variance ($)	Annual Cost Deviance per Customer ($)
Overall	100%	0.0000	0.0565	0
Group 1	21%	-0.0587	0.0238	-21.42
Group 2	15%	-0.0036	0.0402	-1.31
Group 3	12%	0.0221	0.0480	8.07
Group 4	11%	-0.0137	0.0198	-5.00
Group 5	21%	0.0380	0.0713	13.87
Group 6	15%	0.0107	0.1179	3.91
Group 7	5%	0.0462	0.0733	16.87

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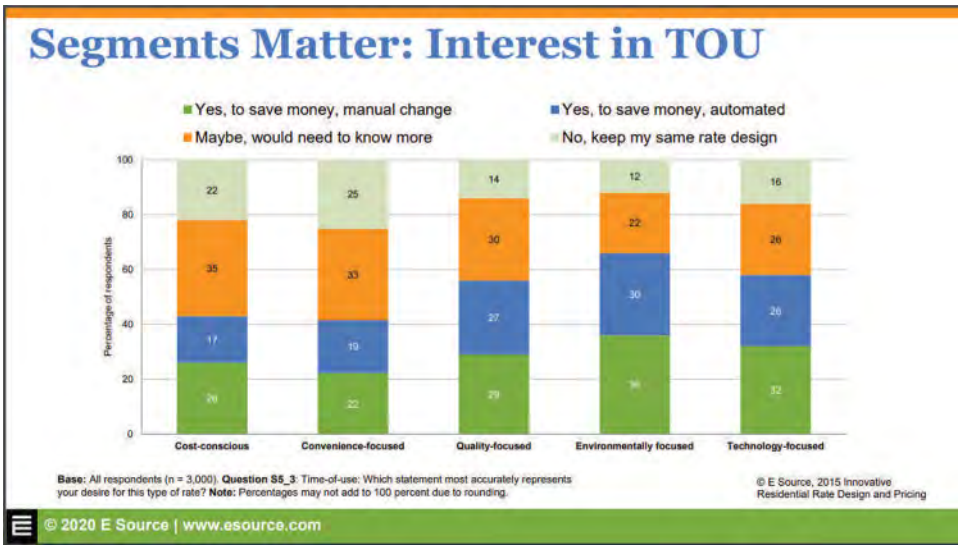

FIGURE 6: View this slide at: https://bit.ly/38BT9pq

75 percent of the customers we spoke to either wanted TOU rates or were willing to consider them.

The environmentally focused and technology focused customers are both much more likely to say yes to TOU rates. For cost-conscious and convenience-focused customers, the number interested in TOU rates is around 40 percent, and it goes up to about 65 percent for environmentally focused customers. These kinds of customers are likely to be very pleased with TOU rates. We also found that if you also describe a demand charge in clear detail, about the same number of customers are willing to consider it an option too.

In this same study, we completed another analysis in which we asked customers to essentially make trade offs between rate and pricing. As you can see in Figure 7, which shows results for six of the 15 scenarios presented, the plan that as many as 95 percent of residential customers have today (the standard hundred dollar, monthly flat rate) is not the most popular! When we offer the time-of-use or peak reduction options, look at how their preferences change! In this case, the preferred option is the flat standard rate with an occasional peak reduction, and they pay $90 instead of $100.

What's even more interesting is that when you flip that around and the thermostat is automatically adjusted by the utility, customers hate the plan. Clearly, language matters!

You can also see in the $105 scenario, the customer pays a five percent premium for "all-you-can-eat" electricity, but this is also not a popular scenario; it's just a more expensive flat rate.

In residential rate design, I like to talk about five critical design imperatives: a) engagement, b) choice, c) advice, d) localized, and e) rewards. How can we design rates to optimize for all of these imperatives? There's a utility in Colorado that's likely to implement something along these lines soon, recognizing that people love choice. Here are their three options: 1) one price all day, but this makes it hard to save any money; 2) demand pricing; and 3) "happy hour" pricing.

Now we're getting into the advisory aspect of customer service where we can say, "This is best rate if you're this type of person." Then we add to that localization and environmental choice. Plus we've included an optional local solar adder, so customers can get community solar. Ultimately, people also really like and want opportunities to earn rewards; they certainly don't want to be penalized! So now we can say, for a customer on time-of-day pricing and demand pricing, they will get an optional flash peak and flash sale. They will save more money. And, we wouldn't make these flash sales available to customers who don't want to take any risk. For those who opt for the predictability of one price all day, there's a premium to be paid. But ultimately, we can determine all of a customer's needs with an easy three-question survey. These questions are as follows:

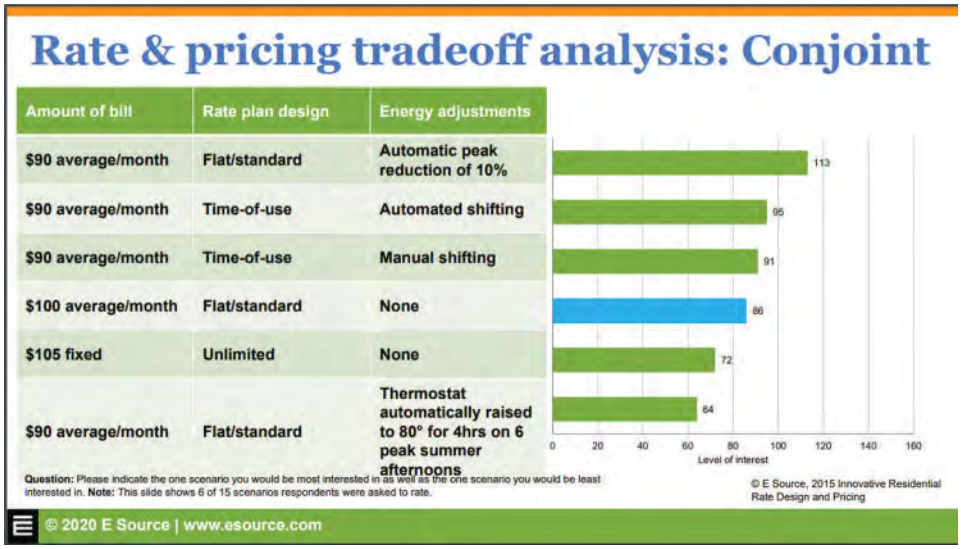

FIGURE 7: View this slide at: https://bit.ly/2Dg39cg

1. Are you willing to alter your use of energy in order to save money?
2. What large energy-using appliances might you be able to shift to operate between 9 pm and 9 am, and avoid using at other times?
    a. Heating / Cooling
    b. Pool Pump, Hot Tub, Spa
    c. Electric Vehicle Charging
    d. Gaming
3. Which of these most accurately describes you and your household?
    a. We want to lower our bills anyway we can.
    b. We want to lower our environmental impact.
    c. We want simplicity and don't have time to think about our energy use.
    d. We love the latest technology and are early adopters.

In another of my power-walking research videos, I told people on the street that utilities are considering implementing new rates called time-of-use rates, and I asked them if they'd heard of these. Most hadn't. One respondent said, "I just think you got to pay for what you use. Doesn't matter what time it is, time-of-day. I mean they want you to get up at two in the morning so your wife can do the laundry? Any time of the day when you're plugged in to something, it should cost you the same."

Another respondent asked if this meant customers would have to pay prime rates for using electricity during prime hours. She went on to explain that she'd experienced this while visiting the U.K. where her mother did the laundry at midnight to take advantage of non-peak hours. She found that irritating but then stated she also liked that it made her more aware of her use of power.

I also asked if it would make things better if the utilities referred to off-peak hours as "happy hour rates" rather than time-of-use rates. But this seemed to invoke references to free drinks. What I loved about all these discussions is that everybody I spoke to seemed to think time-of-use rates would require us all to change just one thing – when we do our laundry.

Moving to beneficial electrification and pricing, I observe we want the pricing plans we design to be economically efficient for our customers. We also want these pricing plans to be environmentally beneficial, as well as grid efficient. When these three things all come together, it turns out we can also lower prices for non-participants because we're reducing peak demand. Now everyone is a winner and the grid is better off too!

Derek Kirchner: Ahmad and Bill, do you have examples of effective ways to communicate with customers about time varying rates? We've talked a little bit about this from the utility perspective, and Bill's power walking videos highlight some of the misconceptions held by many in the general public. We know the rates that have worked and we know the reductions and the shifts that have worked, but how do we successfully tell this story to the general public?

Faruqui: There's a huge misperception that laundry is the biggest driver of an energy bill – witness the conversation I had with the regulator about his wife divorcing him, and what I've heard about Ontario's Premier Ford and his views on TOU. But here is the irony: Laundry is not a huge portion of anyone's bill! The washing machine consumes little energy. The clothes dryer does, but it only runs for half an hour to 45 minutes. In fact, the big ticket item on everyone's electricity bill is the air conditioner in most cases, or the space heater if you're in a winter-peaking area.

In terms of successful TOU marketing examples, Oklahoma and Arizona have it figured out. Arizona has a very hot climate, with a hundred days above 100 degrees every year. APS and SRP are two of the leading utilities in the time-of-use rate space. They tell their customers, "Here are your five major loads. It's your air conditioner, electric oven, electric range, electric dryer, pool pump; those kinds of things. Be thoughtful about when you use them and if possible, use them during the off-peak periods."

Of course, the air conditioner will run whenever it needs to run, but you can pre-cool the house, so then when the peak period arrives, the A/C doesn't have to run as much. I would say APS, SRP, Oklahoma Gas and Electric, and SMUD are doing well. I have not worked directly with SMUD on this issue, but I last visited them right before they transitioned to default time-of-use. What did I see? As I drove to Sacramento on the Interstate, I noticed a big billboard telling me SMUD is introducing time-of-use rates, but they did it in a way that was both simple and understandable. It explained that customers have a chance to save money by buying more power when it is on sale. Every American consumer can relate to that.

Billboards aren't the only solution, but they can be helpful in influencing how we humans think. In the 1980s, Southern California Edison hired the actor George Burns as their spokesperson, and he said "Give your appliances the afternoon off." That was all he said. A very simple, understandable message that resulted in lower customer bills and a reduction of the peak load. George's message worked!

Clear messaging through social media, through billboards, and through word-of-mouth makes a huge difference. Oklahoma has been so successful at this that

even the cab driver and the passenger sitting next to me on the plane were aware of their utility's TOU program. I have mentioned those examples to many other utilities who have only one or two percent of their customers on TOU rates and the response I get is, "Are you trying to shame us?" I say, "No, I'm just trying to give you examples of success from elsewhere." Their response is often, "Oh, we don't have a marketing budget. We can't do this, we can't do that."

As a customer, I now have solar on my roof, a storage battery, and an electric car. I had to try to figure out the best rate for myself, and you'd think I would know what this is, but no, I don't. It is just too confusing! When I called my utility, they didn't have my load shape for the prior year, so the customer service rep told me to wait a year for it to become available. I said, "No, I need to get on some kind of rate now." The rep explained that she had two of the same technologies that I had, but not all three, and so she couldn't say for sure what would work for me. I asked her why it's not possible to create an AI platform to simulate a future load shape for customers like me. Her response was, "Our customers are all asking this, but we don't have an answer for them." I said, "Get a budget and hire somebody." And she responded, "Oh, our management doesn't want to give us a budget."

These are very embarrassing statements coming from a big utility! We're effectively limiting our possibilities for want of some budget and a creative mind.

LeBlanc: E Source has done a lot of communications research, especially on solar rates, but remember, what people want is choice. They hate monopolies and if a monopoly tells them they have only one price option, they are immediately negative. So we always need to present customers with real, not fake, choices. Not by putting a tariff out there and saying, "Oh well, we have 11 choices or we have a hundred choices." No one takes these. Instead, we need a full-blown analysis of how to present the choices to each cluster of customers. How pricing fits a customer's lifestyle is another part of the story. Customers want to know what they can do to save, and then whether that particular option is a fair one. They want to know: 1) How is this price option fair? 2) How does it fit my lifestyle? 3) How can I save?

Kirchner: Excellent point. Have you found the five immortal objections hold through in other geographies or markets, for example in the EMEA (European) or APEC (Asian) markets? Aren't there varying levels of TOU adoption around the world, and to what would you attribute the higher rates of TOU adoption outside of the U.S.?

Faruqui: Having worked on rate design issues in a few countries, I can say it's the same old challenge. I was recently talking to a utility CEO, and I asked why is it so difficult for utilities to tell customers "this rate is more fair for you and it will help you save you money." He said, "Customers reject this approach immediately because they think of a utility as a monopoly and wonder, 'why would a monopoly try to help me? They're just trying to make more money from me.'" This is a huge perception challenge everywhere – from Australia and New Zealand to Hong Kong and the U.K. Retail choice does not solve this enigma either.

In the U.K. and Australia, retail choice has not worked out well for customers. When it comes to pricing, innovation has been limited. The last time I was in Texas, the representative of an energy retailer told me that about a million customers were now on time-of-use rates. But he was unable to share any data with me, saying it was confidential. Retail choice is not the magic bullet we hoped it would be. In 14 U.S. states with retail choice, most residential customers are still with the monopoly utility.

Kirchner: Given that most of the big loads are on the C&I side, what about dynamic pricing or real-time pricing for commercial and industrial? What's been the experience? I know most utilities have at least a non-peak and an off-peak bill determinant for demand charges, which in some fashion or another is a default time-of-use rate. You're trying to incent that behavior, but is there a way to take it a step further, and have you seen anyone be successful on the commercial and industrial side?

Faruqui: Georgia Power has probably the world's most impressive real-time pricing (RTP) program. They have more than 2,000 commercial and industrial customers on either a day-ahead or an hour-ahead RTP rate. It's a two-part rate structure: The first part is the customer's baseline load shape. If the customer does not change their load shape, they will pay the same bill they paid last year. In other words, they subscribe to their last year's load shape, but for any deviations, they pay the real-time price. I think it's a great idea and a good example of success, but it hasn't caught on with many other utilities for reasons that I'm still trying to understand.

The other example of a partial success is critical peak pricing. In California, they have deployed this as the default rate for C&I customers, going back about 10 years now. But for various reasons, customers have not been happy with it and there have been a lot of opt-outs. Many other utilities have time differentiated demand charges. Some also have time-of-use energy charges to go along with the time differentiated demand charges. Metering is not an issue, it's really more about getting customers excited and engaged.

LeBlanc: Success can depend on which group of C&I customers we're talking about. Large C&I customers are very sophisticated. They are likely to have energy managers, and they accept very complex rates, probably 2-part demand charges, 3-part energy charges. Smaller commercial customers often don't have the automation

to make this work. It's a slow process, very similar to residential decision-making, but much more focused on the bottom line than residential customers tend to be.

For example, many residential customers are willing to pay a little more for comfort and convenience because energy is not that big a part of their overall budget, if they are in the top half of the residential sector. Small businesses are often looking to cut expenses. California has done a lot to move customers to TOU, and have done lots of early marketing and early education with small business customers. But remember, small business customers are looking for advice from trusted partners too. If the utility comes across as heavy-handed, they're automatically not going to like it. Utilities have to move in this direction by offering a partnership with their customers.

The other thing that I've often heard from utilities is they tell customers that the new rate isn't going to change their bottom line at all. This is a terrible message! If you're going to bother to do time differentiated prices, if you don't see any changes, then what's the point? Utilities need to couple the rate with an intelligent message about what they are working to accomplish in the long run. Once customers understand that their utility is not building power plants, but is instead focused on helping the environment and low income customers, they're now on board with the new rate.

Kirchner: The key is definitely in connecting the rate story to the bigger picture. That is, as utilities, we're not providing these rates just because we feel like we have to. We're doing it for a good reason. But boiling down an IRP into a 30-second marketing ad is hard to do! Still, we've got to get there.

Most of the TOU rate programs are default TOU. It's not an opt-in program, it's an opt-out. Are there any situations where you've seen opt-in working, or do opt-outs need to lead the way in deployments?

Faruqui: At Oklahoma Gas and Electric, it's opt-in. Same for APS and SRP in Arizona. Those are the three most successful programs today, and they have penetration rates between 20 and 57 percent. There have been incredibly successful opt-in programs. Opt-out will get you more customers, but you still have to do the marketing. Otherwise, there'll be no engagement, and without customer engagement, there will be no load shift. You can do both of them well, and you can do both of them poorly. It's all about your priorities.

One utility with an opt-out CPP rate for large customers hired me to figure out why it was not experiencing any success. I interviewed their demand response manager, the pricing manager, the customer service manager, and finally, the power supply procurements manager. Two of the four hated the CPP rate. The rate design people liked the rate for the job security it provided. The DR person said, "I need the megawatt savings." The supply person said, "Why are you paying them so much money? We can buy power more cheaply than we can get a customer to cut back." The customer service person said, "I really hate this. I tell customers who call us to get off this rate, it's terrible." That's four perspectives in one utility. That's the challenge. You need to achieve internal alignment before you'll be able to make these rates work externally with customers.

LeBlanc: There are a few utilities who have had achieved high market penetration for opt-in programs. Most TOU rates are not opt-out now. That's a relatively new phenomenon. If you look at the behavioral side and not just rate design, with opt out, you end up at above 90 percent penetration. If you offer opt in, you can chug along at three to six percent penetration for your whole life, unless you have an incredible marketing program. But, I wouldn't actually recommend either opt-in or opt-out. What I would love to see is every customer having the opportunity to choose between three or four different rate designs, and then follow the rules of risk and reward.

I would tell them do your lifestyle analysis, do a little survey, and based on this, choose the rate that makes the most sense, knowing you can change it later. This gives a customer some control and choice, which is what they're looking for. I think we'll find this is the beginning of a trend in which customers start talking with each other about energy prices, because that's what's happened at APS. When new people move into a neighborhood, their neighbors will update them on the TOU rates because this is now part of their experience and knowledge. So I recommend utilities offer a choice of very good rate options so that customers can select the best fit for their lifestyle.

Faruqui: I totally agree. No two people are alike, and so give them choices, let them pick. If you were going to a department store and they only offered one kind of shirt, you'd probably never go there again!

Kirchner: Some view time-of-use rates as anti-solar. While demand rates could be that, according to some, what has been your experience with TOU being anti-solar?

LeBlanc: It's very hard to blame a rate for being anti- or pro-solar. I could design a TOU rate that the solar people would love and a TOU rate that the solar people would pick. I think that it goes back to the question of what is, and is not, a policy decision. If your policy is to encourage local rooftop solar, then you may decide to subsidize it within the rate design. If you want to be absolutely fair, you can do that too. You just run the numbers and you're absolutely fair. That's a policy choice. I would not blame the rate design for being pro-solar or anti-solar.

Faruqui: Obviously, it depends on a state's policy objectives. If a state policy objective is high RPS and we want to promote supply-side as well as demand-side

deployments of solar, then let's think of this as an opportunity, the same way we think of an energy efficiency program as an opportunity. Let's provide a rebate to subsidize the cost. We've had 30 percent and now 26 percent income tax credits for solar. Some states provide renewable energy credits for solar. In Austin and in San Antonio, Texas, the utility provides a cash rebate over-and-above the federal income tax credit. That's the way to incent the deployment of solar and other technologies.

Why should rates be used to subsidize customer investments? In my view, that's not a good approach. Whether it's for solar or low income customers, if there is a need for an incentive, offer it either through the tax code or a cash payment. We have food stamps. We could have energy stamps. We could have solar stamps, but the rates should be cost reflective. Otherwise, you get cross subsidies between customers. I don't think TOU rates are anti-solar by the way. Demand charges are viewed by some as being anti-solar. That's not true. If you think about all the incentives already in place for solar, the demand charges being implemented are for the purpose of creating equitable outcomes among customers.

Some customers have solar, some don't. But the reality is every state has to juggle these competing objectives, right? Efficiency, equity, and renewable energy. There is no easy answer. One utility told me about five years ago that the solar industry wanted time-of-use rates. They said they didn't want demand charges, so the utility was going to give them a time-of-use rate. But the time-of-use they were going to get from the utility would not be the one they wanted because of the duck curve. It would need to have a really late peak window from 4 to 9 p.m. rather than from noon to 4 p.m., which solar people would love. The reality is that if you make one customer happy, you're going to make the other unhappy.

LeBlanc: Yes, and we're in a very dynamic supply situation right now. Orders of magnitude greater than I've seen in my career. Load shape curves are changing with DERs and will change even more as electric vehicles begin to proliferate. For the first time, an EV is being seen as an appliance with electrical storage. So whatever we decide to set as the "expected" EV charge time, customers will learn this and remember it for the rest of their lives. It's both important and necessary to set expectations around the optimal charge times right from the very beginning because it will be brutally hard to change these later.

That's why I would recommend to utilities now that they skip beyond TOU as the next new thing and think much more about dynamic pricing. Similar to the process by which developing countries went from having no telephones to having cellphones in one step. If we're not already doing TOU rates, it makes sense to move to something much more dynamic right now because emerging technologies like electric vehicles will really shift these curves, and education is hard to do well. We also want entrepreneurs to work on this problem. The more our utilities can get on the same page around dynamic pricing, the more we'll see entrepreneurs jump in to help solve these problems for customers.

Faruqui: I agree a hundred percent with that. I really think the developing country analogy is perfect. Just leapfrog TOU and go directly to dynamic pricing. We have to do this because so many states want to be 100 percent renewable in 20 years. How is TOU going to help with that? We need 24/7 load flexibility and the only way to get there is through dynamic pricing.

LeBlanc: We should also be putting this capability onto smaller appliances. Air conditioners are pretty big, but going back to solar, when we explained to residential customers that community solar is 40 percent less expensive, and utility solar is half the price of rooftop solar, it shifted their interest from installing rooftop solar to buying solar from their communities.

Kirchner: Yes, this is very much about whether you set rates according to a policy decision or a pricing decision. Trying to move to dynamic pricing is probably the closest balance we have to getting to both of these without being locked into one or the other. If pricing could be tied as closely as possible to the real-time energy market or the real price of power, customers would have the flexibility to make their own economic decisions. In the long run, the load shape would adjust and a natural balance of the system would occur based on preference and not artificial design.

LeBlanc: One last video interview story. I asked a couple on the street, "Have you heard of real-time energy pricing?" When they said no, I gave a long and involved explanation of real-time pricing; that it has a lot to do with the loading order of the power plants because there are base-load power plants that are typically coal or nuclear, and then there are intermediate plants, and then there are peakers, which are often gas turbines. I explained that real-time pricing can give customers the information they need to be able to turn appliances off and on at the right time to help the smooth operation of the grid. There was a lot more to my explanation, but I said to the man, as he walked away, that with real-time pricing he could save as much as five percent on his energy bill. He and his wife weren't interested. They just walked away.

Perhaps it was my explanation?

Presentation slides available at https://bit.ly/2CgOBsB

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PLMA (Peak Load Management Alliance), a 501(c)(6) nonprofit organization, was founded in 1999 as the voice of load management practitioners. Today PLMA has over 160 utility and allied organization members, including private and publicly owned utilities, technology companies, energy and energy solution providers, equipment manufacturers, research and academic organizations, and consultants.

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