GOT DATA?

The Value of Energy Data Access to Consumers

GRIDWORKS

MISSION:DATA

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GRIDWORKS

Creating integrated distribution grids one state at a time

Gridworks, formerly More Than Smart, is a 501(c)(3) non profit organization started in 2009 on the premise that green energy and climate policies are driven by thoughtful, diverse and politically minded people working together to develop new and innovative solutions. Gridworks has a proven track record in developing and implementing polices in areas such as promoting energy efficient electronics, improving cap and trade offset options, enabling regional cleantech funding and now in upgrading the distribution grid. Today, all Gridworks programs are focused on upgrading the electricity distribution grid so a state can enable more DER, enabling more players in DER markets and enabling a networked grid that can enhance other existing infrastructure grids like water and natural gas.

MISSION:DATA COALITION

The Mission:data Coalition is a national coalition of 35+ innovative technology companies that empower consumers with access to their own energy usage data. Mission:data advocates for customer-friendly data access policies throughout the country in order to deliver benefits for consumers and enable an innovative, vibrant market for energy management services.

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EXECUTIVE SUMMARY

This report outlines how providing access to customer energy use data from "smart meters" can help state policymakers and advocates reach their renewable energy and climate goals faster. It outlines how advanced metering can be used to accelerate energy efficiency with data protocols like Green Button while protecting customer privacy.

With modernization efforts underway to make the electric grid cleaner and more efficient, many states are investigating how to best structure the electricity sector in order to promote renewables and other distributed energy resources (DERs) like energy efficiency, demand response and solar photovoltaics (PV). New York, for example, seeks to "animate DER markets" with its Reforming the Energy Vision proceeding, while California seeks to enable "plug-and-play DER," meaning that DERs should be able to instantly connect to the power grid and begin providing services. One of the most important requirements for stimulating innovation in the private sector with respect to DER is the sharing of data from utility "smart meters" with customers and customers' authorized service providers. When shared securely and with customer permission, the privacy of customers can be maintained while providing essential information to DER providers for the sizing, operation and maintenance of innovative grid services. Granular meter readings every 15 minutes or 60 minutes can be used for a host of promising software applications such as "virtual energy audits" that identify efficiency opportunities instantly, the sizing of

photovoltaic systems to maximize peak demand reductions or helping customers choose alternate electricity rates such as time-of-use (TOU) pricing that may save them money.

Of all the DERs available, energy efficiency will likely receive the largest boost from meter data flowing to contractors, auditors and software companies. One research paper from 2010 found 4% - 12% energy savings in households in the presence of energy usage data. **Since 2010, 12 other studies that indicate energy savings potential of 6% - 18% when customers have easy access to meter data.** Academic research indicates that when energy usage data presented to customers are more detailed, greater energy savings will result. Data access can thus accelerate energy efficiency because people exhibit greater conservation behaviors when stimulated by granular feedback than by monthly bills.

Data access improves human conservation behaviors, but it can also improve the efficiency of appliances. By transmitting price or real-time usage electronically to devices, curtailments or "sleep" modes can be automatically triggered. Originally, this was the promise of the smart grid: customer-owned devices producing and consuming energy in harmony with the power grid. As it stands now, however, many innovative companies spend a great deal of time and money accommodating each utility's idiosyncratic differences with regard to data access; even worse, many companies are forced to install their own electric meter on the customer's premise, redundant to the utility's, in order to get usage information in the manner they require. As we show, the costs of the lack of data access are significant—in the tens of millions of dollars in one sector alone. These costs make energy efficiency unnecessarily expensive, hindering the efforts of entrepreneurs and innovators to develop and deploy climate solutions.

When simple interactions with the grid are expensive and complex, we fail to reach the goals of "market animation" and "plug-and-play DERs." But getting the right data doesn't need to be expensive and complex. This report documents the data access policies of leading states where innovative companies have recently begun accessing billing-quality meter data electronically at no charge, with customer permission.

We recommend that:

1) Commissions should require utilities to provide the best available energy usage data to customers (and their authorized third parties) in a standardized, electronic format as part of basic utility service.

2) Tariffs should be published in standardized, machine-readable forms so that software applications can quickly and accurately calculate expected costs.

3) Customer bills should also be available to customers (and authorized third parties) in standardized, electronic format.

Time is of the essence because, without standardized policies and procedures governing data access nationwide, regulators inadvertently handicap the adoption of DER. Regulators can learn a lot from states that have already considered smart meters, the Home Area Network, grid modernization, privacy policies and information technology (IT) systems that empower customers with choices about how and when to use power. Modernizing the grid depends upon thoughtful policies and procedures governing meter data as much as it does on the infrastructure moving energy across the system.

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INTRODUCTION

WHY IS ACCESS TO ENERGY USAGE DATA IMPORTANT?

American homes and buildings account for 39% of the country's carbon dioxide emissions[1] and 69% of its electricity consumption.[2] Although electricity demand has been nearly flat for the past five years, the scale of American electricity use remains daunting: electricity used merely for air conditioning our buildings is larger than the entire African continent's usage, for everything.[3]

Despite the existence of numerous technologies that can help reduce electricity consumption—or shift usage to off-peak times—much more can be done in state energy policy to enable promising new technologies. Utilities have long collected customer usage data for billing purposes. But once-a-month utility bills provide little to no insight to customers as to how electricity or natural gas are actually used. Web and mobile tools have provided consumers with significantly more information about various services from personal finance and travel to health and fitness over the past five years, but the analogous level of service provided by energy utilities has not appreciably progressed. The absence of web and mobile tools offered by utilities is remarkable when one observes that many states have approved advanced metering infrastructure (AMI) or automated meter reading (AMR) systems, measuring the consumption of homes and businesses at 15-minute or hourly intervals. Rich datasets for understanding and

optimizing both financial and environmental costs in homes and buildings exist—if only one could access them. Sadly, monthly bills remain the norm.

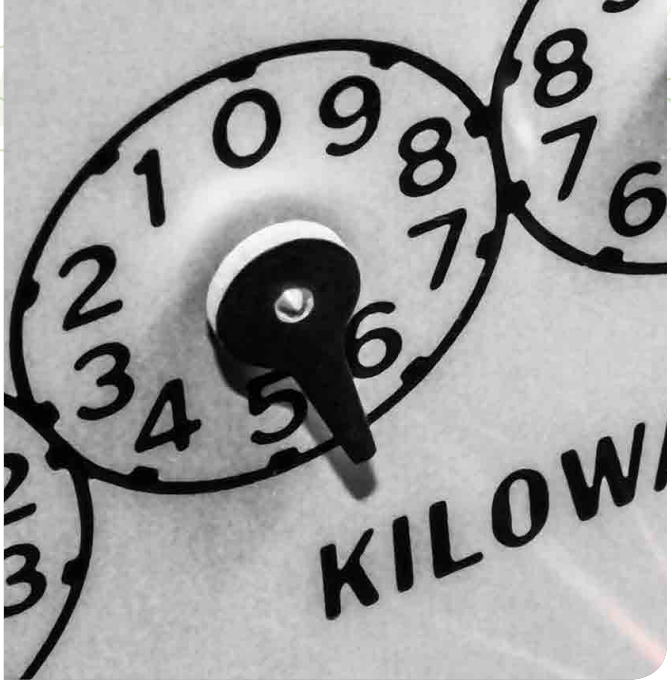
Bolstered by the American Recovery and Reinvestment Act of 2009, the number of "smart meters" providing interval usage data to the utility has risen to nearly 50 million across the United States, providing a potential foundation for better informing customers.[4] From the beginning, meter vendors and utilities eager to secure regulatory approval for billion-dollar investments in AMI highlighted the benefits to customers from granular data: phrases such as "consumer empowerment" were heard in state public utility commissions (PUCs) across the country. Despite these promises, access to usage data is still challenging and costly, even in utility territories with AMI. Consent forms requiring "wet-ink" signatures and inconsistent data formats are persistent barriers for data-seekers. As a result, interval

1 Energy Information Administration. "U.S. carbon dioxide emissions from energy consumption." Sept, 2015. Tables 12.1, 12.2 and 12.3. http://www.eia.gov/environment/data.cfm#summary

2 Energy Information Administration. http://www.eia.gov/electricity/annual/html/epa_02_02.html

3 Henley, Jon. "World set to use more energy for cooling than heating." The Guardian, 26 October 2015. http://www.theguardian.com/environment/2015/oct/26/cold-economy-cop21-global-warming-carbon-emissions

4 Edison Foundation Institute for Electric Innovation. "Utility-scale Smart Meter Deployments: Building Block of the Evolving Power Grid." IEI Report, September, 2014.



usage data is costly for market actors to acquire in a usable form, requiring specialists to navigate utility bureaucracies, consent forms and tedious data-formatting tasks to attain the consistency that software applications require.

Despite these challenges, entrepreneurs and innovators have begun offering numerous services that analyze energy data. Software-based tools can interpret usage data automatically and do things such as notify you of tomorrow's peak demand costs, disaggregate your monthly bill into heating, cooling, lighting and other components, and recommend cost-effective efficiency improvements.

Consumers—who ultimately pay for advanced meter functionality through rates—ought to be able to see detailed information about how much energy they purchase. After all, many other activities common in daily life provide consumers with information about quantities consumed: Gas stations are obliged to show gallons pumped in real time, not merely a price, so that customers can halt the pump when their wallets get squeezed. Grocery stores offer receipts showing quantities purchased, and products can be returned at check-out. But electricity is altogether different. Sometimes referred to as "the invisible commodity," whole-home electricity usage is not easily itemized into a shopping cart. When utilities consider providing insights to ratepayers, there are two common reasons against it: the lingering perception that customers don't care for such insights, or that utilities cannot provide insight anyway due to electricity's ephemeral nature. What is "behind the meter," as they say, is the customer's own business. Regulated utilities have "the obligation to serve," but that obligation has not been widely understood to include much in the way of providing information about the consumption of the product itself.

Just as medical patients have rights to access their medical records, most reasonable people believe energy users ought to be able to access their own usage records. But as with medicine, the records themselves aren't always comprehensible. Some information, such as dollars owed, are quite clear for non-experts to understand, similar to a pregnancy test: the information is obviously meaningful and does not require much in the way of decryption. But what about systolic blood pressure, white blood-cell count or the difference between HDL and LDL cholesterol counts? Data alone do not convey much meaning to the layperson; interpretation by an expert is called for. We cannot expect many individuals to become skilled enough in analyzing charts and interval electricity consumption data to attain the insight that a professional has. For this reason, it is reasonable to expect utilities to provide energy data to third party experts for interpretation, just as laboratories send test results to doctors, not merely to patients. And third party access is where complex policy issues in utility regulation begin.

WHY THIS REPORT?

The modernization of the electric grid presents tremendous opportunities meeting the challenges of climate change. Incorporating renewable energy sources, reducing peak demand and conserving energy can be achieved when the grid is smarter and generation more decentralized. Efforts toward grid modernization are currently underway in states such as California, Massachusetts, Minnesota, New York and others. California and New York have correctly observed that a cleaner and more efficient electric system is directly related to the ability of market participants to access meter data. Meanwhile, smart meter deployments are still underway in many jurisdictions, and potential investments in millions of new smart meters are being considered. The accomplishments of a few states on data access in the past five years can and should be studied by regulators so that the same mistakes are not repeated and so that distributed energy resources can be effectively incorporated at a much quicker pace.

Indeed, the scarcity of utility meter data stands as a formidable obstacle to progress on reducing greenhouse gas emissions: only when the policies and practices surrounding utility meter data access are mature can the immense range of benefits be available to customers. Many activities such

as ENERGY STAR benchmarking or utility-run efficiency programs require usage data. Access to data is often a prerequisite to consumer action on energy efficiency: some consumers and building owners aren't going to invest significant amounts of money before they have examined simple, no-cost measures.

Some recent developments in data access are gaining traction, such as Green Button (see page 8), but there are no reports or resource guides that comprehensively cover all aspects of data access. With state policy, not federal policy, having the largest influence over electric and gas utilities, state regulators need to be informed on issues ranging from advanced metering technology to privacy and "big data." In speaking with regulators and policymakers in over a dozen states, we have seen the following obstacles to enacting data access policies:

- Policymakers have not been quick to understand software's tremendous potential to save energy cost-effectively, in part due to its technical nature
- Private access to one's own data has been conflated with "open data," or data access without customer authorization, raising privacy concerns
- The benefits of data access have not been adequately described or made tangible to policymakers; conversely, the costs from the *lack* of data access have not been identified

For these reasons, combined with the fact that about 50% of all American households and businesses have smart meters (and even more will have them soon), we felt it was essential to catalogue the lessons learned for the benefit of other states. The report concludes with detailed policy recommendations for those states considering smart meters, grid modernization or new privacy policies.

DEFINITIONS AND THE SCOPE OF THIS REPORT

The utility industry and information technology are each complex and their own right, requiring a common vocabulary to communicate effectively about either. Thus, a few words about terminology are in order.

By **data access** we are referring to consumers' access to energy usage data. Consumption data—in kilowatt-hours of electricity, or therms (or cubic feet) of natural gas—is referred to by various terms. **Customer Energy Usage Data** or CEUD is used by the U.S. National Institutes for

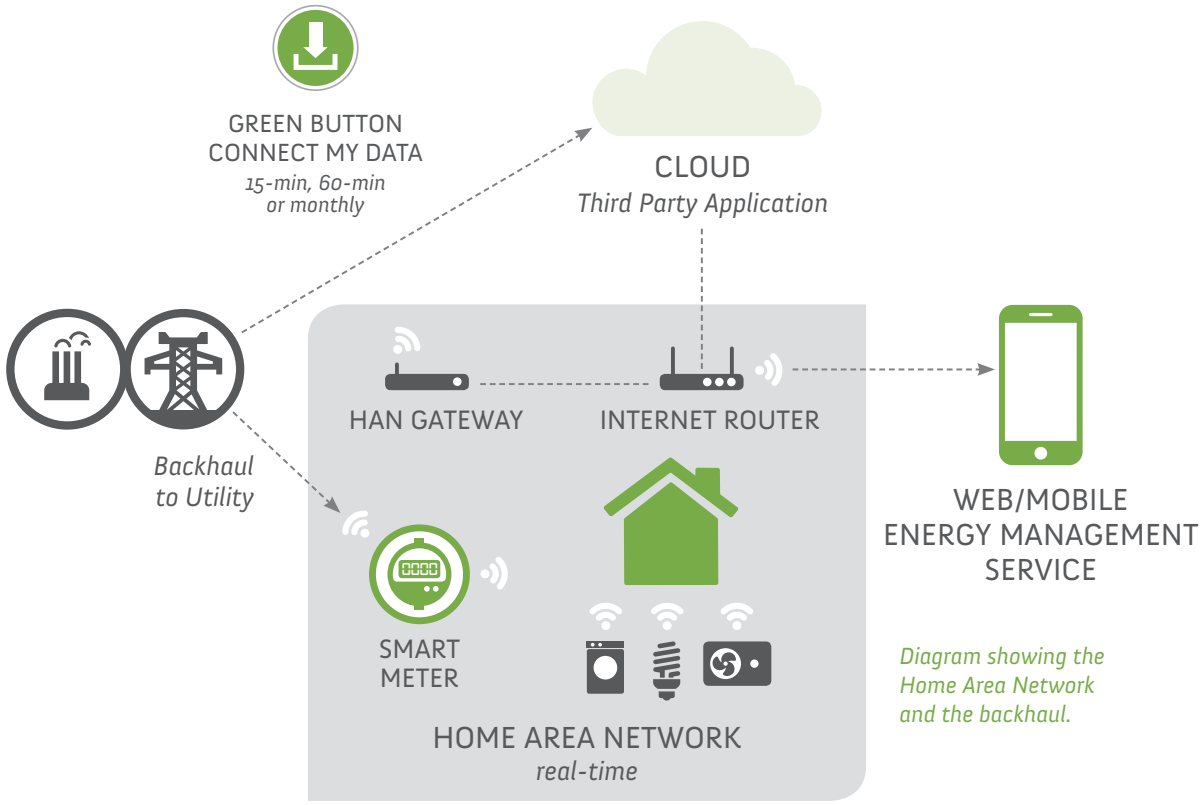
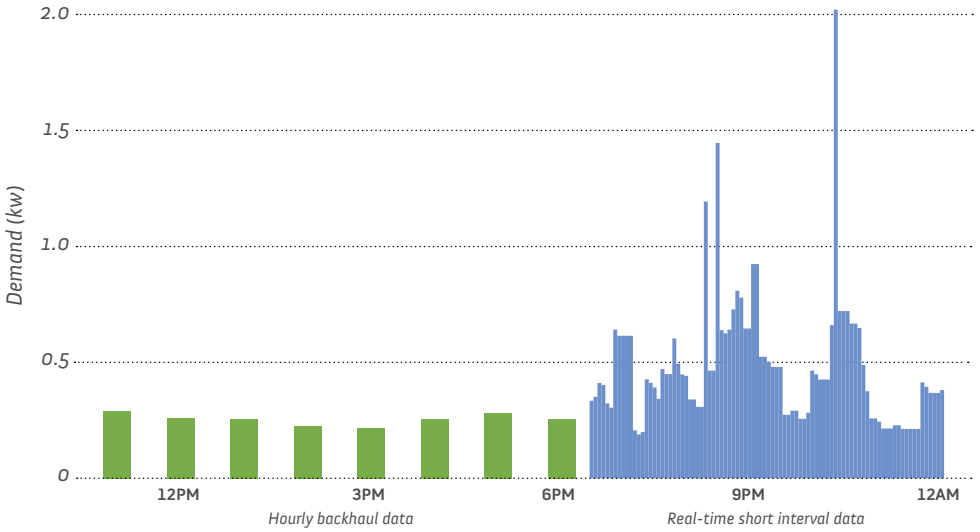


Diagram showing the Home Area Network and the backhaul.



Standards in Technology (NIST) and others; sometimes consumption readings are simply called energy data. For clarity, throughout this report, when we use **data** or **energy data**, we are referring to meter readings regardless of granularity—5-, 15-, 60-minute or monthly.

Furthermore, by **energy data** we refer to consumption readings as well as cost information. As we explain, acquiring cost information in certain states presents challenges (some states have retail competition in which the metering provider does not have pricing information). Nevertheless, we wish to make clear to readers that **data access** hereafter refers to two critical components of a customer's bill: the usage and cost information.[5]

Advanced metering infrastructure (AMI) is defined by the U.S. Department of Energy (DOE) as an integrated system of smart meters, communications equipment and data management systems.[6] Smart meters collect interval data (generally hourly or more frequent) to enable pricing structures that are more granular than merely one reading per month such as demand charges or time-of-use (TOU) pricing. AMI also includes two-way communication so that the utility can transmit messages to the meter such as pricing or shut-off signals. Equivalent terms are sometimes used in different states, such as advanced metering functionality (AMF) or advanced metering system (AMS).

In advanced metering systems, there are two general methods by which energy data may be transmitted from the meter to the customer. The first method is termed **the backhaul**. Referring to the communications network of fixed or mobile receivers by which the utility collects data from a group of meters, backhauled data are transmitted from the meter back to the utility on a periodic basis, often several times per day. There are no instances to our knowledge of real-time readings being made available to customers via the backhaul.

The second method of data access is the **Home Area Network (HAN)**, starting with a radio in the meter with a limited range (75-150 feet) that communicates with devices in the home. Real-time usage, prices and certain signals such as peak demand notifications can be transmitted from the utility through the backhaul to the meter, and from the meter through the HAN to in-home displays, smart thermostats, pool pumps, and other devices. Also, because advanced meters are installed in small and medium commercial buildings as well as homes, the HAN is sometimes referred to as the "Business Area Network" (BAN), a different name but with an identical meaning. We use the term HAN to describe both residential and commercial cases.

We refer to the wide range of companies providing DERs—energy management, solar, demand response, smart

5 Utility rates are complex, to say the least. Knowledgeable readers will raise their hand in exception to the notion that monthly utility bills are simply the product of consumption and price per unit, as fixed charges, taxes, fees and time-of-use (TOU) rates all complicate the calculation. Experts will debate the best method of capturing all billing elements in an electronic form, so needless to say that throughout this report when we refer to pricing information we mean the "best available" information on pricing.

6 See, e.g., https://www.smartgrid.gov/recovery_act/overview/smart_grid_investment_grant_program.html

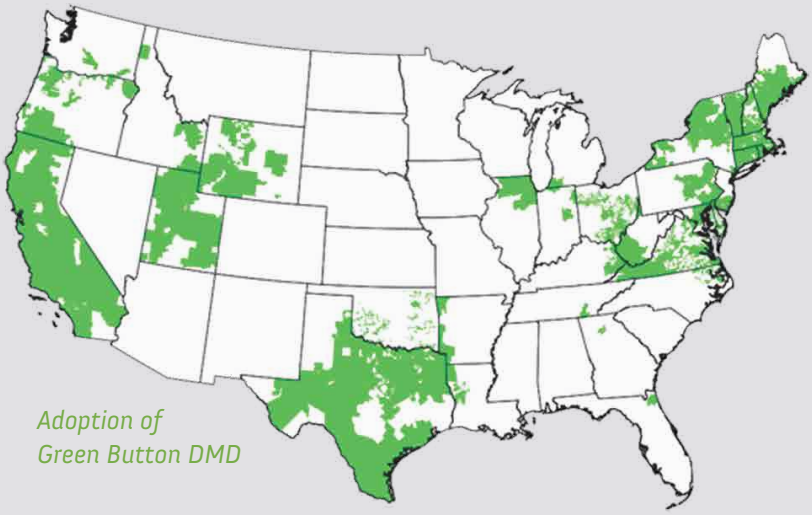
thermostat, etc. as simply **third parties** to distinguish them from regulated utilities and customers. (In states with retail electric competition, there is both a "wires and poles" utility and a retail supplier. We refer to third parties as different from both entities.) Third parties often install **submeters**—that is, meters owned by the customer or third party and that may be redundant to a utility meter—due to the difficulty in getting meter data from utilities. Submeters refer to any meter on a circuit regardless of scale, i.e. from an individual appliance up to a whole home or building.

Finally, a critical distinction with regard to data access is *who* requests it. The privacy of consumers, including the consumer's right to decide what third parties, if any, should have access to his or her energy data, is obviously a critical issue for regulators. Much has been written about this topic, particularly the question: Under what circumstances may customer energy data be accessed *without* customer consent? This report's treatment of data access is limited to instances where the customer *has* granted authorization to third parties. To help the reader better understand this distinction, consider the following cases where authorization is not granted by the customer. These cases are *not* considered in this report.

- Local governments seek aggregated usage data by zip code in order to calculate baseline energy use and greenhouse gas emissions for climate action plans.
- Owners of a commercial building with 10 tenants seek whole-building usage data to comply with municipal benchmarking and transparency ordinances without having to get explicit permission from each of the 10 tenants.
- A residential solar installer wants to know which customers in a given neighborhood have sufficiently high electric bills to be good candidates for solar without contacting each customer individually.

What is Green Button?

Green Button is a technical standard developed by industry for exchanging energy usage data. Championed by a White House call to action in 2011, Green Button is being adopted by dozens of utilities. Green Button is formally known as the North American Energy Standards Board's (NAESB) REQ21, the Energy Services Provider Interface (ESPI). These terms are interchangeable.



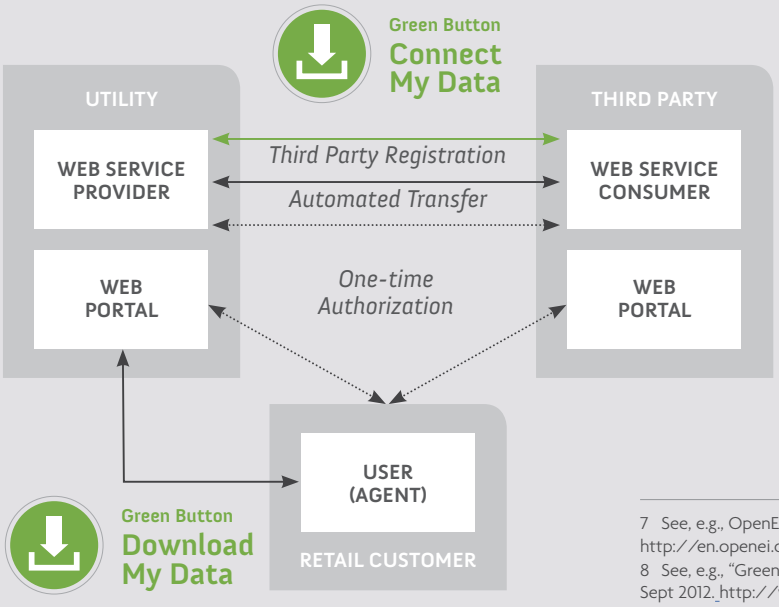
Adoption of Green Button DMD

As with other technical standards, the primary benefits of widespread adoption of Green Button are reduced transaction costs and the facilitation of commerce. For example, if every state had its own W-Fi standard (IEEE 802.11), business travellers would need to buy different Wi-Fi communication cards for each state in order to use a laptop at an airport or coffee shop. Energy management firms today need to write software for parsing and manipulating the unique energy data formats of each utility.

There are two flavors of Green Button. *As the name suggests, Green Button DMD requires users to login to their online utility account and download a file manually. The file format is standardized using an XML (eXtensible Markup Language) schema, and the file can be opened in spreadsheet programs such as Microsoft Excel or OpenOffice. The benefit of DMD is data portability—customers can upload their Green Button files into over 60 apps made by software developers, such as energy conservation games or electric vehicle (EV) cost estimators.*[7]

Unfortunately, despite adoption by 55 utilities (see map), DMD has not been widely used by customers. The primary reason is the friction introduced by the downloading-and-uploading process. Many of the best energy applications function in an ongoing capacity, making recommendations to the customer by email or text messages as usage increases, for instance. Asking customers to periodically upload a data file into a website to keep their energy app current presents a burden that nearly all attention-constrained customers will not bear.[8] *As a result, most third parties do not consider DMD an adequate solution.*

In contrast, Green Button Connect My Data (CMD) is an automatic, ongoing transfer of usage data to a third party upon authorization by the customer. Initially, 12 to 24 months of historical usage data are transferred to the third party. Thereafter, every day the previous day's interval readings are transmitted, giving the third party ongoing access to a customer's usage data.



As of January, 2016, only five American utilities have enabled CMD, enabling registration by any third party:

- *Pacific Gas & Electric*
- *San Diego Gas & Electric*
- *Southern California Edison*
- *PEPCO (Washington, D.C.; commercial customers only)*
- *Commonwealth Edison (commercial customers only)*

7 See, e.g., OpenEI.org's "Energy Apps Catalogue" at http://en.openei.org/apps/?keyword=Green%20Button%20Apps

8 See, e.g., "Green Button: One Year Later." Edison Foundation's *IEI Issue Brief*, Sept 2012. http://www.edisonfoundation.net/iee/Documents/IEE_Green%20Button%20Report_Final.pdf

3

HOW IS ENERGY DATA USEFUL?

12 STUDIES *from 2011-2015*

FOUND

6% TO 18%
ENERGY SAVINGS

WHEN USERS HAVE ACCESS TO METER DATA

coupled with new technologies like disaggregation, actionable feedback and smart controls

A wide variety of digital services—old, new, and as-yet unimagined—offer great promise for cost-effectively reducing consumption, responding to time-of-use (TOU) prices, shifting demand and increasing the adoption of renewables and efficiency. If usage data could be consistently obtained across the nation's 3,200 retail electric utilities, new software technologies could be applied widely to enormous benefit. For example, energy efficiency and clean energy applications using meter data include, but are not limited to:

INSIGHT
web portals analyze usage data and provide actionable tips for saving energy and money

HEATING AND COOLING
customized heating and cooling recommendations for comfort

EDUCATION
community and student energy efficiency competitions, or using a school's energy usage in educational curricula to teach science or mathematics concepts

TARGETING ENERGY EFFICIENCY PROGRAMS
pre-screening of homes or buildings for energy savings potential to more efficiently deliver rate-payer funded programs

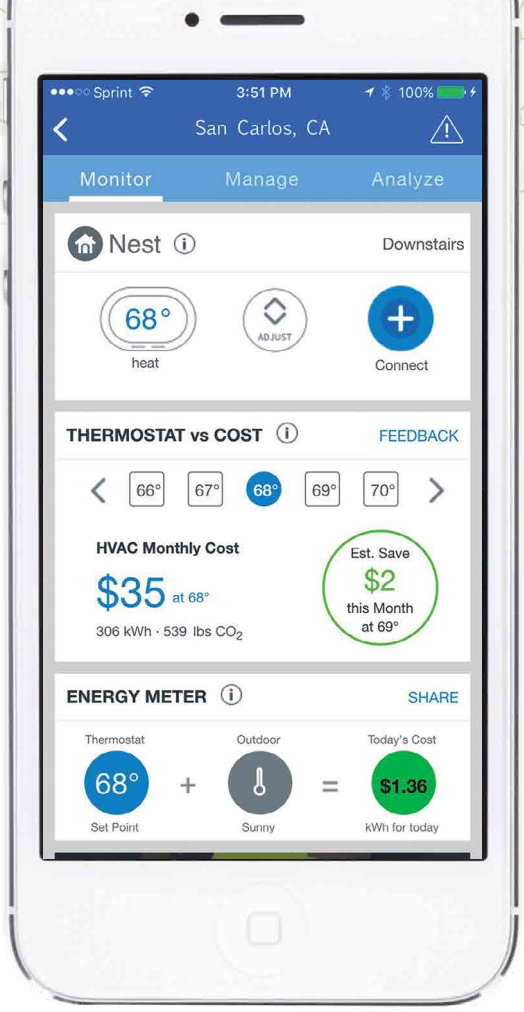
REAL ESTATE
provide energy costs to prospective buyers or renters

BENCHMARKING
ENERGY STAR scoring and compliance with transparency laws

COST REDUCTIONS
Use batteries or demand response to shift usage to times when electricity is less expensive

RATE SELECTION
Suggest cost savings by switching rate plans based on usage patterns, electric vehicle (EV) ownership

RENEWABLE ENERGY
optimize the size and cost-effectiveness of rooftop photovoltaic installations, accurately predict demand reductions due to solar



Smartphone app by WeatherBug Home

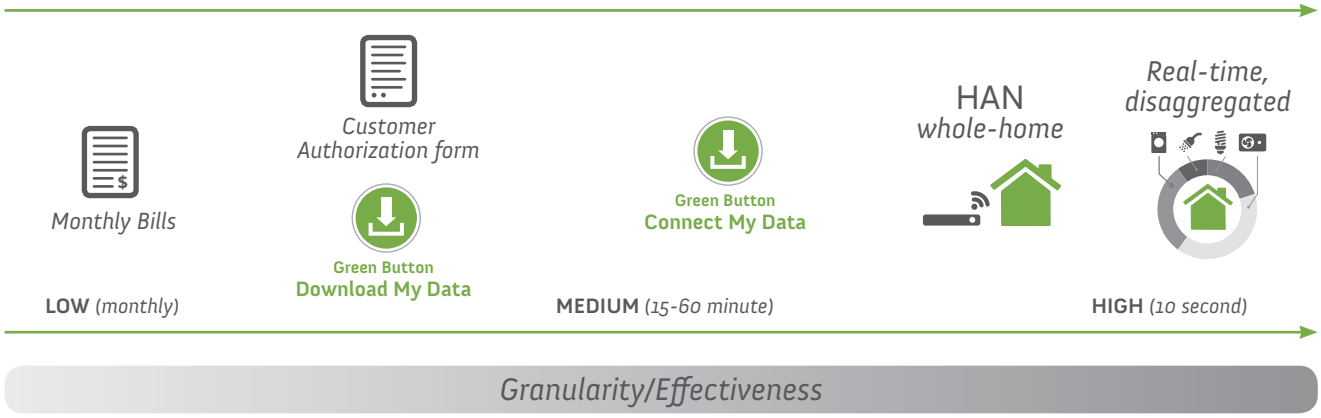
NEW PLAYERS IN ENERGY EFFICIENCY

WeatherBug Home (WBH) is not your typical participant in electricity markets. WBH's parent, Earth Networks Inc., boasts the largest private network of weather stations around the world. The company, based in Germantown, Maryland, made its name by selling hyper-localized meteorological data to governments (for disaster planning and emergency operations) and sports stadiums (for planning game cancellations due to inclement weather). Now the company offers energy efficiency services through a smartphone app.

WBH represents a new category of player in the electric industry, one that is neither contracted to a utility to provide energy efficiency nor a thermostat manufacturer, although WBH has overlap with both. Over 20 million consumers interact with WBH's app on a regular basis. Besides local weather forecasts, the app provides energy and dollar savings estimates from changing thermostat setpoints. Recent technology partnerships with Honeywell and Nest allow you to control your thermostat from the app itself, taking advantage of weather conditions to heat or cool in the most efficient manner. Users in certain utility territories can also bring in usage and billing history from their electric utility for analysis.

"Weather is universal. Everyone talks about the weather. Not everyone talks about energy," says Joey Barr, Director of Partnerships for WBH. "By engaging a universal set of users first, we're able to reach a lot more people and educate them about energy efficiency." Over 4 million people have interacted with the app's energy features—an impressive reach, much to the envy of other companies specializing in energy efficiency.

For WBH and many other companies, accessing user's utility data with consent can empower consumers who ordinarily would not engage in energy efficiency at all. For these firms, interaction with energy users does not originate with utility bills or in the aisle of a hardware store. Instead, it can begin with social networks, discussions about home security systems or even weather forecasts. Data access can enable new services to bridge previously unconnected aspects of consumers' lives and begin conversations about efficiency that would not happen otherwise.



GATEWAY TO ENERGY SAVINGS

Easy access to usage data is a prerequisite for achieving many dimensions of energy efficiency, but not necessarily in ways one might expect. The average consumer should seldom be expected to study usage data herself. Nor should many businesses, for whom energy typically represents less than 1% of annual operating expenses. "Rational inattention" is an expected and perfectly normal behavior; consumers spend less than ten minutes per year thinking about energy.[9] Realizing significant gains in energy efficiency will come not from consumers interacting with their raw energy data, but rather indirectly from technology companies and service providers who process, digest and act upon energy data on the customer's behalf.

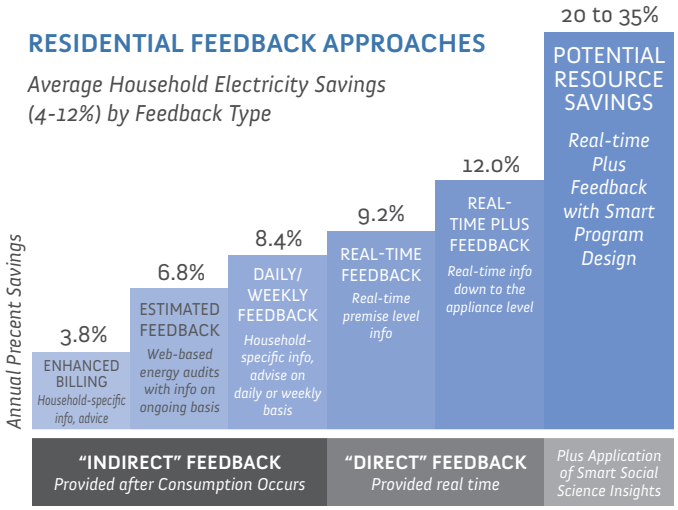
This is why data access is, by itself, insufficient to save energy; other steps are required, too. Nevertheless, it is instructive to review the impressive range of energy savings attained by data-driven feedback measures. Many studies have been conducted, the most comprehensive of which is ACEEE's meta-analysis of 57 feedback studies (2010), summarized in the chart below.

Since ACEEE's report in 2010, additional studies by industry, academics and utilities have continued to advance the case for data access. Some studies demonstrate energy savings, while others demonstrate reductions in peak demand—load shifting in addition to load reducing. **We found 12 studies from 2011 to 2015 in which 6% to 18% of electricity use was saved because of access to interval meter data coupled with new technologies.**

If energy savings increase as a function of granularity and timeliness of feedback as indicated by ACEEE (2010), then what utility information technology (IT) functions can in turn provide the greatest opportunities for savings? The figure above shows Green Button functionality (Download and Connect) and HAN features on a spectrum of effectiveness. Beginning at left, monthly bills provide, of course, the lowest granularity and effectiveness. Utilities manually send data to third parties pursuant to a customer authorization form in spreadsheets or PDFs via email. Such data can be monthly (low granularity) to 15-minute or 60-minute (medium granularity) depending upon the utility, the meter and customer class. Green Button Download My Data can similarly span low to medium granularity and, as stated before, its effectiveness is muted by the fact that its use requires action by the user each time (not altogether

RESIDENTIAL FEEDBACK APPROACHES

Average Household Electricity Savings (4-12%) by Feedback Type



Ehrhardt-Martinez, K., Donnelly, K.A., and Laitner, J.A. 2010
Faruqui, A. and Sergici, S., 2009

9 Accenture, "Actionable Insights for the New Energy Consumer." 2012. https://www.accenture.com/t20151127T210510__w__/us-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Industries_9/Accenture-Actionable-Insights-New-Energy-Consumer.pdf

YEAR	AUTHOR	SAVINGS (%)	METHOD	SECTOR
2011	Conservation and Customer Perceptions: The Real Time Monitor Pilot of Santee Cooper	6% savings	311 residents with real-time IHDs	residential
2012	Alberta Real-time Electricity Consumption Monitoring Study	9% - 17% savings	260 residents with real-time IHDs	residential
2012	Dean Mountain, "Real-time Feedback and Residential Electricity Consumption: The Newfoundland and Labrador Pilot"	18.1% savings	Stratified random sample of 100 residents with real-time IHDs	residential
2013	Armel, Gupta et al.	12.0%	Disaggregation	residential
2013	Granderson, Lin and Piette (Lawrence Berkeley National Laboratory)	17% median savings after the first year, rising to over 40% after several years	Survey of energy information systems (EISs) at 28 sites, predominantly using whole-building interval electricity use data.	commercial
2013	Houde, Todd, Sudarshan et al.	5.7% savings	Randomized controlled trial with over 1,700 residents exposed to real-time feedback technology (but with 10-minute interval data)	residential
2014	Ben Ho, Vassar College for EnergyHub, Inc.	6%	smart thermostat with web and mobile software	residential
2014	BKi	7.4% electric, 13% gas	Bimonthly energy reports showing disaggregation	residential
2014	Churchwell, Sullivan, Thompson and Oh (Nexant, for Pacific Gas & Electric)	7.7% savings for customers on TOU rates	277 customers were exposed to either a website and mobile app with real-time data via the HAN or an in-home display (IHD)	residential
2014	City of Mountain View, Acterra, Home Energy Analytics	5.5% savings	Over 2,000 residents signed up for website and email reports with statistical disaggregation of energy use	residential
2015	Blumsack and Hines for Green Mountain Power	6.2% - 16.4% peak load reduction	in-home display coupled with critical peak pricing or critical peak rebates	residential
2015	DTE Electric Company	17.5% peak load reduction with IHD; 43% peak load reduction with IHD + programmable thermostat	Randomized controlled trial with email and automated phone messaging regarding peak days	residential

different from a customer authorization form). Moving to the right, Green Button Connect My Data offers more effectiveness by having a typical latency of 24 hours. At the most advanced level, the HAN offers real-time readings, often at intervals of 10 seconds or less, allowing users to turn on lights or appliances in the home and immediately see what impact such actions have on power consumption.

Finally, the most advanced and effective feedback is at a very detailed level: the appliance. It makes sense that the most actionable information will be specific ("Turning down your air conditioner will save you $30") rather than general ("Something appears to be using a lot of energy right now"). Appliance-level measurement is typically an expensive proposition, although HAN-connected devices such as thermostats can offer some clues. For example, with a HAN-connected smart thermostat, air conditioning load can be quantified without installing an additional submeter by simply correlating on/off status of the thermostat with power increases measured at the utility meter.

In general, however, appliance-level measurement is

prohibitively expensive. Thus one of the more fascinating developments in residential energy efficiency in the past ten years is the maturation of statistical disaggregation using nothing more than meter readings and software tools. Armel et al. (2013) at Stanford University have been leaders in this field. As Armel et al. show, the ability to recognize individual loads in a home is proportional to the granularity of measurement: Advanced software with 15- to 60-minute readings can differentiate only coarsely between loads that correlate with outdoor temperature and loads that are time-dependent; at one second of measurement, software can uniquely identify the top five to ten appliance types (air conditioning, heaters, refrigerators, etc.); at one millionth of a second in measurement or less, individual lightbulbs can be identified with software, without using a single submeter.

The potential impact of software-based disaggregation is impressive. Utility bills itemized by appliance – even if their accuracy isn't 100%—are a quantum leap beyond the last century of practice in the utility industry. Recognizing the power of disaggregation, one major retail energy provider recently announced it will provide an itemized utility bill to customers.[10] Microsecond measurement may not be possible with off-the-shelf smart meters from major manufacturers, but nevertheless, disaggregation's prevalence will likely grow substantially, using whatever interval readings are available. Techniques such as machine learning and advanced statistics promise to provide customers with more detail a bout their energy usage than they have ever had before. More detail means greater customer choice: what electrical devices to buy and how to operate them. But of course, services that use disaggregation will only be widely available if two conditions are met: First, policies must enable third party access (with customer consent) while protecting privacy, and second, policies must ensure technologically-consistent implementations across utilities so that HAN devices can connect to meters regardless of geographic location.

With so many benefits, it's tempting to want to quantify the value of data access relative to the energy savings cited above. Separate from the other elements of packaging and presenting data to users in influential ways, what is the relative contribution of data access to energy savings, in hard numbers?[11] Cost-benefit analyses are typical when weighing utility investments, and so regulators understandably ask the question. But we caution readers from attempting to value data access in isolation. Data access alone and without other efforts is unlikely to lead to energy savings. It is, rather, an enabling technology that makes substantial energy savings possible. Perhaps the best articulation of the value of data access comes from Lawrence Berkeley National Laboratory writing about energy information systems (EISs) in the commercial sector. Asked what value he placed on an EIS providing whole-building interval data, one building manager said, "Does a mechanic quantify the value of *their* tools?"[12]

10 Press release by Direct Energy, July 21, 2015. https://www.directenergy.com/news-room/press-releases/2015/direct-energy-direct-your-energy

11 See, e.g., Chapter 4 of *Residential Electricity Use Feedback: A Research Synthesis and Economic Framework*. EPRI, Palo Alto, CA: 2009. 1016844.

12 Granderson, J, Lin, G, Piette, MA. Energy information systems (EIS): Technology costs, benefits, and best practice uses. Lawrence Berkeley National Laboratory, November 2013. LBNL-6476E.

"Data access with Xcel has been an uphill battle. It's easier to just bypass them. That's why Boulder County chose to install their own submeters on our recent energy advising project."

- Brad Queen
Energy Consultant at Cube Resources (Boulder, CO)

4 THE COSTS OF NOT HAVING ACCESS TO ENERGY DATA

There are numerous examples from across different market segments such as solar or energy efficiency services that are indicative of the costs involved in gathering, digitizing, normalizing and manipulating energy data from utilities. Unfortunately, these costs are very widespread and persistent. In many cases, service providers find it easier to install a new meter, redundant to the utility's, because it is cheaper than getting data from the utility—even with customer consent. This burden is ultimately reflected in increased costs to those users of energy efficiency services, penalizing precisely the offerings many state energy policies are trying to promote: renewable energy and energy efficiency.

"If we can't access meter data, we lose customers. It's that simple. Installing new meters is too expensive for most of our clients."

- Nitin Manchanda
CEO of Energy Hippo

COMMERCIAL/INDUSTRIAL

With larger electric consumers, there are four cost drivers of submetering. First, there is the cost of the meters themselves. Unlike the residential market, the commercial sector has many types of electrical configurations, leading to a wide variety of options. Current transducers (CTs) need to be sized to the correct amperage, for instance, whereas residential electrical panels are often (though not always) standardized at 200 amps. Submeters are fairly expensive in the commercial sector owing to greater specialization and because business customers have a higher willingness to pay than consumers, eliminating downward pricing pressure on manufacturers.

Second, a data acquisition computer or "datalogger" is required to gather the data, transmit data via an internet connection and store data on disk if there is an interruption in connectivity.[13]

Third, there are significant installation costs from a certified electrician. Unlike the installation of residential utility meters, which have standardized sockets and can be swapped out in minutes (at least in North America), installing equipment "behind the meter" on commercial switchgear is complex and unique to every location. Sometimes installation requires more than one site visit from an electrician due to special equipment needs. Commercial electrical service at 480 volts is more dangerous than 120 volts and requires installers to wear personal protective equipment. Sometimes a planned shutdown of a building is required to de-energize circuits so that the meter can be safely installed; the inconveniences and costs of disruption often weigh heavily in the minds of business owners.

Fourth are connectivity costs for downloading data periodically. Unlike consumer energy management devices, which can easily connect to home broadband routers,

13 Some submeters have dataloggers built in, but most off-the-shelf submeters from major manufacturers do not.

ITEM	RANGE
Meter	*$500 to $2,000*
Data Aquisition	*$900 to $2,400*
Installation	*$1,500 to $2,000*
Total	**$2,900 to $6,400**

businesses work to protect their networks from intrusions, and any foreign device on a network is viewed as a threat. Many businesses simply do not allow unapproved devices to connect to their network. That requires many third parties to seek alternatives, such as cellular modems, that carry both one-time and ongoing monthly expenses.

THE SOLAR INDUSTRY OFFERS ENERGY MANAGEMENT, BUT METER DATA ACCESS IS A HANDICAP

SolarCity has first-hand experience with the challenges associated with accessing and leveraging utility AMI to provide customers with a more holistic sense of their energy consumption.

SolarCity, the country's largest solar installer, wanted to offer its customers online energy management services. The customers who install solar panels are clearly more inclined toward energy management than the average consumer. Not only would presenting its customers with energy use information reinforce the value of solar panels, but SolarCity could also broaden its offerings to include stand-alone energy efficiency services, such as targeted recommendations and retrofits.

SolarCity released its "MySolarCity" app in Apple's App Store and Google's Play Store in 2014. MySolarCity shows customers their real-time energy consumption and compares it with solar output. Given the universal penetration of AMI in California, SolarCity's largest market, one would have thought that MySolarCity would take advantage of smart meters. However, SolarCity found the HAN "pairing" process to be so time-consuming and plagued with errors that it now installs its own meter, redundant to the utility meter.

> SolarCity found the HAN "pairing" process to be so time-consuming and plagued with errors that it now installs its own meter

Fortunately, SolarCity already has electricians on site to connect the solar panels and inverters, so the incremental labor cost of an electric meter is small. But the meter itself adds a nontrivial expense to an industry known for aggressively cutting pennies from its cost structure. If nearly 300,000 customers of SolarCity's have an additional meter, that equate to tens of millions of dollars spent on redundant equipment. "We actually have a Zigbee radio in our inverters already," said Eric Carlson, SolarCity's Senior Director of Grid System Integration. "We could have integrated with the Home Area Network for zero marginal cost, but it was ultimately lower cost and more scalable to install our own meter. If a simple utility method to activate HAN equipment for our customers was available, we would have used the existing smart meters instead." Carlson also cited the differences among utilities' HAN activation processes, the manual nature of HAN activation and SolarCity's need to standardize a nation-wide offering as reasons for bypassing the utility meter.

Web scraping on the rise

When data-dependent companies experience costs or hurdles in accessing their customers' usage data, they naturally seek alternatives. One option is to use the utility's customer-facing website. By logging in with a customer's credentials, third parties can access bill histories, rate information and, often times, interval data. Customized software that logs into websites in this fashion are known as "scrapers."

What are web scrapers?

Also known as spiders, crawlers, robots or simply "bots," scrapers refer to software built to automatically extract information from websites. Typically, scraping is the process of simulating web browsing as a human. Scrapers are widely used on the internet, ranging from search engines that index website content to marketing firms that compile the prices of products online. In the utility context, scrapers are made by a growing number of energy efficiency firms and other third parties to gather utility bill and consumption information from customers' online accounts. Scraping reduces the costs of manually transcribing information, a nontrivial expense for repetitive tasks such as entering 12- or 24-month bill histories. Typically, the customer gives his/her login and password to a third party, and the third party's scraper automatically logs in to the utility website and gathers the information needed.

How does scraping work?

1) *The customer establishes an account on the utility's website for viewing and paying bills.*
2) *The customer signs up for a third party service, giving the third party his/her utility login and password*
3) *The service automatically logs into the utility on a periodic interval (say, once per day) and downloads the user's usage data, historical bill information, etc.*

Potential problems from scraping

Scraping is well-known as a concern for many companies such as online retailers, but it is rarely thought of by utilities as a problem worth addressing. First of all, it may go undetected for a long period of time. When scraping accurately simulates a human's browsing of a website, it is very difficult to tell the difference between a computer and a human, leading Chief Information Officers to believe that scraping isn't prevalent. If scraping is detected, it could be that the robot is merely accessing information customers were already authorized to access in the first place. In the context of very large and embarrassing data breaches of late (Home Depot, Sony Pictures Entertainment, the U.S. Office of Personnel Management) involving data much more sensitive than utility bills, it is understandable that scraping may be viewed by many utility managers as a low-risk threat.

Then there is the fact that many customers have provided their credentials willingly to a third party. Provided the consent was informed, it is reasonable to view third parties as agents acting on behalf of customers – identical to, for example, aging parents giving their children control over bill payment. If such agency is legitimate, it is hard to say any harm resulted from password-sharing.

On the other hand, careless credential-sharing can lead to specific IT problems. For example, while under development by their authors, scrapers can result in highly repetitive requests, increasing traffic loads. A scraper that inadvertently enters an infinite loop (not uncommon in software development) can greatly slow down webservers that are serving legitimate users. Overloading can be managed with a range of IT tools such as rate limiting, IP filtering, deep packet inspection and various intrusion-prevention systems, but website outages and unpredictable traffic loads are risks from scraping.

In vertically-integrated markets, another risk to utilities is more existential in nature: disintermediation by third parties. The utility risks losing its strong and direct customer relationship to app makers and third parties once the utility interacts less frequently with the customer. More and more services are provided by utilities online, such as bill payment, service requests, rate selection tools and the marketing of efficiency programs. But if customers rely on third parties for those services instead of interacting with their utility, the fear is that utilities are relegated to managing wires and poles, thereby missing out on future sources of revenue.

As for scraping, regulators should start by acknowledging its existence. Regulators will likely feel that ratepayers are better served by legitimate third parties that must register with the PUC or the utility, rather than face a growing number of unknown third parties who could easily pass around customer login credentials to fourth or fifth parties without anyone's knowledge. **Password-sharing is not a future, hypothetical risk.** *Data-driven applications are growing every day in number. If the path of least resistance for third parties is scraping, then it is likely to continue until utilities and regulators provide a sanctioned data access method that is simple and convenient and supported by thoughtful policies and procedures.*

Pacific Gas & Electric had over 100 third parties attempt registration within the first month Green Button Connect became available.

5 SOLUTIONS: STATES THAT LEAD THE WAY ON DATA ACCESS

Only two states with smart meter deployments—California and Texas – have, through their public utility commissions, ordered utilities to provide consumers and authorized third parties with access to their electricity data. Two states, Illinois and Colorado, are in the process of modernizing their rules governing customer information disclosures. Although each is different in approach, these states' experiences are instructive to those who seek guidance amidst competing interests and, often, highly technical material.

CALIFORNIA

From the mid-2000s, California has consistently embraced data access without charge as a requirement in connection with AMI deployment. The Commission established six functional requirements for AMI systems, including collection of "data at a detail level that supports customer understanding of hourly usage patterns and their relation to energy costs" and "access to personal usage data such that customer access frequency does not result in additional AMI system hardware costs."[14] California has not made a determination regarding ownership of energy usage data, but it has clearly established that consumers have a right to receive data from their meter and share it with third parties of their choice.[15]

California requires investor-owned utilities (IOUs) to provide backhauled data to customers and third parties designated by the customer via Green Button Connect and to activate the HAN radio. A detailed summary of major California PUC decisions regarding data access can be found in Appendix 2

While it has taken many years to finally meet the state's requirements *(see Appendix 2)*, California IOUs can rightfully claim to be the nation's first large-scale adopters of Green Button Connect. The resolution of three key issues is largely responsible for this accomplishment. First, the Commission was very explicit that the IOUs should not be held liable when a third party breaches customer privacy in violation of the law. Without assurances from the Commission that their liability would be strictly limited, the IOUs would not embrace data access. Second, the Commission established very simple and straightforward eligibility criteria for third parties. Simplicity was critical because onerous requirements would have severely limited the participation of innovative third parties and gone against the state's goals to encourage new efficiency offerings.

In order to be eligible to receive customer usage data, the Commission ruled that third parties must:

(i) demonstrate technical capability to interact with the IOUs' servers using Green Button;

(ii) provide contact information and a federal tax identification number in order to unify the registration system state-wide;

(iii) acknowledge receipt of the Commission's privacy policy in D.11-07-056; and

(iv) not be present on the Commission's list of banned third parties.[16]

This policy of simplicity has been very successful: Pacific Gas & Electric had over 100 third parties begin registration within the first month it became available.[17]

14 See A.05-03-016 (2006) and A.06-12-026 (2007) approving pre-deployment funding for PG&E and Southern California Edison AMI projects, respectively.
15 California Public Utilities Commission, D.11-07-056, p. 36.

16 Observant readers will notice that IT security requirements, representations and warranties regarding business practices, liquidated damages in cases of breach, and other contractual obligations that would typically be found in agreements between utilities and their contractors are conspicuously absent from this list.
17 Presentation by Pacific Gas & Electric at "Birth of the Green Button" event in San Diego, CA, February 6, 2015.

That last eligibility criterion represents perhaps the most important solution to the challenge of enabling data access while simultaneously protecting privacy: by having the Commission, and not utilities, adjudicate disputes, the utilities are relieved of their responsibility to police third parties. As long as the utilities were ultimately left holding the bag for a "bad actor"'s misdeeds, the utilities would understandably clamp down on data-sharing and keep third party participation to a minimum. In California, an IOU cannot unilaterally decide to terminate data-sharing; that responsibility is exclusively in the hands of the customer and the Commission.

TEXAS

Texas has made the determination that consumers own their own energy usage data. A common web portal, Smart Meter Texas (SMT), was established that allows consumers across the state a consistent method to access their own energy usage data. Real-time data is available through the Home Area Network interface. The state activated backhaul data access, which is made available in 15-minute increments the following day. The data available for customer download are in Green Button/ESPI format, but the data transmitted automatically to authorized third parties is in a different format that is not ESPI-compliant.

Texas PUC Substantive Rule 25.130(g) establishes requirements for advanced metering systems in Texas. The list of requirements is extensive and includes:

- the capability to provide direct, real-time access to customer usage data to the customer and the customer's retail electric provider (REP). The initial requirement for interval data, delivered on a day-after basis, was 60 minute, with a goal of 15 minute intervals by 2010. This objective has been realized.
- open standards and protocols that comply with nationally recognized, non-proprietary standards;
- capability to communicate with devices inside the premises, including, but not limited to, usage monitoring devices, load control devices, and prepayment systems through a home area network (HAN), based on open standards and protocols that comply with nationally recognized non-proprietary standards such as Zigbee, HomePlug, or the equivalent;
- the ability to upgrade these minimum capabilities as technology advances.

With respect to customer data access specifically, PUC rule 25.130(j) requires that:

- An electric utility shall provide a customer, the customer's REP, and other entities authorized by the customer read-only access to the customer's advanced meter data, including meter data used to calculate charges for service, historical load data, and any other proprietary customer information. The access shall be convenient and secure, and the data shall be made available no later than the day after it was created;
- The requirement to provide access to the data begins when the electric utility has installed 2,000 advanced meters for residential and non-residential customers;
- An electric utility shall use industry standards and methods for providing secure customer and REP access to the meter data;
- A customer may authorize its data to be available to any entity, not just its REP.[18]

While Texas's policies on data access represent a large step forward, there are similarities to California in that implementation has lagged in some areas. For example, the consent process at Smart Meter Texas by which a customer grants access to a third party has been criticized by market participants as clumsy and an unnecessary friction point, leading to disappointing customer usage statistics as shown in a recent report.[19] Also, the fact that SMT does not adhere to national standards like Green Button Connect means that idiosyncracies delay third parties' integration with the system. As of December 1, 2015, only four third parties had successfully received customer energy data, while 76 third parties are actively attempting registration.[20]

Finally, the management of SMT, jointly run by four transmission and distribution utilities in the state, have been criticized for ballooning costs and poor support, including a two-week outage of SMT in 2015 that interrupted all data transfers. As a result, there is an ongoing case at the PUC regarding long-term governance of this unique, state-wide system.[21]

18 See, e.g., Texas PUC Order re: AEP Texas's Request for Approval of Advanced Metering System Deployment Plan and Request for AMS Surcharges, PUC Docket No. 36928, 2009, p. 7.

19 South-central Partnership for Energy Efficiency as a Resource (SPEER), *Smart Energy Roadmap for Texas*. 2015. https://eepartnership.org/program-areas/policy/intelligent-energy-management/

20 Presentation of ERCOT Advanced Metering Working Group, December 15, 2015. http://www.ercot.com/content/wcm/key_documents_lists/55957/SMT_Third_Party_Satistics_Report_Reporting_Period_November_as_of_12.1.15.docx

21 Texas PUC Project No. 42786. Note that SMT serves only customers in competitive areas in Texas.

COLORADO

Colorado has recently amended its rules addressing backhauled data, though its smart meter penetration is modest. Beginning in 2014, the Colorado PUC sought to amend the rules set forth in Code of Colorado Regulations (723-3, section 3026) governing access to and privacy of customer information in the possession of utilities. The objective was to protect ratepayer privacy while allowing local governments and energy efficiency firms to have access to a customer's meter data upon informed consent. Section 3026(d) now states:

> *As part of basic utility service, a utility shall provide access to the customer's standard customer data in electronic machine-readable form, without additional charge, to the customer or to any third-party recipient to whom the customer has authorized disclosure of the customer's customer data. Such access shall conform to nationally recognized open standards and best practices. The utility shall provide access in a manner that ensures adequate protections for the utility's system security and the continued privacy of the customer data during transmission.*

Section 3026 also affirms customers' rights to transmit their data to anyone of their choosing. And similar to California's privacy ruling, it states that utilities shall have no liability for a third party's breach of customer data, provided that the utility receives the customer's consent and transmits the data securely.

As part of amending its electric and gas utility rules, Colorado also updated the utilities' outdated, paper-based consent forms.[22] Notable changes include: (i) web-based consent with the same information as the paper form was approved; (ii) eliminating the requirement that third parties must have a Colorado address for service of process; and (iii) a checkbox indicating how long the consent is valid, either 12 months, 24 months or indefinitely.

Implementing these rules changes, which were adopted in 2015, is the subject of an ongoing proceeding, and much remains to be done. Colorado's biggest utility, Xcel, is resisting implementing Green Button Connect.[23] Nevertheless, it is noteworthy that Colorado has affirmed data access as part of basic utility service, ensuring that commercial building owners, homeowners and others will be able to benefit from the utilities' investments in advanced metering.

ILLINOIS

In December, 2015, the Illinois Commerce Commission proposed an order detailing how consumers can authorize third party access.[24] Another proceeding considers the Open Data Access Framework, a kind of "customer bill of rights" for access to meter data, proposed by Citizens' Utility Board and Environmental Defense Fund in 2014.[25] Illinois's AMI deployment is underway, with approximately 5 million meters to be fully installed by 2019. Illinois is likely to become the third state with data access.

22 Colorado PUC Decision No. C15-0752 dated July 16, 2015.
23 *Verified Compliance Application of Public Service Company of Colorado.* Colorado PUC Docket No. 15A-0789E, dated October 2nd, 2015, p. 5.
24 Illinois Commerce Commission, Proposed Order in Docket No. 15-0073 on "Investigation Into the Customer Authorization Required for Access by Third Parties Other Than Retail Electric Suppliers to Advanaced Metering Infrastructure Interval Meter Data." December 23, 2015. Docket No. 15-0073
25 Illinois Commerce Commission, Docket No. 14-0507.

6

ADDRESSING PRIVACY CONCERNS

In policy debates, we often hear of the need to "balance" the benefits of data accessibility with privacy rights. With each introduction of new technologies as smartphones' GPS features or fitness trackers, the volume of personal data generated increases substantially, and it is only sensible to consider how to get the most personal or societal benefit from these technologies while limiting the risks of misuse. However, the policy discourse around the data collected by smart meters too often over-simplifies issues, framing the challenge as one of technological progress versus privacy where a gain on one side means a loss for the other. While such trade-offs exist in many areas, it would be premature to simply declare smart meters and privacy as opponents in a zero-sum game.

A more accurate and nuanced understanding is one that places customers in the center of a new set of information relationships.

A more accurate and nuanced understanding is one that places customers in the center of a new set of information relationships. From this perspective, giving the consumer access to, and control over, his or her energy data is consistent with the trend towards greater privacy protection and consumer empowerment. Previously, the utility was the sole supplier of information to customers; monthly bills provide information uni-directionally to the customer. But DER adoption is reshaping the flows of information, not just the flows of energy. Photovoltaic energy generated from rooftops and EV charging patterns contain data that are generated by customers, not by a utility. If, in effect, the meter measures customer behaviors, then the resulting data from the smart meter arguably belong to the customer. Empowering customers with smart meter data can thus be considered giving the customer control over data he or she generated in the first place. And, as we mentioned previously, a customer accessing his or her own personal information should not raise privacy concerns.[26] One can argue persuasively that access to one's own digital information does not result in a "trade-off" in which privacy is sacrificed.

Privacy issues do legitimately arise when consumer data are shared with a third party. Fortunately, several privacy laws and state commissions have addressed privacy specifically with regard to AMI data, just as laws and rules have been successfully crafted in the finance and healthcare sectors to protect consumers. Many of these existing policies emphasize transparency to customers and provide customers with ways to control the use of their personal information. To begin to understand privacy law with regard to energy data, it will be worth our readers' time to become familiar with one of the earliest privacy policies to come from the U.S. government, the Fair Information Practice Principles (FIPPs). Developed by the U.S. Federal Trade Commission with origins dating back to the 1970s, the FIPPs are commonly referenced in state commission proceedings.

26 Provided, of course, that the information is transmitted securely.

The FIPPs are simple guidelines that represent widely-adopted concepts of fair information practices:

1. **Notice/awareness**, making customers aware before personal information is collected about them;
2. **Consent,** securing affirmative consent from customers to use their personal information in clearly specified ways;
3. **Access**, enabling customers to view and access the information collected about them;
4. **Integrity/security**, protecting the personal data in a secure manner; and
5. **Enforcement/redress**, which could include either self-regulation, civil actions through the court system, or government enforcement that can include civil or criminal penalties

The FIPPs are a simple starting point. But for state regulators that oversee public utilities, the first challenge in creating a thoughtful privacy rule lies not with the utilities per se, many of whom are already prohibited from sharing or selling any customer data, but rather with third parties. What jurisdiction do commissions have over third parties? Most third parties are emerging software and hardware companies and are not provided guaranteed rates of return or afforded legal protections as the utilities are. Instead, they operate in competitive markets quite unlike regulated entities.

> The lack of explicit commission authority over third parties does not mean alleged privacy violation are without recourse entirely.

No PUCs to our knowledge have explicit authority to regulate entities outside of public utilities, commercial transport, railroads and the like. But the lack of explicit authority does not mean alleged privacy violations are without recourse entirely. Most third parties operate like other internet or software companies, and several mechanisms exist to ensure the privacy and security of individuals' energy usage data. These companies are subject to a wide variety of laws governing electronic communications, such as:

- The federal Electronic Communications Privacy Act protecting communications and stored data from government intrusion;
- the Federal Trade Commission Act protecting consumers from "unfair or deceptive" practices;
- state laws that require companies to respond to consumer requests for the data held about them;
- state laws that require website operators to explain their privacy policies to consumers; and
- state data breach laws that require companies to notify customers when personal information is compromised as a result of an intrusion or lapse in security practices.

Thus, calling high-tech software companies "unregulated" is not strictly true; it would be fairer to say that high-tech companies are seldom regulated by state commissions but are subject to oversight by other entities such as state attorneys general or federal regulators.

With respect to smart meter data specifically, states may seek specific assurances with regard to the use of these data, much in the way that lawmakers have mandated information practices in healthcare and financial services. For commissions that are considering data access policies, there are a number of templates that states will find very useful. States like California and Texas have created policies that ensure strong protections of privacy and security in ways consistent with continued innovation. These templates are outlined in Appendix 1.

U.S. DEPARTMENT OF ENERGY'S VOLUNTARY CODE OF CONDUCT

In 2015, the U.S. Department of Energy (DOE) began implementation of a "DataGuard" seal for utilities and third parties committed to implementing the January 2015 Voluntary Code of Conduct (VCC) Final Concepts and Principles for Data Privacy and the Smart Grid.[27] The DOE spent two years developing the VCC with input from utilities and third parties, with a principal objective being to establish consistent, voluntary guidelines to which third parties can voluntarily and publicly embrace and be held accountable.

27 See, e.g., https://www.smartgrid.gov/sites/default/files/VCC_Concepts_and_Principles_2015_01_08_FINAL_1.pdf and https://www.smartgrid.gov/data_guard.html

DataGuard
Energy Data Privacy Program

DataGuard was developed in order to help fill the gap between third parties and commission jurisdiction, which is typically limited to regulated utilities. DataGuard works by third parties signing an adoption statement and submitting it to DOE, who maintains it on file and publicly lists the third party as a VCC adopter. If a company then fails to comply with the VCC, it would be subject to an action for misrepresentation under state law or Section 5 of the Federal Trade Commission Act barring unfair or deceptive acts or practices.[28] The idea is to put regulators at ease by providing an enforcement mechanism against non-regulated entities who breach customer privacy.

The Privacy Voluntary Code of Conduct describes principles for voluntary adoption that:

1. encourage innovation while appropriately protecting the privacy and confidentiality of Customer Data and providing reliable, affordable electric and energy-related services;
2. provide customers with appropriate access to their own Customer Data; and
3. do not infringe on or supersede any law, regulation, or governance by any applicable federal, state, or local regulatory authority.

THE VCC IS SUMMARIZED IN FIVE KEY CONCEPTS:

1. CUSTOMER NOTICE & AWARENESS

The VCC emphasizes "that customers should be given notice about privacy-related policies and practices as part of providing service."[29] Additionally, service providers should provide materials in formats that are easily accessible and comprehensible to users. Notices should be provided at the start of service, on a recurring basis after, and at a customer's request. Notices should be clear and concise and focus on what data is gathered by service providers as well as access to his or her own data usage. The notice ensures that service providers must receive consent from consumers before their information is shared.

2. CUSTOMER CHOICE & CONSENT

Describes requirements for processes that allow the customer to control access to his or her data for Secondary Purposes (i.e., to authorize differential access to multiple third parties, limit the duration of access, keep a record of data releases, rescind authorizations, and dispose or de-identify data once authorization or the need for the data has expired). Identifies data types and disclosures that do not require customer consent. Includes a requirement requiring certain data to be obtained directly from the customer.

3. CUSTOMER DATA ACCESS

Describes requirements for procedures that allow customers to access their data, identify possible inaccuracies, and request they be corrected.

4. DATA INTEGRITY & SECURITY

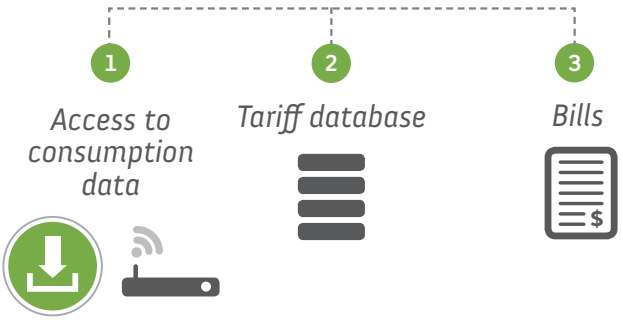
Describes requirements for a cyber security risk management program, and methodologies for creating aggregated or anonymized data.

5. SELF-ENFORCEMENT MANAGEMENT & REDRESS

Describes requirements for actions by Service Providers who voluntarily adopt the Voluntary Code of Conduct to ensure that they comply with it.

28 See https://www.ftc.gov/public-statements/1983/10/ftc-policy-statement-deception
29 VCC, p. 5.

7 POLICY RECOMMENDATIONS



- **Energy usage data should be available free of charge as part of basic utility service.** Access should be viewed as a foundational feature of the modern electric grid. Backhauled data should follow the best practices of ESPI/Green Button Connect, while the HAN should be immediately enabled. Enact a "bring your own device" (BYOD) policy in which customers can easily connect any Zigbee-compliant device; testing and certification of Zigbee devices should be very inexpensive and standardized state-wide.
- **Tariffs and customer bills should be published in standardized, machine-readable forms.** People care about dollars, not kilowatt-hours. Giving third parties access to tariffs in a machine-readable format is important because it takes human beings out of the cost-calculation process and lets software do the work, regardless of how complex tariffs may be. Commissions should publish approved tariffs in a standardized XML format.[30] Separately, historical bills should also be available for download in a standardized XML format, with third party access to whomever the customer authorizes.

In addition:

- **Utilities implementing ESPI/Green Button Connect should have their implementations periodically tested and approved by an independent certification authority.** Besides ensuring technical consistency, certification demonstrates to the market that a utility is truly compliant with the standard. New market entrants will postpone activity in uncertified areas because of the risk of costly, idiosyncratic variances. Periodic certification also provides a transparent enforcement mechanism for regulators, who can exert effective oversight over utilities by simply requiring independent certification. In 2015, the non-profit Green Button Alliance[31] was formed to provide exactly this testing and certification function, similar to the Wifi Alliance for devices using IEEE 802.11 or the Zigbee Alliance for devices using IEEE 802.15.4.
- **Third party-led authorization processes should be allowed.** For customers with access to an online utility account, authorizing a third party to access his or her usage data is relatively straightforward. But what about the huge number of consumers and businesses nationwide who do not have, or do not want, an online account? The friction associated with creating such an account as a precondition to using a third party's energy management service is not trivial. One solution is for commissions to require utilities to accept a third party-submitted form requesting access to usage data. With a paper

30 The same group that developed the ESPI standard, the UCA-IUG OpenADE Task Force, is working on developing a standardized XML schema for tariffs: https://github.com/energyos/OpenESPI-GreenbuttonDataSDK/tree/master/GreenButtonTariff

31 See http://greenbuttonalliance.org/

form, website or mobile app, the third party collects the customer account number and/or service address and submits this information to the utility as proof of the customer's authorization. This "third party-led" process is placed in contrast with a customer-led authorization that requires the customer to interact directly with the utility, sometimes a process fraught with complexity for many consumers.[32] This process exists today with paper forms, sometimes called customer information service requests (CISR) or letters of authorization (LOA). We note that some states with competitive retail markets have already ruled on this issue as it relates to retail suppliers.[33]

- **Utilities should have no liability for a third party's breach of customer privacy.** Simply put, only a third party should be liable for acts committed by the third party. So long as a utility has fulfilled certain obligations, it should not bear any responsibility for privacy breaches committed by third parties. The utility's obligations include (i) receiving valid authorization from the customer to share energy data and (ii) sharing such data securely with the designated third party (using modern encryption such as Transport Layer Security, or TLS). Failure on the part of regulators to make explicit a utility's limited liability will result in utilities policing third parties to avoid potential liabilities and inevitably lead to significant delays in enabling consumers to make effective use of their data.
- **If a third party engages in a "pattern or practice" of misusing customer data in violation of state or federal law, the Commission should order utilities to cease providing energy data.** The question of commission jurisdiction over third parties arises frequently in the context of privacy violations. What can a utility regulator do when a third party breaches customer privacy? The simplest answer is: order the utility to terminate data-sharing with the entity in question. Termination will not prevent future breaches of usage data already transmitted, but it will prevent ongoing data transfers from being put at risk. In such cases, it is important to remember that third parties should be entitled to due process before the commission before data access is revoked. We recommend California as a model.[34]

32 For more detail on third party-led authorizations, see, e.g., presentation by Michael Murray at Joint RMS/WMS Workshop II on Improving 3rd Party Access to Smart Meter Texas, October 16th, 2015. http://ercot.com/content/wcm/key_documents_lists/73667/07_Murray_presentation___ERCOT_workshop_Oct_16.pptx

33 See, e.g., Illinois Commerce Commission Docket No. 14-0701.

34 California Public Utilities Commission Decision D.13-09-025 dated September 19th, 2013. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M077/K191/77191980.PDF

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APPENDIX 1
Good Examples of Privacy Laws and Rules

CALIFORNIA STRIKES A BALANCE

PUC privacy decision (2011)

In 2009, California enacted Senate Bill (SB) 17 (Padilla) which, among other things, reiterates California's requirement that utilities deploying AMI provide consumers with access to their data;[35] prohibits utilities from selling consumer AMI energy usage data;[36] and, except in limited exceptions, prohibits making that data available to third parties not under contract with the utility, unless consented to by the customer.[37] If the utility does contract with a third party to provide a service that allows a customer to monitor his or her energy usage, and that third party uses the data for a "secondary commercial purpose," the utility must include in the contract a requirement that the third party prominently disclose that secondary commercial purpose to the customer and secure customer consent to the use of his or her data for that secondary commercial purpose prior to the use of the data.[38]

On July 28, 2011, the CPUC adopted rules intended to implement SB 1476, imposing privacy and security requirements on utilities and contractors who handle consumer energy data. Public Utilities Commission Decision D.11-07-056, establishes strict timelines for activation of backhauled data access, through Green Button Connect using a "common data format consistent with ongoing national standards" and enablement of the Home Area Network (HAN) radio embedded in each meter. It simultaneously adopts privacy and security rules governing smart meter data, among other requirements. The Order included the following salient directives related to customer data access:

- All California investor-owned utilities must provide, or continue to provide, customers with price and usage data. It must be "updated on at least a daily basis, with each day's usage data, along with applicable price and cost details and with hourly or 15-minute granularity (matching the time granularity programmed into the customer's smart meter) available by the next day." Residential customers must be offered "bill-to-date, bill forecast data, projected month-end tiered rate, and notifications to customers as they cross tiers to higher rates".[39]
- Within six months, the IOUs must provide third parties access to a customer's usage data via the backhaul when authorized by the customer. The utilities were to coordinate with each other to "propose a common data format to the extent possible and be consistent with national data standards efforts." The approaches must propose for third parties "eligibility criteria and a process for determining eligibility where the Commission can exercise oversight over third parties receiving this data."[40]
- Within six months, the IOUs must complete a pilot study to provide price information to consumers in real time or near-real time.[41]
- Within four months, the IOUs must submit plans to implement HAN functionality. These implementation

35 California Public Utilities Code §8380(b)(4)
36 *Ibid.*, §8380(b)(2)
37 *Ibid.*, §8380(b)(1)
38 *Ibid.*, §8380(c)

39 California Public Utilities Commission, D-11-07-056, Ordering Paragraphs 5, 6, p. 164.
40 *Ibid.*, Ordering Paragraphs 8, 9, p. 165
41 *Ibid.*, Ordering Paragraph 10, p. 166

plans must include the capability to support at least 5,000 HAN devices, and progressively larger deployments over time with an ultimate goal of unlimited HAN devices by 2015. The implementation strategies must address issues such as costs, expanded data access and granularity, current and evolving national standards and security risk mitigation and best practices, etc.[42]

Regarding privacy and security, D.11-07-056 reaffirmed the PUC's jurisdiction over utilities and authority to require utilities to extend those rules to third parties under contract with utilities, but did not address the question of jurisdiction over third parties not under contract to a utility. The utility is required to educate customers about the "potential uses and abuses of usage data."[43] The rules do not regulate the consumer's own decision as to with whom to share data, but they state that the utility is not responsible for policing those entities who receive information pursuant to a Commission requirement or customer wishes.[44]

The rules establish a distinction between a primary purpose of electrical or gas consumption data (providing a bill for electric power, fulfilling operational needs of the electrical system, providing services required by state or federal law or implementing demand response, energy management or energy efficiency programs under contract with a utility, the Commission or as part of a Commission authorized program conducted by a governmental entity under supervision of the Commission) and secondary purposes (e.g., any other purpose such as marketing or research) and require customer consent before a utility can share data with a third party.[45] The "covered information" subject to the rules is electrical usage information obtained through AMI when associated with information that can be used to identify a customer, excluding information where the identifying information has been removed such that a customer cannot be re-identified.[46] Finally, the Rule establishes a definition of "covered entity" includes electrical utilities, third parties under direct contract with electrical utilities for conducting a primary purpose, third parties that the Commission either selects, authorizes, or funds for conducting a primary purpose, and third parties who acquire data from the utility with the authorization of the customer.[47]

42 *Ibid.,* Ordering Paragraph 11, p. 166-167
43 *Ibid.,* p. 36
44 I*bid.,* p. 35
45 *Ibid.,* Factual Finding 10, p. 12
46 *Ibid.,* Factual Finding 10, p. 150-1
47 *Ibid.,* Factual Finding 10, p. 150

Generally, the requirements as to covered entities who receive covered information are as follows:

TRANSPARENCY. Covered entities must provide customers with meaningful, clear, accurate, specific, and comprehensive notice regarding the collection, storage, use, and disclosure of covered information in their first paper or electronic correspondence with the customer, if any, and conspicuous posting the notice or link to the notice on the homepage of their website.

PURPOSE. Covered entities shall disclose each category of covered information collected, used, stored or disclosed by the covered entity, and, the reasonably specific purposes for which it will be collected, stored, used, or disclosed. For covered information disclosed to third parties, the covered entity shall disclose each category of covered information and the purposes which it is disclosed, and the identities of the third parties to which it is disclosed; the periods of time that covered information is retained by the covered entity; and a description of the means by which customers may view, inquire about, or dispute their covered information, and how customers may limit the collection, use, storage or disclosure of covered information and the consequences to customers if they exercise such limits.

ACCESS. Covered entities shall provide to customers upon request convenient and secure access to their information, at a level no less detailed than that at which the covered entity discloses the data to third parties. Covered entities shall provide customers with convenient mechanisms for granting and revoking authorization for secondary uses of covered information, disputing the accuracy or completeness of covered information and requesting corrections to covered information. As for disclosure entities like law enforcement agencies pursuant to legal process, a covered entity may not disclose covered information except under a warrant or other court order naming with specificity the customers whose information is sought. Unless otherwise directed by a court, law, or order of the Commission, covered entities shall treat requests for real time access to covered information as wiretaps, requiring approval under the federal or state wiretap law as necessary.

One issue is data minimization. The Commission adopted a principle that covered entities shall collect, store, use, and disclose only as much covered information as is

reasonably necessary or as authorized by the Commission to accomplish the purpose, may retain such information only for as long as reasonably necessary for such purpose and may not disclose to third parties more information than is reasonably necessary or authorized by the Commission for that purpose.[48]

In adopting a data minimization principle, the Commission recognized that the data typically collected addressed only "company costs, aggregate demand, and company revenues" and that much more powerful data made available by AMI could disclose activities of customers. Presented with evidence that different utilities have different practices relating to the time of retention of customer data (which typically ranged from 3-10 years), the Commission declined to establish a specific limitation on the amount of time or purpose for which data could be collected opining ultimately that "[a]dopting a principle of "data minimization" does not change any regulations that currently require the retention of data for periods of time nor does it change any specific reporting requirements" and that the "recommended rules create no new liability that would fall upon utilities and other entities in conjunction with data retention."[49]

USE AND DISCLOSURE LIMITATIONS. With few exceptions, customer data can be shared only with customer consent, or under a "chain of responsibility" approach whereby parties that received covered information may disclose such information without consent to another party only for a primary purpose and only if the contract requires that party to adopt restrictions no less restrictive than those adopted by the providing entity.[50] The contract must consider a "pattern or practice" of violations to constitute a material breach and a covered entity must promptly cease disclosing information to a third party if the Commission determines that such a pattern or practice has occurred or otherwise orders the covered entity to cease provide such information.[51]

One key issue in use the term of the customer authorization. Recognizing that an arbitrary time limit could inhibit innovation of promising new energy services and/or customers' access to them, the Commission rejected a proposed two-year limitation on the term for which a customer's authorization would be valid, substituting a requirement of an annual notice of the authorization and an opportunity for the customer to opt-out.[52]

DATA SECURITY. The rules also require covered entities to ensure that the covered information they collect, store, use and disclose is reasonably accurate and complete and they must use reasonable administrative, technical and physical safeguards to protect covered information from unauthorized access, destruction, use, modification or disclosure. If data is disclosed through a security breach affecting 1,000 or more customers, the covered entity must provide notice of that breach to the Commission.

AUDITS. Covered entities must provide to the Commission information on their privacy notices to consumers, including internal privacy and data security policies, the categories of agents and third parties to whom they disclose covered information, data on customer complaints, and, on an annual basis, the number of third parties accessing covered information and the number of non-compliances with the privacy rule.

California's Assembly Bill 1274 (2013)

In 2013, the California Legislature, which had not originally imposed privacy rules on non-regulated third parties, approved AB 1274 to establish requirements applicable to third parties not under Commission jurisdiction. AB 1274 is intended to provide a less detailed and more flexible regulatory framework, with the objective of fostering innovation while ensuring protection of energy usage data that identifies a specific individual.

AB 1274 applies to a customer's electrical or natural gas usage made available to the business as part of an advanced metering infrastructure provided by a utility and that includes the name, account number, or physical address of the customer.

Under AB 1274:

"Unless otherwise required or authorized by federal or state law, a business shall not share, disclose, or otherwise make accessible to any third party a customer's data without obtaining the express consent of the customer and conspicuously disclosing to whom the disclosure will be

48 *Ibid.,* Factual Finding 10, p. 156
49 *Ibid.,* p. 72
50 *Ibid.,* p. 79.
51 *Ibid.,* p. 158.
52 Ibid., p. 81.

made and how the data will be used"[53]

Therefore, a business would be prohibited from sharing or disclosing a customer's data usage information to any third party without obtaining consent from the customer. AB 1274 also requires a business and nonaffiliated third party to implement and maintain reasonable security procedures and practices to protect the data from unauthorized disclosure. Further, the law prohibits a business from providing an incentive or discount to the customer for accessing their usage data without the prior consent of the customer. Once the records are no longer to be retained by the business, the business must dispose of the data by (1) shredding, (2) erasing, or (3) otherwise modifying the data to make it unreadable or undecipherable through any means. Willful violations expose a violator to civil remedies.

COLORADO MODERNIZES PRIVACY RULES

In 2014, the Colorado PUC sought to amend the rules set forth in Code of Colorado Regulations 723-3, section 3026, governing access to and privacy of customer information in the possession of utilities in order to protect ratepayer privacy while allowing local governments and energy efficiency firms to have access to a customer's meter data upon informed consent. The amended rules, affecting both electric and gas utilities, require that customer data be maintained as strictly confidential and that customer data can only be used by the utility "as necessary to provide regulated utility services."

Section 3026 (d) states that, "As part of basic utility service, a utility shall provide access to the customer's standard customer data in electronic machine-readable form, without additional charge, to the customer or to any third-party recipient to whom the customer has authorized disclosure of the customer's customer data. Such access shall conform to nationally recognized open standards and best practices. The utility shall provide access in a manner that ensures adequate protections for the utility's system security and the continued privacy of the customer data during transmission." Section 3026 also affirms customers' rights to transmit their data to anyone of their choosing. And similar to California's privacy ruling, it also states that utilities shall have no liability for a third party's breach of customer data, provided that the utility receives the customer's consent and transmits the data securely.

As part of amending the electric and gas utility rules, Colorado had to address its outdated, paper-based consent form. Notable changes include: (i) web-based consent with the same information as the paper form was approved; (ii) eliminating the requirement that third parties must have a Colorado address for service of process; and (iii) a checkbox indicating how long in the future the consent is valid, either 12 months, 24 months or indefinitely.

53 Assembly Bill 1274, 2013-2014, California Civil Code Division 3 Party 4, Section 1, 6B.

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APPENDIX 2
Summary of California PUC decisions on data access

Decision D.09-12-046, dated December 17, 2009, required investor-owned utilities (IOUs) to (1) provide "an authorized third party with access to the customer's usage information collected by the utility" by end of 2010 and to (2) provide customers with access to smart meter data on a "real-time or near real-time basis no later than the end of 2011." Neither deadline was achieved.

Decision D.11-07-056, dated July 28, 2011, ordered strict timelines for activation of backhauled data access and HAN enablement. It adopted privacy and security rules governing smart meter data, among other requirements. The Order included the following salient directives:

- Within six months, all IOUs must provide, or continue to provide, customers with price and usage data. It must be "updated on at least a daily basis, with each day's usage data, along with applicable price and cost details and with hourly or 15-minute granularity (matching the time granularity programmed into the customer's smart meter) available by the next day. Residential customers must be offered "bill-to-date, bill forecast data, projected month-end tiered rate, and notifications to customers as they cross tiers to higher rates."[54]
- The IOUs must work with the California Independent System Operator (CAISO) in developing a methodology to make wholesale prices available to customers on each company's website.[55]
- Within six months, the IOUs must provide third parties access to a customer's usage data via the backhaul when authorized by the customer. The utilities were to coordinate with each other to "propose a common data format to the extent possible and be consistent with national data standards efforts." The approaches must propose for third parties "eligibility criteria and a process for determining eligibility where the Commission can exercise oversight over third parties receiving this data."[56]
- Within six months, the IOUs must complete a pilot study to provide price information to consumers in real time or near real-time.[57]
- Within four months, the IOUs must submit plans to implement HAN functionality. These implementation plans must include initial deployments of at least 5,000 HAN devices. The implementation strategies must address issues such as costs, expanded data access and granularity, current and evolving national standards and security risk mitigation and best practices, etc.[58]

Regarding privacy and security, D.11-07-056 reaffirmed the PUC's jurisdiction over utilities and authority to require utilities to extend those rules to third parties under contract with utilities, but did not address the question of jurisdiction over third parties *not* under contract to a utility. The utility is required to educate customers about the "potential uses and abuses of usage data."[59] The rules do not regulate the consumer's own decision as to with whom to share data, but provide that the utility is not responsible for

54 California Public Utilities Commission, Decision D.11-07-056. July 28, 2011. Order Paragraphs 5, 6.
55 *Ibid.,* Ordering Paragraph 7.
56 *Ibid.,* Ordering Paragraphs 8, 9.
57 *Ibid.,* Ordering Paragraph 10.
58 *Ibid.,* Ordering Paragraph 11.
59 *Ibid.,* p. 36.

policing those entities who receive information pursuant to a Commission requirement or customer wishes.[60] The rules outline a distinction between *primary purposes* (providing customers with a certain feature or service) and *secondary purposes* (e.g., marketing purposes, amalgamation with other data sets) and require customer consent before a utility can share data with a third party. A customer's consent is presumed indefinite but can be revoked at any time.

Resolution E-4527 (HAN implementation). Following protests of utility HAN implementation plans, the Commission in Resolution E-4527 (September 27, 2012) imposed specific deadlines and requirements for implementation of HAN functionality. IOUs were required:

- to begin accepting HAN activation requests from customers beginning in January 15, 2013—5,000 before June 30, 2013; 25,000 before December 31, 2013, 200,000 before December 31, 2014 and an unlimited number thereafter (Ordering Paragraph 1, p. 28);
- to collaborate with each other and third parties and relevant standards-related organizations, to develop (1) a common set of reasonable requirements and testing processes for validating interoperability between utilty smart meters and commercially available HAN devices for the purpose of monitoring real-time electricity usage; and (2) a set of reasonable requirements to be satisfied by a HAN device supplier for its device to be eligible for interoperability testing (E-4527, p. 28-29);
- to publish, by February 1, 2013, on their websites a list of at least 5 commercially-available HAN devices validated for interoperability, with updates within 6 months (E-4527, p. 29); and
- to collaborate with each other and third parties to provide basic education to customers about the HAN function, its potential applications and benefits, potential interoperability risks associated with HAN devices not subjected to validation tests and the respective responsibilities of the utility, HAN device supplier and customer (E-4527, p. 30).

Customer Data Access to Interval Data through the Utility. Pursuant to Decision D.11-07-056, Ordering Paragraphs 8-9, the Commission ordered the IOUs to provide third parties with customer data upon consent in D.13-09-025 dated September 19th, 2013. The decision allowed PG&E and SCE to recover up to $19.4 million and $9.1 million from ratepayers, respectively.[61] The Commission affirmed that the price to customers (and third parties) of this service should be zero; ordered that eligibility criteria of third parties and technical operation of the web service should be made consistent amongst all the IOUs; outlined a dispute resolution process in which the Commission, and not a utility, has the sole power to revoke a third party's access in case of an alleged breach; and affirmed that utilities have no liability for a third party's breach, provided that the utility follows the Commission's rules and has not acted "recklessly."

"Customer data" includes electricity consumption data, generally at hourly resolution for residential and 15-minute for commercial and industrial. In a somewhat vaguely-defined "phase two" of Customer Data Access, PG&E and SDG&E stated their intention to add (i) natural gas data and (ii) pricing data to the files transmitted to authorized third parties. The data format and communication protocol standard to be followed is the Energy Services Provider Interface (ESPI).

The decision affirmed simple and straightforward eligibility criteria for third parties. To receive customer energy data, a third party must (i) demonstrate technical capability to interact with the IOUs' servers, (ii) provide contact information and a federal tax identification number in order to unify the registration system state-wide, (iii) acknowledge receipt of the Commission's privacy policy in D.11-07-056, and (iv) not be present on the Commission's list of banned third parties.

Data quality was only mentioned briefly in D.13-09-025. The IOUs are required to notify third parties whether customer usage and pricing data is, or is not, revenue quality. ("Revenue quality" is generally understood to mean the usage readings that are used to generate bills. Data become "revenue quality" after the validating, editing and estimation process.) Unfortunately, the Commission's lack of specificity regarding data quality, and the IOUs' resulting "advice letters" documenting their ESPI implementation, led to protests by several stakeholders. The IOUs explained that backhauled data from the previous day are not

60 *Ibid.,* p. 35.

61 For states or utilities considering Green Button Connect, we caution the reader against using California's costs to estimate their own. The California utilities were the nation's first adopters and had to build the technology themselves; now, multiple utility vendors offer Green Button Connect functionality for sale.

necessarily revenue quality right away, but rather, bills must first be generated in order for data to be deemed revenue quality. The problem for third parties was that settlement of demand response or ancillary services with the Independent System Operator (ISO) require revenue-quality data. If the IOUs did not provide revenue-quality data through ESPI, then an entire class of services that save ratepayers money and that were originally envisioned as consumers of data through ESPI would be jeopardized. Ultimately, PG&E and SDG&E agreed to provide revenue-quality meter data via Green Button Connect, making use of the "QualityOfReading" flag within ESPI to denote its quality classification.[62]

62 See Pacific Gas & Electric Amended Advice Letter #4378-E-A dated August 14, 2014 and San Diego Gas & Electric Amended Advice Letter #2586-E-A dated August 15, 2014.

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APPENDIX 3
Recommended reading

Klass, Alexandra B. and Wilson, Elizabeth J., *Energy Consumption Data: The Key to Improved Energy Efficiency* (May 5, 2015). 6 San Diego Journal of Climate and Energy Law 69 (2015), Minnesota Legal Studies Research Paper No. 15-13. **http://ssrn.com/abstract=2602974**

State and Local Energy Efficiency Action Network. 2012. *A Regulator's Privacy Guide to Third-Party Data Access for Energy Efficiency.* Prepared by M. Dworkin, K. Johnson, D. Kreis, C. Rosser, J. Voegele, Vermont Law School; S. Weissman, UC Berkeley; M. Billingsley, C. Goldman, Lawrence Berkeley National Laboratory. **http://energy.gov/sites/prod/files/2014/05/f15/cib_regulator_privacy_guide.pdf**

North American Energy Standards Board (NAESB). *RXQ.6.10 - Retail Customer Authorization Form.* NAESB membership required: **https://naesb.org/retail_standards.asp**

OpenEI, Utility Data Access Map. **http://en.openei.org/wiki/OpenEI:Utility_data_access_map**

Krukowski, Andrea and Majersik, Cliff, Institute for Market Transformation. *Utilities' Guide to Data Access for Building Benchmarking.* March, 2013. **http://www.imt.org/resources/detail/utilities-guide-to-data-access-for-building-benchmarking**

"Why 50 million smart meters still haven't fixed America's energy habits." *Washington Post,* Jan 29 2015 by Chris Mooney. **http://www.washingtonpost.com/news/energy-environment/wp/2015/01/29/americans-are-this-close-to-finally-understanding-their-electricity-bills/**

Residential Electricity Use Feedback: A Research Synthesis and Economic Framework. EPRI, Palo Alto, CA: 2009. 1016844.

Ehrhardt-Martinez, Karen, Kat Donnelly and John "Skip" Laitner. 2010. *Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Saving Opportunities.* Washington, DC: American Council for an Energy-Efficient Economy. **http://aceee.org/sites/default/files/publications/researchreports/e105.pdf**

Armel, Carrie; Gupta, Abhay; Shrimali, Gireesh and Albert, Adrian. Is disaggregation the holy grail of energy efficiency? The case of electricity. Energy Policy 52, p. 213-234. January, 2013. **http://web.stanford.edu/group/peec/cgi-bin/docs/behavior/research/disaggregation-armel.pdf**

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APPENDIX 4
Technical resources

GREEN BUTTON STANDARDS DEVELOPMENT

The standards body guiding Green Button (also referred to as the Energy Services Provider Interface) is the North American Energy Standards Board (NAESB):
https://www.naesb.org/espi_standards.asp

Technical working groups are led by the UCA International Users' Group, which convenes the Open Smart Grid Users' Group. Listserv and conference call information is available:
http://osgug.ucaiug.org/sgsystems/OpenADE/default.aspx

NIST provides many resources on smart grid standards including Green Button:
http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/GreenButtonInitiative

Software development resources such as software development kits (SDKs) are available on Github:
https://github.com/energyos

MORE THAN SMART

MISSION DATA