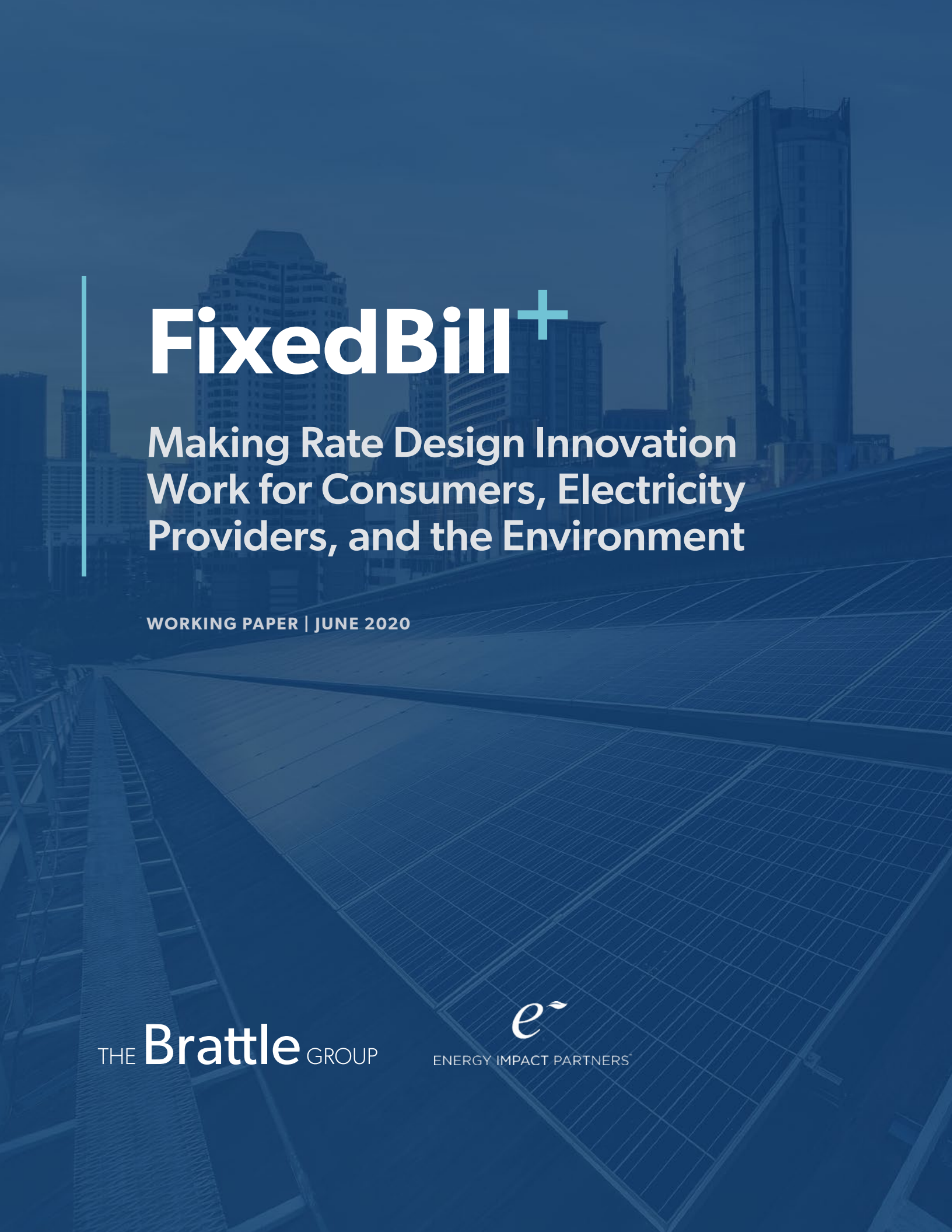

FixedBill+

Making Rate Design Innovation Work for Consumers, Electricity Providers, and the Environment

WORKING PAPER | JUNE 2020

THE Brattle GROUP

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NOTICE

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- In addition, Dr. Fox-Penner serves as an Academic Advisor to The Brattle Group and holds equity in Energy Impact Partners (EIP), a utility-backed energy investment and innovation firm, and consults for EIP and Brattle on energy technologies. Dr. Fox-Penner also conducts research in areas of interest similar to the business interests of EIP and Brattle. Boston University has reviewed the terms of this arrangement in accordance with its financial conflicts of interest in research policies.

A fixed billing solution that benefits consumers, electricity service providers, and the environment

A new trend has emerged in residential electricity rate design. Colloquially referred to as subscription pricing or "Netflix pricing," the approach involves pricing electricity in the same way as a growing number of subscription-based consumer goods. Rather than charging customers based directly on the amount of electricity they consume each month, customers are offered a fixed monthly bill that is guaranteed to remain constant for a specified term (typically a year). Interest in this fixed-bill idea among electricity service providers (including utilities, competitive retail suppliers, and other third parties) was initially driven by the observation that many customers prefer simplicity and freedom from managing their energy use. This paper – which reflects the perspectives of researchers from industry, investing, academia, and consulting – presents a compelling opportunity to improve on the conventional fixed bill approach. Our proposal is referred to as **FixedBill+**. It combines the simplicity of a conventional fixed bill with the flexibility benefits, environmental benefits, and cost savings from energy efficiency (EE) and demand response (DR) programs. Enrollment in FixedBill+ would be contingent on customer acceptance of certain EE and DR measures. FixedBill+ could be offered on an opt-in basis and the fixed bill amount would be individually tailored to each customer's usage history.

As a result, our proposed FixedBill+ approach could reduce customer bills relative to today's typical residential rates, while improving electricity service providers' profit margins, due to system cost savings resulting from the EE and DR measures. Under the illustrative but plausible assumptions in this paper, customers could expect a 3% (around $40 per year) discount in a FixedBill+ offer, relative to their standard rate. These savings are coupled with complete bill stability – a feature that does not exist in standard volumetric rate offerings.

At the same time, FixedBill+ is an opportunity for electricity service providers in regulated and non-regulated markets to improve profit margins. FixedBill+ affords electricity service providers the opportunity to charge a reasonable hedging premium in order to accept the risks that are inherent in a year's worth of energy supply and demand. The provider could also share in some of the cost savings achieved through EE and DR measures. The result is a win-win for consumers and service providers.

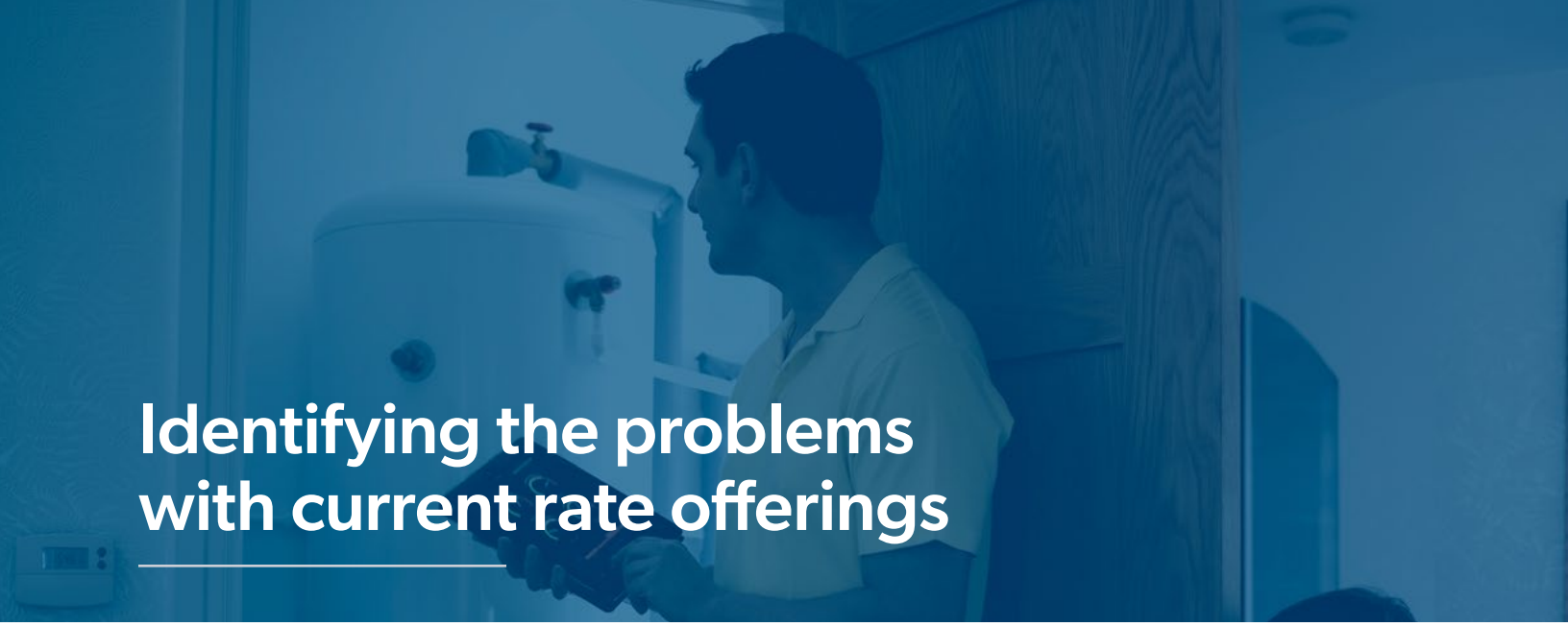
The environment wins as well. In our illustrative example, 100,000 participants in a FixedBill+ offering could be expected to reduce their energy use by over 1 million MWh. For a largely natural gas-based electricity system, that is the carbon equivalent of more

	Standard Volumetric Rate	Conventional Fixed Bill	FixedBill+
Conservation incentive / environmental benefit	✓		✓
Rate design simplicity	✓	✓	✓
Customer bill stability / provider revenue certainty	✓	✓	✓
Customer bill savings opportunity	✓		✓
Provider opportunity for enhanced earnings		✓	✓
Load flexibility incentive		✓	✓

FIGURE 1: COMPARISON OF RESIDENTIAL RATE DESIGNS

than 100,000 gasoline-powered cars being taken off the road for a year. **Figure 1** highlights the attributes of FixedBill+ versus those of conventional fixed bills and the standard volumetric rate in which most residential customers are currently enrolled.

While these illustrative benefits are significant, the devil is in the details for this innovative rate concept. There are still areas of uncertainty. Market research, regulatory innovation, and pilot programs will pave the way for electricity service providers to roll out FixedBill+ at scale. In particular, in order to safeguard the societal benefits of FixedBill+ model, regulators will need to develop appropriate mechanisms to ensure that the right incentives are in place to maximize cost-effective EE and DR. We recommend further work in these areas as a next step toward introducing the FixedBill+ as a new addition to the menu of rate offerings available to consumers.



Identifying the problems with current rate offerings

Although the way we generate electricity is changing, and the way we use electricity is changing, the way we pay for electricity has largely remained the same for decades. Recently, though, electricity service providers[1] have begun to explore an alternative way to price electricity that may better align with both consumer preferences and the needs of the power system. This new pricing mechanism is commonly referred to as a "fixed bill."

At its core, a fixed bill is what it sounds like: a single, flat bill that does not change from month to month based on how much energy you use. For example, you might pay $100 per month regardless of your energy consumption (in kilowatt-hours (kWh)) or your peak demand (in kilowatts (kW)).

In the past, competitive energy retailers have marketed these types of pricing schemes as "all-you-can-eat" energy plans – targeting customers who wanted to consume lots of power, and were willing to pay a premium to avoid thinking about it. Many consumers are drawn to the predictability and simplicity of these plans, but the concept has drawn sharp criticism from advocates of EE and demand-side flexibility. These advocates point out that fixed bills remove the marginal price signal that efficiently harmonizes supply and demand. Basically, standard fixed bills give consumers no reason to try to conserve.

Basically, standard fixed bills give consumers no reason to try to conserve.

In this paper, we present a variation on the conventional fixed bill offering that would still provide the same predictability and simplicity to consumers, while tending to reduce energy costs (both financial and environmental) and giving electricity providers a stake in all of these benefits. We refer to this concept as FixedBill+, with the '+' being vital to making sure that this delicate balance holds. Here are the three key elements embedded within that symbol.

1. **Comprehensive energy management**

   FixedBill+ involves a quid pro quo between an electricity consumer, their electricity service provider, and society. In exchange for the convenience and stability of a fixed bill, the

1 Throughout this paper, we use the term "electricity service providers" to refer to regulated electric utilities, competitive retail energy suppliers, and other third parties that provide energy services beyond commodity electricity.

consumer must permit the provider to reach beyond the electricity meter, into their home, and take limited control of a set of agreed-upon energy-related functions. For example, FixedBill+ customers might be required to allow their energy provider infrequent control of their home or business HVAC (heating, ventilation, and air conditioning) system, which can be achieved through occasional adjustment of a connected thermostat. This would allow the energy provider to time power use more efficiently to take advantage of natural ebbs and flows in electricity demand. Collectively we will refer to these actions as demand-side management (DSM), which includes both EE and flexible DR.

2. Periodic adjustments

At first blush, there seems to be a dichotomy between fixed billing and variable billing, but there is not. Instead, they should be considered points on a spectrum – a range of timeframes along which an electricity service provider might offer to take on the risk and responsibility for managing energy costs on behalf of a customer. As such, the initial fixed bill offer must be individually tailored to each customer's historical electricity usage. Of course, no provider can offer to fix a customer's bill forever, because of the myriad uncontrollable factors that affect the cost of supplying energy and the evolution of customer demand. Imagine, for example, if a fixed-bill customer buys a new electric vehicle (EV), or perhaps even a small fleet of electric space heaters. And even the best DSM portfolio is unlikely to hold back a customer who is truly committed to an all-you-can-eat mentality. So, pricing in a FixedBill+ system will need to rise or fall based on average consumption over some period. For example, the FixedBill+ offer might peg a consumer's fixed bill for the coming year to the price that it cost to serve that consumer over the preceding year (weather adjusted).

In addition to restraining customers' all-you-can-eat instincts, these periodic adjustments create an incentive for consumers to invest in long-term efficiency upgrades, such as new, more efficient appliances – for which buying decisions are more difficult for a third-party energy manager to influence. In fact, annual adjustments create an ideal opportunity for the provider and customer to motivate (and finance) major efficiency investments, the same way wireless companies now use contract expiration as an opportunity to re-evaluate each customers' service package and equipment.

3. Incentives for energy providers to reduce costs

The easiest way for energy providers to profit from a fixed bill is to charge a risk premium above their expected cost to serve each customer. Yet, FixedBill+ will only be a boon for society if energy providers are also incentivized to reduce the actual total cost of service for each customer. That means all of the "upstream" links in the energy value chain – such as wholesale energy markets and distribution utilities – need to pass on truly cost-reflective signals to the retail level. It also means giving retail energy providers – whether they are utilities, competitive suppliers, or other third parties – a stake in the cost savings.

The alignment of incentives to reduce costs and carbon emissions, while maximizing electricity provider earnings, is a particularly important dimension of the FixedBill+ proposal. Of course, the regulatory changes required for this alignment differ between areas where customers are serviced by vertically integrated electric providers and areas with retail choice. We will spend some time discussing these differences later in this paper.

First, it is worth asking: Why care about the fixed bill model at all? And why focus on it *now*?

Why fixed billing?

Two distinct forces in the electricity market are propelling arguments in support of fixed bills. One set of forces is on the **supply** side of the market; the other, **demand**.

STARTING WITH THE SUPPLY SIDE

At an aggregate level, the generation mix is gradually transitioning from fossil-fuel-based power plants to renewable energy wind and solar plants. This is a key factor because fossil-fuel-based power is affected by variable costs (i.e., price per megawatt-hour, or $/MWh) dependent on fuel prices, whereas renewable energy plants require substantial up-front investment but have very few costs that can truly be considered variable (because their "fuel" is free). In other words, the cost of the electricity supply is becoming increasingly fixed in the short-to-medium term. Hence, fixed billing will increasingly align with the underlying nature of the cost of energy in this regard.

Somewhat more urgently, simple per-kWh pricing for the transmission and distribution (T&D) portion of the bill is also becoming a poor mechanism for cost recovery – mostly owing to the growth of distributed generation and the potentially massive changes in electricity demand caused by rooftop solar, distributed energy storage, EVs, and other possible avenues of electrification. The costs of T&D are mostly sunk. In the short-to-medium term they are essentially fixed, much like the costs of renewable energy, while in the longer term they are driven by local peak demand conditions. But these costs have historically been recovered through almost entirely variable rates.

Our goal with this paper is not to wade into our industry's ongoing debate about how to compensate distributed generation, or exactly how to balance short-term versus long-term price signals for T&D. However, it is important to note one benefit of FixedBill+ in the context of this debate: It inherently makes price signals to consumers more reflective of the largely sunk nature of T&D costs, while still providing a framework that encourages the cost-effective deployment of distributed energy resources (DER).

MOVING ON TO THE DEMAND SIDE

On the demand side, the primary driver of interest in fixed bills is consumer preference. In other aspects of their lives, consumers have come to think of fixed bills as a form of subscription pricing, and they have come to like it. From music, to TV, to razors, many consumers are demonstrating a strong preference for fixed bill pricing schemes for certain types of products. What do these products have in common? Consumers

have a fairly consistent, predictable demand for these products, and do not want to spend time thinking about every microtransaction. Electricity fits into that category pretty snugly.

In some ways, electricity could be an even better fit for 'subscription' pricing than music or TV, because consumers tend to enjoy spending time selecting pop songs and prestige dramas much more than they enjoy spending time managing energy costs. In fact, consumers' general distaste for thinking about their energy consumption is one of the few consistent axioms of the energy industry. Our energy costs today are higher than they ought to be because so many of us value our time more than we do the potential savings or environmental impacts we could achieve.

Therein lies an important "carrot" for policymakers and regulators in the FixedBill+ model. Properly implemented, it takes the responsibility for DSM off the shoulders of consumers, and places it on sophisticated electricity service providers and regulators. Electricity service providers are paid to find electricity markets fascinating, and they can be motivated to extract small amounts of value from large numbers of consumers.

PRIOR RESEARCH

Prior research has addressed various aspects of coupling fixed bills with EE and DR offerings for residential customers. In particular, work by Lon Huber introduced a concept referred to as "Energy Service Subscription Pricing (ESPP)." That work also highlighted many of the same emerging drivers of interest in the FixedBill+ concept that are addressed in this paper (e.g., proliferation of more advanced distributed energy technologies, shifting customer preferences, and adoption of renewable generation), as well as implementation challenges and a range of deployment models.[2] Additionally, an article by Helen Lo, Seth Blumsack, Paul Hines, and Sean Meyn articulated the benefits and challenges of subscription-based pricing coupled with load automation in an environment of low marginal costs.[3] A variation of the FixedBill+ concept that combines hourly subscription pricing with load flexibility incentives has been piloted in California by Southern California Edison, TeMix, and Universal Devices, Inc. through a California Energy Commission-funded demonstration project.[4]

2 See, for instance: Lon Huber and Richard Bachmeier, "What Netflix and Amazon Pricing Tell Us About Rate Design's Future," *Public Utilities Fortnightly*, September 2018. Also: NRECA, "Innovations in Pricing: Energy Service Subscription Pricing," prepared by Lon Huber, February 2019. Also: Lon Huber, "Primer: Subscription Pricing for Regulated and Competitive Energy Providers," Guidehouse Insights, October 12, 2018.

3 Helen Lo, Seth Blumsack, Paul Hines, and Sean Meyn, "Electricity rates for the zero marginal cost grid," *The Electricity Journal*, April 2019.

4 More information on the project can be found here: http://www.temix.net/images/GFO-15-311_Retail_Automated_Transactive_Energy_System.pdf.

Technology makes the "+" possible

What makes this moment so ripe for experimentation with FixedBill+? One answer is that consumers are increasingly accustomed and attracted to the idea of subscription pricing. But this demand "pull" would not be sufficient on its own. Electricity service providers also need the right technology to make the model work. Today, that technology is available through smart meters, smart energy devices, and DER management systems.

1. **Smart meters**

   Meters yielding hourly or sub-hourly interval data have been rolled out to more than half of US households. These meters enable energy providers to calculate the actual cost of service for each individual customer. In non-regulated markets, this hypothetically enables load-serving entities to be billed according to the specific load profile of their individual customers, rather than an average load profile for each customer class. While this practice has not yet been implemented in every market, there is no longer a technical limitation to doing so. For FixedBill+, the importance of this technical capability cannot be overestimated.

2. **Smart energy devices**

   The cost to make a device "smart" (connected to a network, and running at least basic software applications) has fallen dramatically, so there are now smart options for most major sources of energy demand. Thermostats are the first to achieve lift-off in the market, but other devices are following suit – such as EV chargers, household battery systems, pool pumps, and even hot tub controls. Energy providers can be granted some measure of control over these devices in order to achieve the first and most important tenet of FixedBill+: *comprehensive energy management*.

3. **DER management systems**

   Software tools from companies like AutoGrid[5] enable energy providers to manage resources for hundreds of thousands of consumers at once, all coordinated towards the needs of the grid as a whole. And increasingly, the makers of smart energy devices like those described above are building energy management functionality into the devices themselves.

5 Disclosure: AutoGrid is an EIP portfolio company.

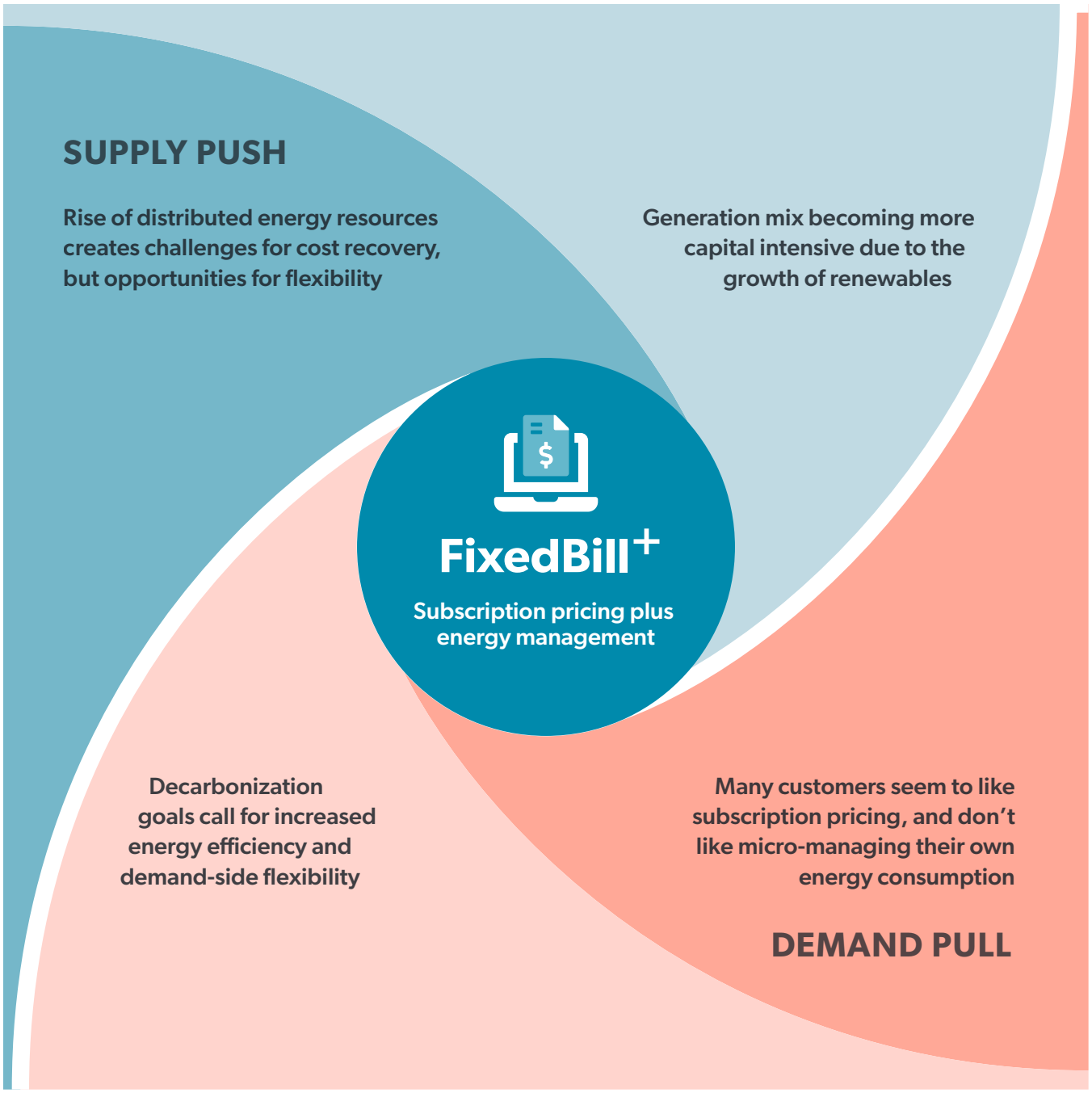
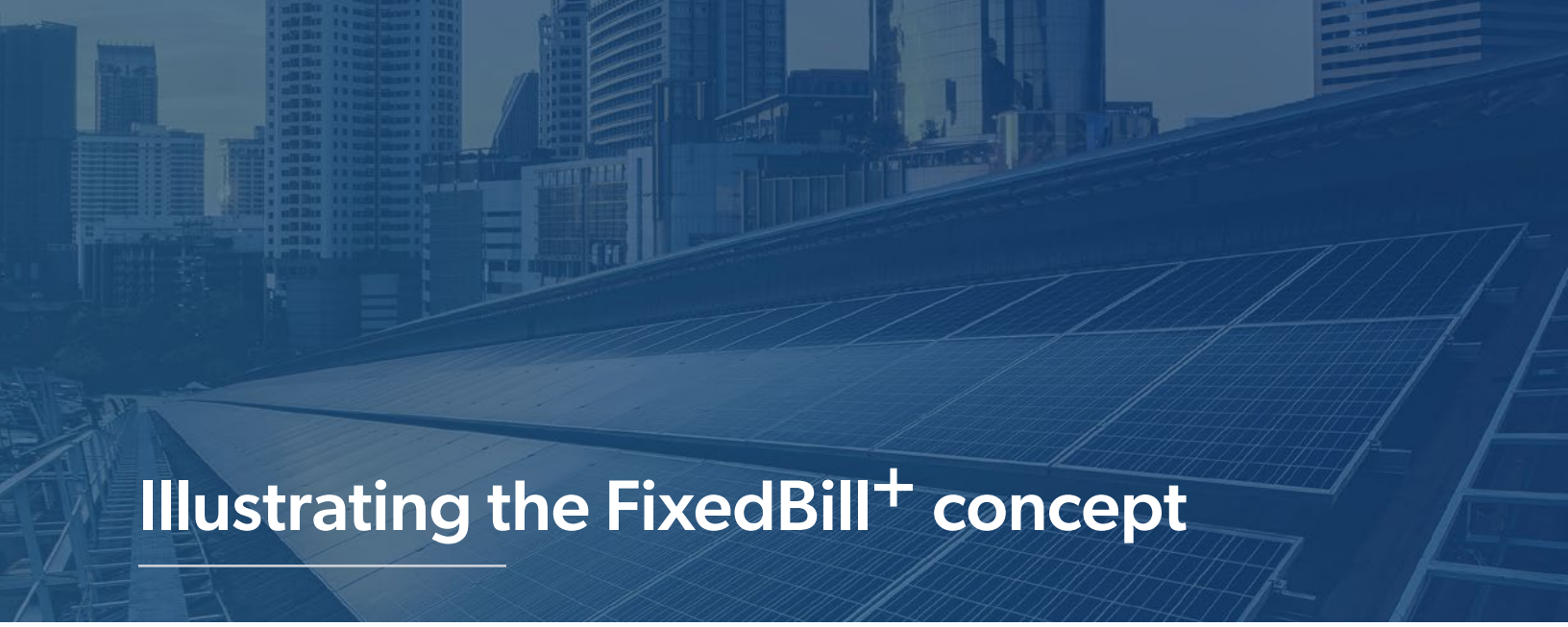


FIGURE 2: FACTORS DRIVING THE FIXED BILL+ OPPORTUNITY

A recent study by The Brattle Group found that there will be 200 GW of cost-effective load flexibility potential in the US by 2030, worth more than $15 billion annually and driven largely by the technological advancements described above. The FixedBill+ could be one compelling way to unlock that potential. **Figure 2** summarizes the factors driving the FixedBill+ opportunity.



Illustrating the FixedBill+ concept

To illustrate how the FixedBill+ concept could work in practice, we developed an example for a representative utility system. Our example contrasts how utility revenues and costs, and customer bills and usage, would change when moving from a standard rate offering to either (1) a conventional fixed bill or (2) a FixedBill+ option.

In this example, our illustrative utility faces capacity and energy costs that are in the middle of the range observed for utilities around the US. The utility's residential customers also are roughly representative of the national average, with monthly consumption of 1,000 kWh and coincident peak demand of 3 kW per customer on average. Additional technical details about the illustrative utility are included in the appendix.

The **"standard" rate** that is offered to the utility's residential customers includes a volumetric charge of 11 cents/kWh and a fixed monthly charge of $10 per month. Under this offering, the average customer's bill is $120/month, though it varies monthly as one would expect from a rate that is largely a function of the customer's monthly usage.

Under a **conventional fixed bill offering**, customers would be offered a fixed monthly bill that is determined based on their historical energy use. Embedded in the fixed bill is a hedging premium that accounts for the energy provider taking on the risk that the customer's electricity consumption under the new rate will be higher than forecast – with the associated cost of serving the customer being higher as a result. In this case, we have assumed that the fixed bill offering includes an 8% energy cost hedging premium on the supplier's variable costs. With those assumptions, our hypothetical average customer would be offered a fixed monthly bill of $125/month for the full term of the offer (one year in this case).[6] So, a customer who signs up for this rate would be willing to pay an extra $5 per month for the benefit of a steady and entirely predictable monthly bill over the course of one year.

As discussed earlier in this paper, a challenge posed by traditional fixed bills is the elimination of an actionable price signal that encourages customers to consume energy efficiently. We have assumed that the customer's electricity consumption would increase by 7% due to transitioning away from a rate that is tied to

6 We assume that the electricity service provider would only hedge the variable portion of its costs (i.e., fuel and generation capacity), and that the hedging premium would be a function of marginal costs. At an assumed marginal energy cost of $40/MWh and a capacity cost of $80/kW-yr, the provider's cost associated with an 8% increase in usage and peak demand is 4% of the average customer's bill.

Simply put, the customer's bill is reduced and the provider's earnings are enhanced – the proverbial win-win. And the environment wins as well.

their monthly usage. This assumed usage increase is based on anecdotal evidence from various fixed bill offerings in the US. For a single participant in the fixed bill offering, that amounts to an additional 840 kWh of electricity consumption per year. Across 100,000 participants in the program over a single year, the result is an additional electricity generation requirement exceeding 90,000 MWh.[7] For a utility with a natural gas combined cycle as the marginal generating unit, that is the annual carbon equivalent of 8,000 more gasoline-powered cars on the road, entirely due to our illustrative utility's fixed bill offering.

The provider's **FixedBill+ offering** mitigates these concerns about inefficient energy use by requiring acceptance of an EE and DR package as a condition of enrollment. For this example, we have assumed that participation in the FixedBill+ offering would require:

1. Allowing the service provider to modify the customer's smart thermostat settings during a limited number of system peak events per year.
2. Adopting an approved EE measure from a menu of options provided to the customer.

The smart thermostat program is assumed to reduce the customer's peak demand by 1 kW (commonly 25% to 33% of an average customers coincident peak demand) and the EE measure is assumed to reduce the customer's energy use by 10%.

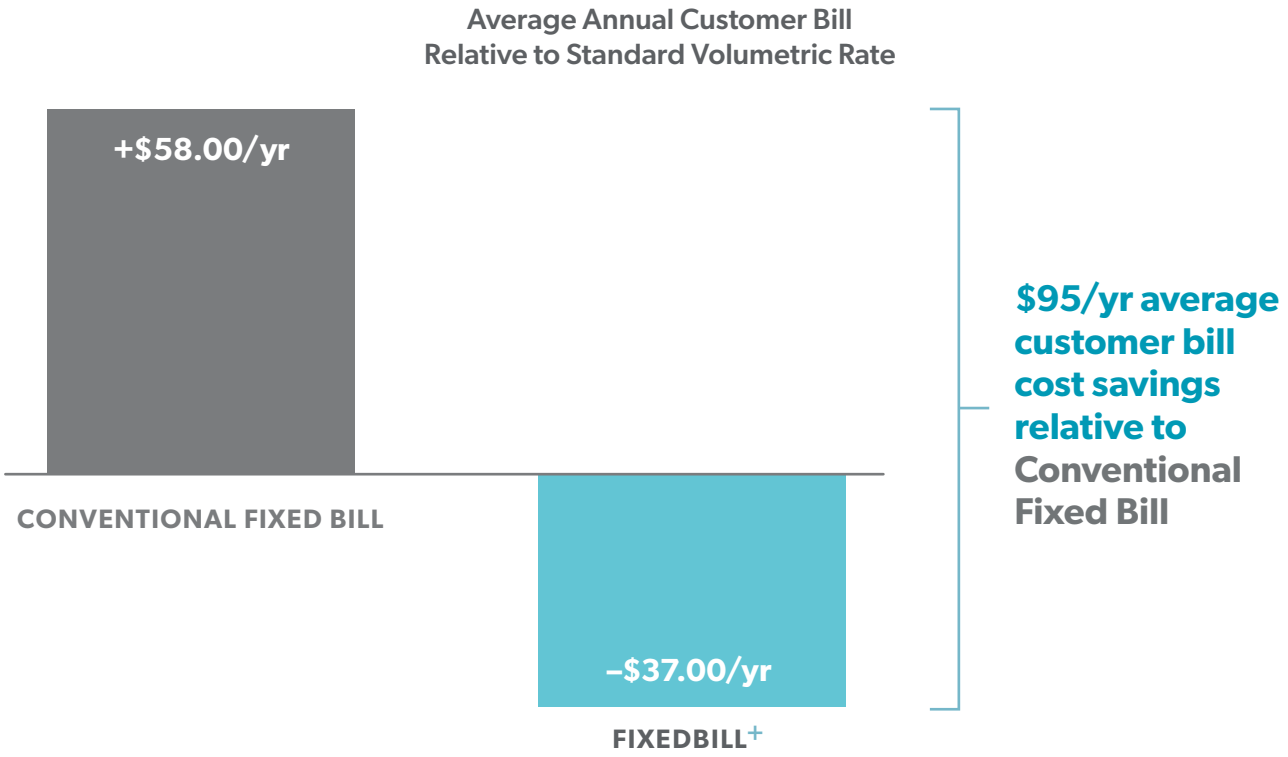
The EE and DR package reduces the electricity service provider's cost to serve the customer, above and beyond the costs the provider incurs to administer those EE and DR programs.[8] The reduction in peak demand lessens the need to procure new generation capacity, and the reduction in energy use saves on fuel and other variable costs. Because of these cost savings, the provider can offer the customer a FixedBill+ that is lower than both the conventional fixed bill and the standard rate offering. In this case, the customer would receive a FixedBill+ offer that is roughly 6% ($95/year) lower than the conventional fixed bill and approximately 3% ($37/year) lower than the standard rate.[9] And, just like the conventional fixed bill, the customer's FixedBill+ is entirely stable and predictable for the full one-year term of the offer. **Figure 3** compares the three rate offerings.

From the service provider's perspective, the FixedBill+ rate offering can reduce costs while improving profit margins and enhancing revenue stability. Compared to the standard rate offering, the provider's cost to serve a customer that commits to a one-year FixedBill+ term is reduced by $50 per year, while the provider's revenue reduction associated with offering a discounted rate is only $37 per year. This net increase in profit margin is attributable to the 8% hedging premium that is built into the FixedBill+ offering, as well as an assumption that a portion of the system cost savings accrues to the electricity provider rather than being passed through to the customer.

7 This estimate accounts for line losses between the generator and the customer.

8 Our analysis accounts for the various equipment, marketing, and administrative costs that would be incurred by the service provider when offering the EE and DR package.

9 Figures shown are rounded to the nearest percent.



	Standard Volumetric Rate	Conventional Fixed Bill	FixedBill+
Volumetric charge ($kWh)	$0.11/kWh	0.00/kWh	0.00/kWh
Fixed charge ($/month)	$10/mo	$125/mo	$117/mo
Average annual customer bill ($/year)	$1,440/yr	$1,498/yr	$1,403/yr

FIGURE 3: AVERAGE ANNUAL CUSTOMER BILL

Note: Totals may not add due to rounding.

Simply put, the customer's bill is reduced and the provider's earnings are enhanced – the proverbial win-win. And the environment wins as well. Participants reduce total energy consumption (and therefore greenhouse gas emissions) by 4% relative to their consumption under the standard rate, despite no longer being exposed to a retail price signal that directly encourages conservation.

For our illustrative utility, 100,000 participants in a FixedBill+ offering would provide roughly $4 million in annual customer bill savings, $5 million in annual system costs savings, $1 million in annual energy provider earnings, and a total conservation benefit of more than 1 million MWh.[10] These conservation-related CO_2 savings are the equivalent of taking more than 100,000 gasoline-powered cars off the road for a year.

10 Assumes an average EE measure life of 10 years.

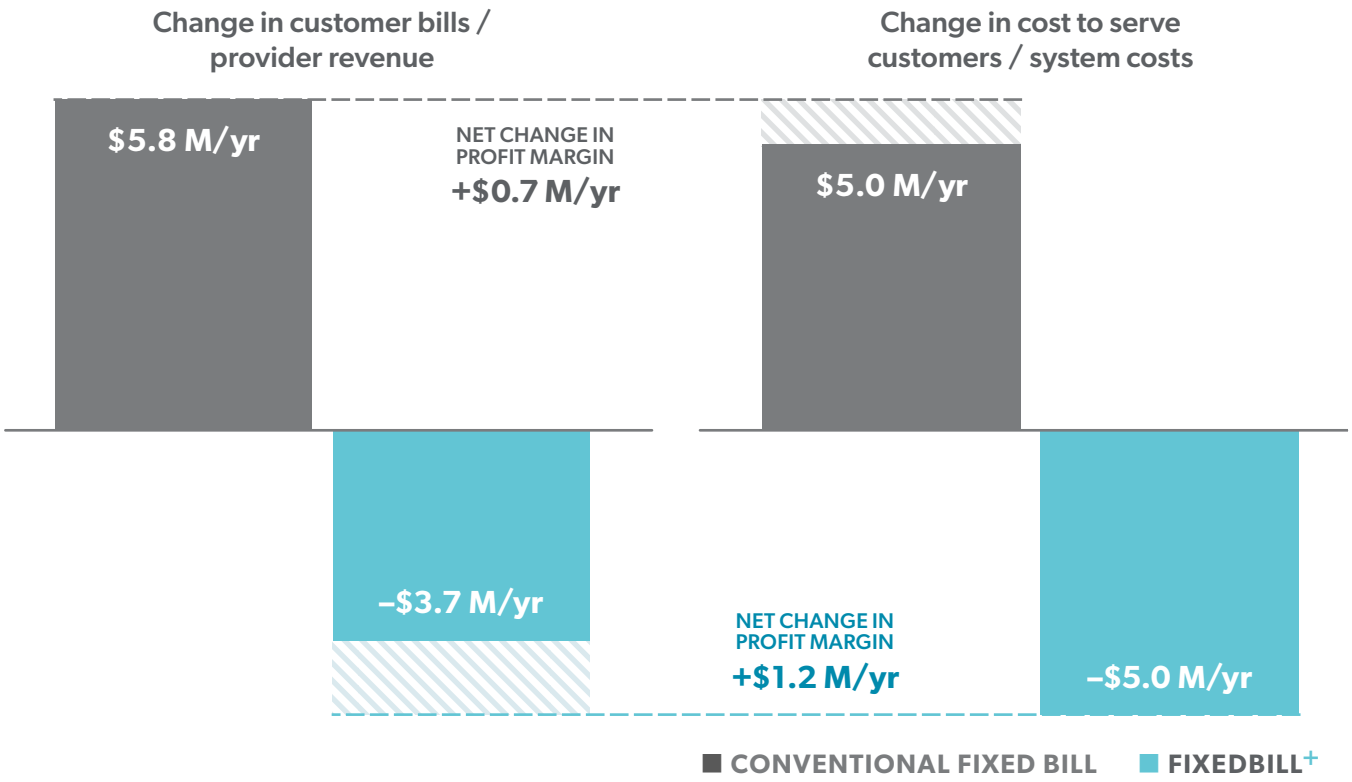


FIGURE 4: IMPACT OF FIXED BILLS FOR 100,000 CUSTOMERS, RELATIVE TO STANDARD RATE

Note: Totals may not add due to rounding.

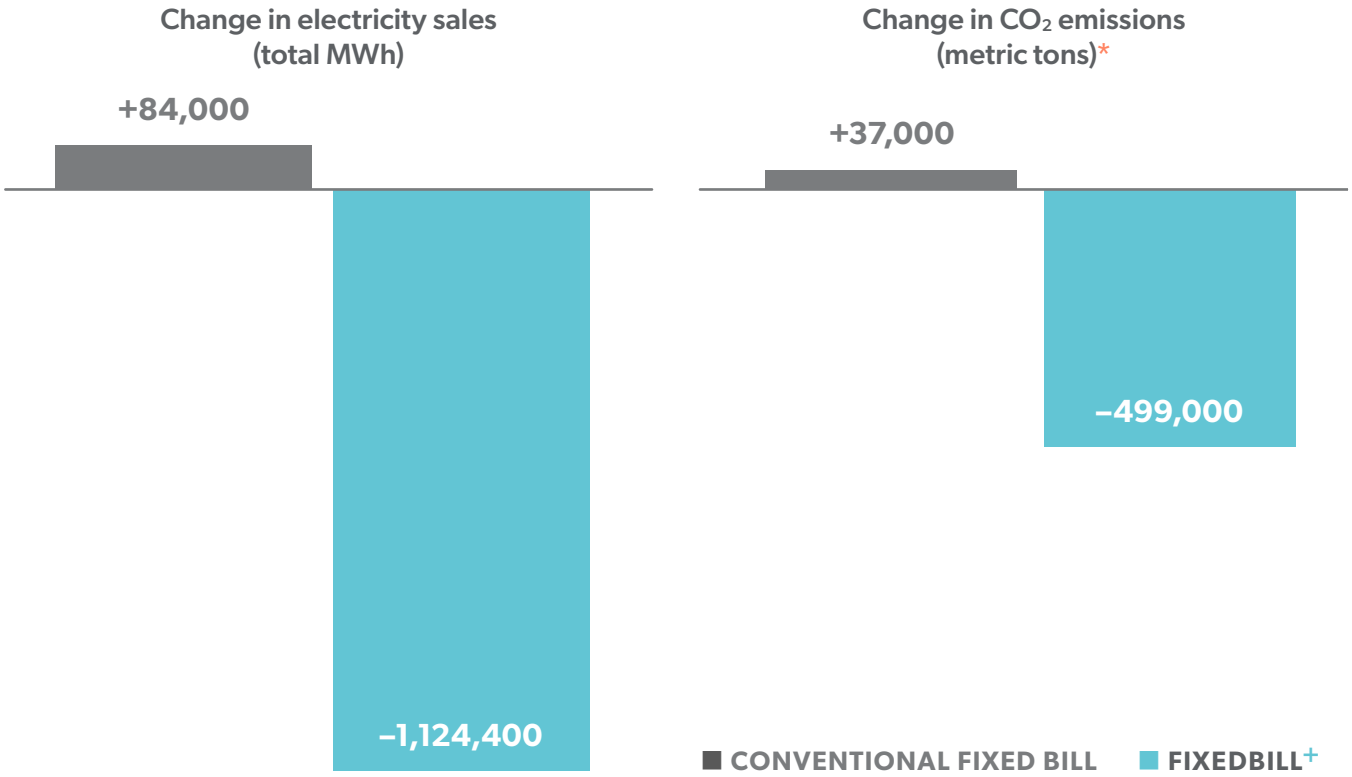


FIGURE 5: ENVIRONMENTAL IMPACT OF FIXED BILLS FOR 100,000 CUSTOMERS

* Assumes marginal unit is combined gas cycle with heat rate of 7,600 btu/kWh

	Standard Volumetric Rate	Conventional Fixed Bill	FixedBill+
Conservation incentive / environmental benefit	✓		✓
Rate design simplicity	✓	✓	✓
Customer bill stability / provider revenue certainty	✓	✓	✓
Customer bill savings opportunity	✓		✓
Provider opportunity for enhanced earnings		✓	✓
Load flexibility incentive		✓	✓

FIGURE 6: ATTRIBUTES OF RESIDENTIAL RATE DESIGNS

See **Figures 4 & 5** for comparisons of these results for the conventional fixed bill offer and the FixedBill+ offer.

Under plausible conditions for a US utility system, our example illustrates the potential for significant benefits from a FixedBill+ offering. Consumers benefit from predictable and reduced electricity bills. Energy providers benefit from improved earnings and a more flexible system. And the environment – and society at large – benefits from reduced greenhouse gas emissions and a smaller physical footprint of the power system. **Figure 6** contrasts these features of a FixedBill+ offering to those of a common volumetric rate and a conventional fixed bill.

Of course, these findings will vary depending on a given utility system's characteristics, the portfolio of EE and DR programs offered, and the impacts of those programs. There is a variety of ways in which an electricity service provider could design a FixedBill+ offering. For instance, one possible alternative could be to couple the fixed bill with hourly or sub-hourly rebate payments that are offered for voluntary curtailment (or increases) in load when valuable to the system. This could address the challenge associated with otherwise getting customers to agree to adopt specific EE and DR measures. The voluntary nature pf this approach may reduce the strength of the conservation/load flexibility requirement relative to the example presented in this paper, though customers have been shown to respond effectively to time-varying rebate payment structures. Other ways in which electricity service providers may depart from the illustrative example in this paper could be to take a more exclusive focus on either DR or EE options, or to use a different hedging premium. Each approach would have relative advantages and disadvantages, with results that may differ from those in this paper.

Consider our example as a potential proof of concept, demonstrating the potential attractiveness of a FixedBill+ offering subject to the inherent uncertainty in the underlying assumptions. As discussed in the sections that follow, market research and piloting of the FixedBill+ concept will be a key first step for regulators, electricity service providers, and industry stakeholders to reduce this uncertainty before moving forward with a full-scale FixedBill+ rate offering.

FixedBill+ business models

Throughout this paper, we have used the phrase "electricity service provider" to refer to the entity offering FixedBill+. This term is intentionally broad, since at least three regulatory and business model combinations can align the interests of providers, consumers, and society.

1. Regulated utilities

A regulated utility in a vertically integrated market can offer FixedBill+. In this situation, the regulated utility offers a fixed monthly bill to a consumer in exchange for the right to implement cost-effective DSM. To incentivize the most beneficial usage management, the utility could retain some portion of the savings from reducing the cost to serve that customer. In a jurisdiction with decoupling, some adjustments may be required to address how these earnings are treated.

2. Bill pay agents

Hypothetically, bill pay agents can operate in any market, whether it is fully regulated or retail-choice. The idea is that a customer pays the agent an agreed-upon rate, in exchange for that agent paying all of the bills that the customer receives from the customer's supplier. In a FixedBill+ scenario, the customer would pay the agent a fixed monthly fee, while the bill pay agent would be responsible for paying the customer's underlying bills – which will vary month-to-month. Hence, the bill pay agent will be incentivized to implement DSM in order to cost-effectively reduce the customer's monthly bills, as the agent can pocket the difference between those bills and the fixed fee they receive from the customer.

Under the bill pay agent model, the more that the customer's underlying utility rate includes time-variant or peak-demand-based pricing, the more a bill pay agent will be incentivized to implement DSM. In most jurisdictions, the adoption of time-varying rates has been low to date, for a variety of reasons. Since the bill pay agent would have an incentive to enroll their customer in a time-varying rate, the FixedBill+ concept can play a positive role in facilitating time-varying rate adoption.

3. Retail suppliers

In a limited number of deregulated markets, a retail supplier with consolidated billing[11] can offer FixedBill+. Under a FixedBill+ plan, the supplier

11 Supplier consolidated billing is an emerging model in which the consumer receives a single bill from their supplier which includes one line-item for wholesale energy supply charges, and another for distribution utility delivery charges. This model exists in Texas and is being implemented in Maryland, so has limited applicability.

would collect a fixed amount from the customer each month, while undertaking DSM in order to lower their wholesale energy procurement cost and delivery charges (which will both vary from month-to-month). Wholesale charges are based on time-variant and peak-demand-based prices, while delivery charges tend to be based on a single volumetric (per kWh) price.

ALIGNING REGULATION AND INCENTIVES

Setting the DSM requirements of a FixedBill+ offering will require a careful regulatory and market balancing act. The net combined effect of the required programs should be large enough not only to offset the modest expected usage increase from lost marginal price signals, but also to contribute affirmatively to a comprehensive and timely climate change mitigation policy. Setting the bar too high, however, risks customer rejection and a backlash from the proponents of conventional fixed bills (i.e., those without added DSM). Caught between these forces, customers must feel that the benefits of a fixed bill and the comfort and control benefits of DSM outweigh the inconvenience and transaction costs of new DSM investments and interventions.

Traditional, bundled utility retailers face slightly different regulatory challenges with FixedBill+. These providers can serve as a single-point financial and regulatory clearinghouse for the various elements of this innovation. While they face the same challenge of balancing DSM mandate strength with customer adoption, their vertical integration more easily enables the savings from avoided generation and non-wire alternatives to be realized and split with the customer. Financing deeper measures with lower costs of capital using on-bill financing may also be easier.

Creating incentives for the electricity service provider to benefit from mandated customer DSM participation introduces additional questions and challenges. The electricity service provider will need to forecast the reduction in its own supply costs to the customer and keep some of that reduction as its own reward. For the simplest EE measures (e.g., lighting), savings may be readily estimated, but for the larger and more important uses (e.g. heating and cooling) forecasting savings may be a more customer-specific undertaking. Since the entire fixed-bill attraction requires the provider to assume all forecasting risk, adding DSM to the equation will increase the hedging premium. Moreover, the net payback must be large and quick enough to attract providers.

Certain market design elements will facilitate deployment of the FixedBill+ model:

- Ensuring that the price signal facing FixedBill+ providers reflects the true time-varying nature of the cost of service (to the extent possible). This can be achieved by ensuring customers have access to time-varying rates. In addition, providers should be able to monetize services they provide, either by participating in markets or utility programs.
- Allowing subscription-pricing providers to share in the benefits. This is particularly important for regulated utilities, where utility management of consumer loads would lead to a reduced revenue requirement. Utilities should be able to retain at least some of the additional earnings.

MOVING FORWARD WITH FIXEDBILL+

Changes in the utility sector, a revolution in energy technology, and evolving customer expectations have created a potentially attractive environment for FixedBill+ offerings. Yet many questions remain about how to make this concept work effectively. We recommend two specific next steps.

1. Start learning from pilots and market research

This paper uses a plausible but hypothetical example to demonstrate that FixedBill+ can benefit consumers, electricity service providers, and the environment. The next step is to put real numbers into that example. Surveys and focus groups can be used to identify the specific design features that will attract customers to FixedBill+ offerings. DSM market potential studies will be needed to identify the most impactful EE and DR measures to be included in the FixedBill+ offer.

Piloting will provide insight into how customers will respond once enrolled. Pilots could be designed as scientific experiments, with treatment and control groups. Or, they could be implemented using a "test-and-learn" approach through which FixedBill+ offers are introduced to customers on a full-scale basis, with the offers being modified over time to reflect insights from early adoption of the new rate design.

2. Implement "no regrets" regulatory changes

The ease with which the regulatory changes recommended in this paper can be implemented will vary from one jurisdiction to the next. Regulators, electricity service providers, and industry stakeholders considering a FixedBill+ offer will want to review the extent to which their market rules, regulations, and policies support the deployment of FixedBill+. After identifying barriers to deployment, a blueprint for addressing the barriers will provide an actionable path for realizing the FixedBill+ benefits discussed here.

Appendix: Methodological Details of FixedBill+ Illustration

TABLE 1: SUMMARY OF RESULTS	Standard Volumetric Rate	Conventional Fixed Bill	FixedBill+
Rate and bill for average customer			
Volumetric ($/kWh)	0.11	N/A	N/A
Fixed ($/month)	10.00	124.80	116.90
Total bill ($/month)	120.00	124.80	116.90
Change relative to standard rate for average customer			
Consumption (kWh/month)	–	70	-37
Consumption (%)	–	7%	-4%
Peak demand (kW)	–	0.21	-0.9
Peak demand (%)	–	7%	-29%
Total bill ($/month)	–	4.80	-3.10
Total bill (%)	–	4.0%	-2.6%
Cost to serve customer ($/month)	–	4.20	-4.13
Impact of new rate with 100,000 participants			
Customer bill change / provider revenue ($/yr)	–	5,760,000	-3,718,000
Cost to serve customers / system costs ($/yr)	–	5,040,000	-4,957,333
Net change in provider margin ($/yr)	–	720,000	1,239,333
Change in energy sales (total MWh)	–	84,000	-1,124,400

TABLE 2: MODELING ASSUMPTIONS	ASSUMPTION
System and customer characteristics	
System marginal energy cost ($/kWh)	0.04
System marginal capacity cost ($/kW-yr)	80
Avg customer monthly consumption (kWh/month)	1,000
Avg customer system peak coincident demand (kW)	3
Current retail rate	
Volumetric charge ($/kWh)	0.11
Fixed charge ($/month)	10.00
Impact of Fixed Bill	
Provider volume hedging assumption (%) [1]	8%
Customer behavioral increase in consumption (%) [2]	7%
Impact of EE/DR package	
DR peak reduction (kW) [3]	1
DR benefit-cost ratio [3]	3.0
EE peak & energy savings (%) [4]	10%
EE benefit-cost ratio [4]	2.0
EE/DR system cost savings passed on to participant (%) [5]	75%

1 Average amount by which utility assumes usage will increase, to mitigate volume risk exposure

2 Actual customer usage increase in response to fixed bill price signal

3 Consistent with BYOT program where thermostat is provided by the customer

4 Consistent with portfolio- and measure-level cost-effectiveness results observed in DSM potential studies using Utility Cost Test (UCT)

5 The remainder could be kept by the provider and/or passed on to non-participants