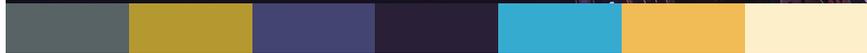
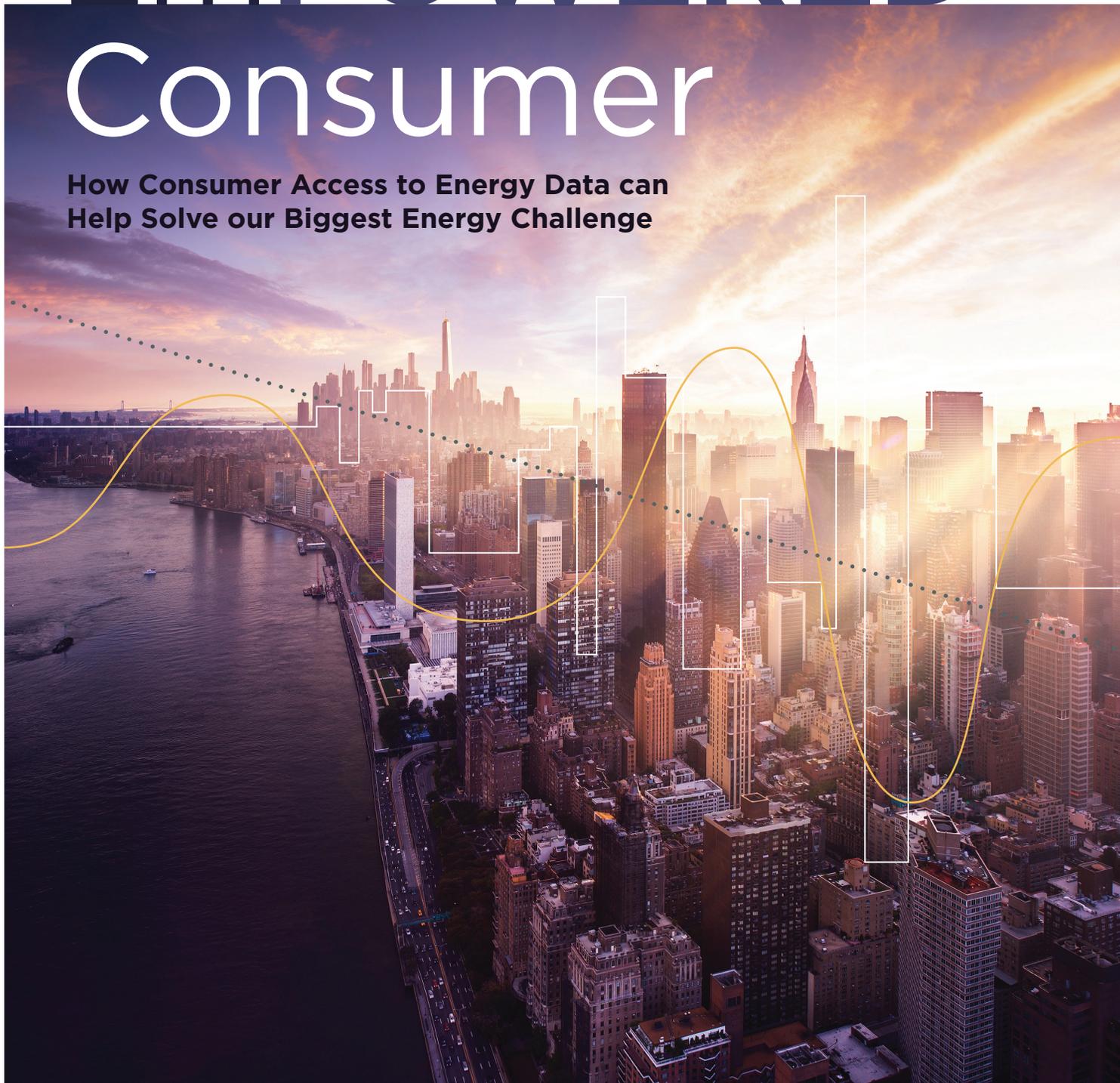


# The EmPOWERED Consumer

How Consumer Access to Energy Data can  
Help Solve our Biggest Energy Challenge



## Executive Summary

America's single biggest energy challenge is how to reduce energy use in buildings. New data-driven software and hardware technologies have emerged as powerful tools to attack this problem.

The good news is that the U.S. has invested billions of dollars to deploy 60 million advanced or "smart" meters that can provide consumers information about their energy use that they can in turn use to significantly reduce their own consumption. But most of the energy savings enabled by advanced metering cannot be realized until consumers have easy access to their own energy data generated by their new meters.

Texas and California have led the way to empower consumers by providing them, free of charge, access to their own usage information collected by their new meters and the ability to share that data with companies who can help them save money by improving energy efficiency or reducing use at peak times — Illinois is poised to do so as well. This meter data includes both (1) energy usage information collected by the utility from the smart meter and provided to the customer through the utility IT systems and (2) real-time usage information that the smart meter directly provides to the customer's home and business. This data is provided in machine-readable formats consistent with widely-adopted industry standards.

This paper references studies documenting the significant energy saving potential of data-driven energy management. It also discusses how early states have dealt with issues like consumer privacy so that states interested in moving forward can learn from the leadership and experience of others. In order to bring these benefits to all consumers in a timely way, states should move without delay to encourage and enable utilities to freely share this data with customers and their authorized energy management service provider.



THE MISSION:DATA COALITION is a national coalition of technology companies delivering consumer-focused energy savings for homes and businesses.

THE MISSION:DATA COALITION represents a vibrant ecosystem of technology companies – with sales in excess of \$1 billion per year – who have developed many products leveraging smart meter data to benefit consumers and utilities.

## Building energy savings: The opportunity for innovation

"Digital empowerment" – providing consumers convenient access to their own energy usage and pricing information – has emerged as a central strategy for addressing one of our most important energy challenges: how to significantly reduce energy use in buildings.

Buildings represent the single largest energy consuming sector, accounting for 41 percent of the nation's energy use. As a source of greenhouse gases, U.S. buildings represent one of the world's largest sources of carbon emissions.

Moreover, building energy savings present the single largest, low-cost opportunity to reduce total U.S. energy use. According to some estimates, fully 20 percent of the energy use in U.S. buildings could be avoided with measures that pay for themselves.<sup>1</sup>

A central challenge in reducing building energy use is that it depends on millions of individual decisions, most of which are made with little or no feedback. Most consumers obtain usage information only once a month on their utility bill and lack an immediate understanding of the connection between their energy choices and cost.

The plummeting cost of computing power and the availability of detailed consumption data are now enabling development of software and hardware tools to give consumers new opportunities to better understand, manage and control their energy decisions. Examples include (1) "no-touch" energy audits that recommend efficiency measures for homes and businesses; (2) EnergyStar® benchmarking, facilitating compliance with building consumption energy transparency laws; (3) tools to optimize the operation of home appliance as well as home and building heating/air conditioning, appliances and on-site generation or storage; (4) recommendations for sizing solar and other clean energy installations; (5) inexpensive verification of efficiency and demand response measures and (6) real-time analytics and alerts – the ability to detect patterns in real-time, using energy analytics, for example detecting a space heater is on when no one is home.

The savings are particularly promising in the states that have deployed advanced meters, meters that record energy usage in intervals of a few seconds and can provide ongoing usage information directly to the

1. K. Carrie Armel, Abhay Gupta, et. al., Is Disaggregation the Holy Grail of Energy Efficiency? The Case of Electricity, Precourt Energy Efficiency Center, Stanford University, Technical Paper 2012-05-1, 2012



**Building energy savings:  
The opportunity for innovation** *(continued)*

consumer almost instantaneously. However, millions of previous generation meters can also collect data that is valuable to consumers and yield data that can drive many energy apps as well. The insights a consumer can gain from his or her ongoing energy consumption data are very powerful, enabling energy savings estimated by the American Council for an Energy Efficient Economy (ACEEE) at up to 12% or more.<sup>2</sup>

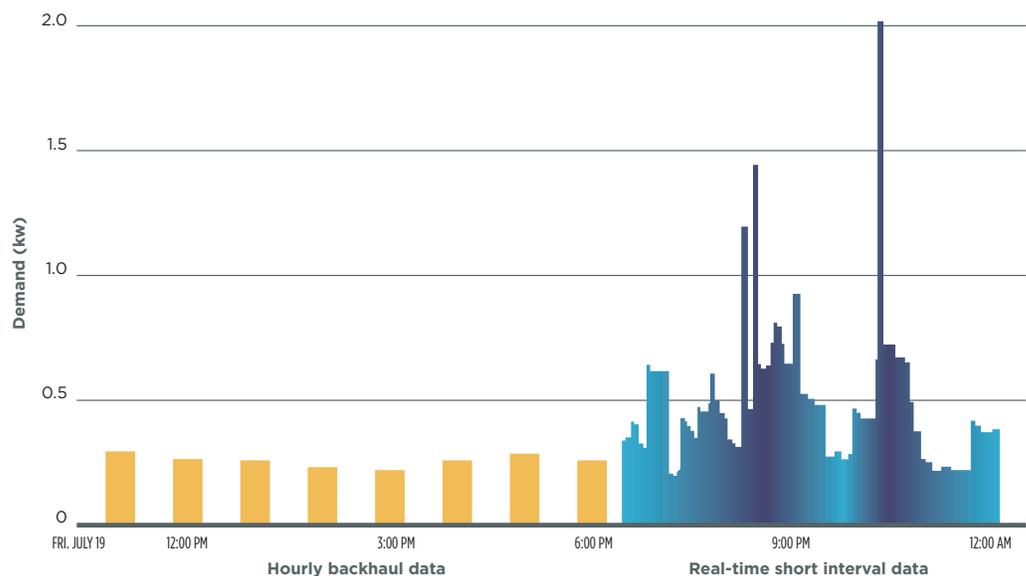
Almost half of U.S. households have or soon will have advanced meters capable of providing detailed energy usage data, potentially the single most powerful tool to save energy.<sup>3</sup> By some estimates 40% or more of the entire benefits of smart meters are customer savings.<sup>4</sup>

Providing consumers easy, convenient access to their own energy usage and pricing data can be done at low cost, a small fraction of the cost of the new meters themselves. With respect to metered usage data, the Mission:data Coalition supports providing the following functionalities to consumers at no cost and as a component of basic utility service:

- 1.** First, consumers should have access to their own electricity usage “interval data” provided via the utility’s website in standardized formats (Green Button Connect). In states with smart meters, data is typically made available the following day in 15 or 60 minute increments for commercial and residential customer respectively.
- 2.** Second, in states where advanced meters contain a Home or Premise Area Network (HAN/PAN) radio, consumers should be able to access their own real-time usage data through that radio. This method provides highly-detailed, real-time usage information on an ongoing basis directly to the consumer or its service provider.
- 3.** To ensure that energy management tools can provide consumers with accurate estimates of dollar savings, the Mission:data Coalition supports providing consumers access to their detailed billing and tariff information in machine readable format.

Finally, to facilitate the widespread adoption of energy efficient, consumers need to be able to easily share this data with companies (“third parties”) they choose to provide them with energy management services. The process by which consumers authorize third parties to receive their data should be simple and convenient, and regulatory commissions should allow third parties to lead the authorization process.

This chart illustrates the data provided through a smart meter, with hourly interval data portrayed in the bars on the left and very short interval, real-time data portrayed on the right.



To ensure that consumers have the widest selection of energy management tools, access must be provided via widely-adopted standard formats, avoiding local solutions that impede use of products and services built around national standards. HAN/PAN capabilities should be enabled as soon as advanced meters are deployed.

2. Karen Ehrhardt-Martinez, Kat Donnelly, et.al. *Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Saving Opportunities*, American Council for an Energy Efficient Economy (aceee.org), Report Number E105, June 2010. See Armel supra 1. As data-driven technologies improve, these savings are expected to increase.

3 Edison Foundation Institute for Electric Innovation, *Utility-Scale Smart Meter Deployments: Building Block of the Evolving Power Grid*, September 2014

4 California Public Utilities Commission, Resolution E-4527, September 27, 2012, p. 6; Ahmad Faruqui et. al. *The Costs and Benefits of Smart Meters for Residential Consumers*, Institute for Electric Efficiency, July 2011.



## Building energy savings: The opportunity for innovation *(continued)*

**Three states that are leading the effort to empower consumers with access to their energy data.**

### CALIFORNIA

In Decision 11-07-056, the California Public Utilities Commission required utilities to activate data access, through the interface using a “common data format consistent with ongoing national standards” – Green Button Connect — and activate the Home or Premise Area Network (HAN/PAN) radio embedded in each meter so that consumers can obtain real-time data. This data is made available to consumers and authorized third parties free of charge. In 2012, the PUC ordered activation of real-time HAN data, requiring utilities to support HAN/PAN functionality for progressively higher numbers of customers – and all customers by early 2015. As of late 2015, two of three IOUs have implemented Green Button Connect and all have implemented the HAN radio requirements.



### TEXAS

Texas has made the determination that consumers own their own energy usage data and worked to establish a consistent, simple method for consumers to access their own usage data. Texas PUC Substantive Rule 25.130 establishes requirements for advanced metering systems including:

- The capability to provide consumers direct, real-time access to their usage data. Interval data must now be delivered in 15-minute intervals. A utility must activate data access once it has deployed 2,000 advanced meters.
- Compliance with nationally recognized open, non-proprietary standards,
- The capability to communicate with devices inside the premises, including through a HAN, based on open standards and protocols that comply with nationally recognized non-proprietary standards; and
- The ability to upgrade these capabilities as technology advances.

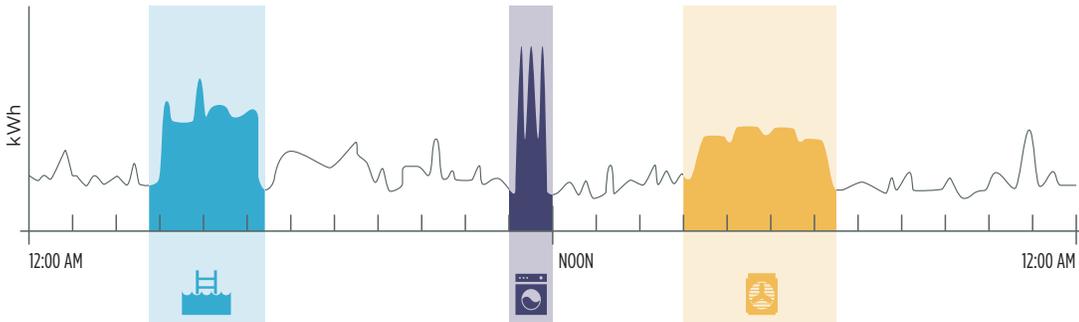
### ILLINOIS

The Illinois Commerce Commission is considering adoption of an Open Data Access Framework, the first comprehensive framework to establish transparent, simple rules to allow consumers to access their energy usage data. Illinois’ two largest utilities – Commonwealth Edison and Ameren Illinois – have indicated that they intend to adopt Green Button Connect.

In addition to these states, PEPCO has implemented Green Button Connect for commercial customers in the District of Columbia. Together these states and districts account for 25 million of the 60 million smart meters deployed or to be deployed in the United States, meaning that the data-enabled energy market now accounts for about 40% of all households with advanced meters.

# How Data Access is Delivering Energy Savings

Both commercial and residential consumers can realize significant energy and cost savings from data access. For example, new technologies can read real-time, very short interval data from the smart meter and because appliances often have unique energy usage signatures, consumer software can use a technique, “disaggregation”, to determine what kind of devices are being operated and how they might be more efficiently used. This graph portrays, for example, the energy “signatures” of a pool pump, dryer and air conditioner, respectively, illustrating how device-level usage patterns can be detected and addressed without the need for extensive hardware.



Strategies like disaggregation can present consumers with recommendations tailored to their individual usage and needs. For example, the running of appliances like pool pumps can be timed to run at night when rates are low. Or aging appliances no longer functioning efficiently can be repaired or replaced.

## CONSUMER: California

“The program made me aware of how to track energy consumption and gave me advice on how to save more,” according to a resident of the City of Benecia, which uses Green Button Connect data to provide residents personalized tips on saving energy. The program has reduced consumer electricity bills by an average of 10% per month.

## The residential sector: a transformative opportunity

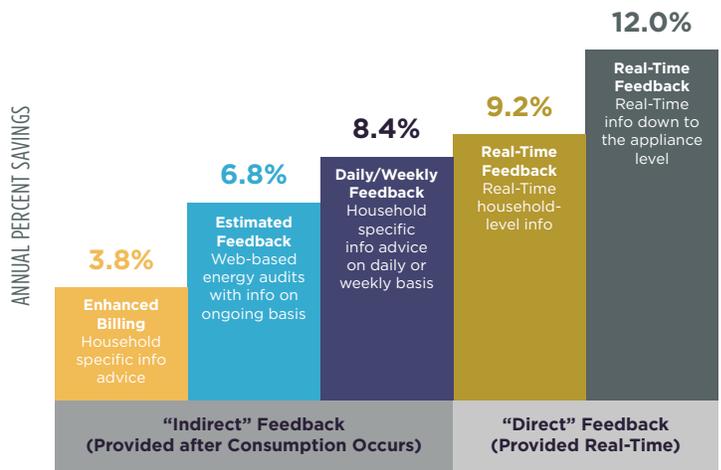
This biggest benefit of data access may lie in its potential to fundamentally transform energy use in the residential sector, achieving much deeper home energy savings than previously possible. Compared to the commercial building sector, the residential sector has long been considered the “tough nut” to crack because of lower household energy loads and the greater diversity among household energy usage patterns.

Better data means better decisions. By identifying specific usage patterns in each residence and delivering recommendations for saving energy based on that particular use, data-enabled solutions offers significant promise in delivering low-cost savings and making traditional energy efficiency programs more cost effective.

While physical improvements are often viewed as generating the biggest energy savings, data-driven energy management technologies are emerging as the most powerful tool for managing residential energy use. According to the ACEEE, measures like attic insulation reduce average energy use up to 7 percent and new appliances like refrigerators or water heaters may reduce use by 1-2 percent.<sup>5</sup> In comparison, ACEEE and Stanford’s Precourt Energy Efficiency Center have found that data-driven energy management technologies can reduce household energy by 12 percent or more.<sup>6</sup>

Other studies reinforce the value of data-driven approaches. A 2012 study of real-time information feedback approaches, in which consumers could react to instant power usage readings by reducing lighting or appliance loads, found energy savings on average of 3.8% across large populations; most encouraging was that some households saved over 25%.<sup>7</sup>

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



BASED ON 36 STUDIES IMPLEMENTED BETWEEN 1995-2014

Table 1. Source - ACEEE. This table provides a numeric range of achievable energy savings in homes enabled by varying types of data in conjunction with technology tools.

<sup>5</sup> Karen Ehrhardt-Martinez, A Comparison of Feedback-Induced Behaviors from Monthly Energy Reports, Online Feedback, and In-home Displays, ACEEE, 2012, p. 7-62.

<sup>6</sup> Erhardt-Martinez; Armel et. al.

<sup>7</sup> Rebecca Brown, Bringing It All Together: Design and Evaluation Innovations in the Alameda County Residential Behavior Pilot (Presentation to the Behavior, Energy and Climate Change Conference), December 8, 2014; City of Mountain View, Acterra and Home Energy Analytics, Energy Upgrade Mountain View Final Report, January 2015.



**How Data Access is Delivering Energy Savings** *(continued)*

More recently, in Alameda and Santa Clara Counties in California, the use of data-access functionality now available across much of the state has demonstrated significant household savings. One study in Alameda County found average consumer savings of 7.4% for electricity and 13% for natural gas. Another study involving the city of Mountain View, California, found savings of 5.5% in electricity and 16.4% in gas.<sup>8</sup>

Data-driven technologies can deliver savings very inexpensively.<sup>9</sup> Data analytics give utilities and customers the ability to identify specific measures that yield the most cost-effective savings and verify those savings over time. The potential of a data-driven approach to energy efficiency is highlighted in this table comparing the Mountain View results from 2011 to 2014 to PG&E’s traditional home energy efficiency program from 2011 to 2013. The traditional program utilizes a full array of marketing, large incentives, complex energy modeling tools, in-home audits, and other activities.

The targeting of energy efficiency investments based on how households are actually using energy can make traditional energy efficiency programs much more cost effective. For example, the data-driven approach employed in the Mountain View study achieved comparable savings at a fraction of the cost of the traditional program.

As states transition to time-of-use rates, data-enabled tools will be especially important. Significant promise exists for tools like smart thermostats, which use data based on consumer habits and apply analytics to achieve significant savings. These and other technologies have been developed at a time when most states have not enabled data access, but have the potential to do so and become even more powerful as adoption increases. For example, a 2015 U.S. Department of Energy Study of time-based rates and smart thermostats found, that among consumers facing time-varying

**CONSUMER: Texas**

One resident using Energy ScoreCard, a web-based service that pulls real-time data from his smart meter as well as weather and smart thermostat data, kept his home cool while reducing use of his air conditioning unit from 11.4 hours to 5.8 hours per day. He can also take advantage of new time-of-use rates that give him free electricity after 9:00 p.m. — all made possible by Texas’ advanced metering deployment and data access.

rates “average demand reductions per customer were nearly double for customers with PCTs [programmable communicating thermostats] than they were for customers without PCTs.”<sup>10</sup>

Because these tools are low cost, all households can benefit – not just owners but renters as well. States like Texas and Illinois that have embraced smart meters have instituted programs to help consumers, particularly those from underrepresented communities, understand the new technologies and/or obtain them at little to no cost. As such, low-cost efficiency tools represent a segment of clean energy technologies that will be affordable and accessible to a broad range of housing and demographic categories.

PROGRAM METRIC	Data-Driven Mountain View Program (2011-2014)	Traditional Home EE Program (2011-2012)
TOTAL NUMBER OF PARTICIPANTS	1,576	3,823
PARTICIPANTS ANALYZED USING BILLING DATA	1,239	1,625
ELECTRIC SAVINGS PER PARTICIPANT (kWh)	301	203
NATURAL GAS SAVINGS PER PARTICIPANT (therms)	62	74
GHG SAVINGS PER PARTICIPANT (lbs CO2e)	993	1,101
REDUCTIONS IN ELECTRIC USE (ALL PARTICIPANTS)	5.52%	5.40%
REDUCTIONS IN NATURAL GAS USE (ALL PARTICIPANTS)	16.44%	16.40%
REDUCTIONS IN ELECTRIC USE (TOP QUARTILE)	14.49%	7.18%
REDUCTIONS IN NATURAL GAS USE (TOP QUARTILE)	32.58%	19.87%
TOTAL COST OF PROGRAM	\$409,000	\$25,310,500
PROGRAM COST PER PARTICIPANT	\$260	\$6,621

<sup>8</sup> Rebecca Brown, Bringing It All Together: Design and Evaluation Innovations in the Alameda County Residential Behavior Pilot (Presentation to the Behavior, Energy and Climate Change Conference), December 8, 2014; City of Mountain View, Acterra and Home Energy Analytics, Energy Upgrade Mountain View Final Report, January 2015.

<sup>9</sup> City Mountain View, Energy Upgrade Mountain View, January 2015.

<sup>10</sup> U.S. Department of Energy, Interim Report on Customer Acceptance, Retention, and Response to Time-Based Rates from the Consumer Behavior Studies, June 2015, p. 52.



## How Data Access is Delivering Energy Savings *(continued)*

### Data access is expanding opportunities in the commercial sector

Commercial buildings represent a well-established efficiency and distributed generation market that can realize significant gains from data access. This sector represents the second-fastest growing segment among major energy-consuming sectors.<sup>11</sup> It represents a big opportunity since 80% of commercial real estate buildings lack energy intelligence<sup>12</sup> and up to 30% of the energy use in this sector is wasted.<sup>13</sup>

Providing data access from use of existing advanced metering infrastructure can greatly expand opportunities in the commercial sector by eliminating this cost. Lawrence Berkeley National Laboratory has found that commercial and industrial sectors can realize median savings of 17% from individual energy information systems (EIS) that analyze interval usage data.<sup>14</sup>

One of the primary reasons that energy information systems are not more prevalent in the marketplace today is that conventional methods of acquiring interval usage data for analysis are costly and labor-intensive. Typically, energy information systems today require installation of a redundant sub-meter on the customer's side of the utility meter to record usage in a useful and accessible

format. When purchased in small batches, sub-meters, including related data-logging equipment and installation, can cost businesses between \$2,000 and \$6,000 each. The fact that some businesses are willing to pay these costs today demonstrates the tremendous value that energy information systems have in the commercial and industrial sectors.

Data access is increasingly recognized as bringing significant benefits to utilities. In an age of declining load growth, commercial customers represent an important, growing market for new energy solutions. Utilities partnering with third parties are able to provide a wider array of services that can address specific customer needs.

While some utilities may have viewed providing customer data access as costing them a market advantage over third party providers, an emerging paradigm suggests that utilities are best served by embracing the services that third parties can provide to customers, either directly or through utility contracts. Customers who receive analytics and digital services that help them manage their energy use are much more likely to (1) be satisfied with their energy providers, (2) recommend their energy provider to others, and (3) participate in energy management programs and acquire other energy services.<sup>15</sup>

## Protecting Privacy: Models that Work

Empowering consumers with access to their own energy data – and choice about whether and with whom they share that information – reflects the growing trend in privacy rules to give consumers access to the information collected about them.

Privacy is an important issue when the consumer entrusts his or her utility usage information to competitive energy provider or “third party” provider of energy management services. Because consumer confidence is critical, the Mission:data Coalition has supported proposals to prohibit the sale of individuals' identifiable energy usage data by utilities or energy service providers.<sup>16</sup> Mission:data further supports the principles that companies should protect the security and privacy of that data, provide clear and understandable disclosure about how energy usage information will be used, and use data only for the purposes authorized by the consumer. At the same time, it is important to recognize that innovative companies need the flexibility to develop new products and services. Utility-style regulations, in which requirements are lengthy and based on the needs of regulated monopolies, and under which compliance costs can be rate-based, are not always appropriate for companies that are more similar to competitive, innovative businesses in other sectors.

<sup>11</sup> U.S. Department of Energy, Energy Information Administration, “U.S. Energy Demand Slows Except for Industrial, Commercial Sectors,” April 29, 2015.

<sup>12</sup> Energy Manager Today

<sup>13</sup> U.S. Department of Energy

<sup>14</sup> Energy Information Systems (EIS): Technology Costs, Benefits, and Best Practice Uses. Granderson, J., G. Lin. November 2013. LBNL-6476E.

<sup>15</sup> Accenture: Unleashing Business Value in a Digital World.

<sup>16</sup> With exceptions, e.g. When a company is sold, it should be able to transfer customer information to the acquiring company.



### Protecting Privacy: Models that Work *(continued)*

States that have blazed the trail in providing consumers with access to their data have established policies to protect the privacy and security of individuals' energy usage data while leaving companies flexibility to innovate. States like California and Colorado have designed and implemented policies that ensure strong protection of privacy and security in ways consistent with continued innovation. These templates are outlined below:

- **California Public Utilities Commission (CPUC) Decision 11-07-056.** In Decision 11-07-056, The PUC coupled expanded data access with new privacy requirements, requiring that utilities and third parties receiving data, (1) must provide consumers meaningful, clear, accurate, specific, and comprehensive notice regarding the collection, storage, use, and disclosure of individually identifiable energy usage information, (2) must disclose to consumers each category of covered information, and, the purposes for which it will be collected, stored, used, or disclosed, (3) must provide to customers upon request access to their covered information, (4) may share, with few exceptions, individually identifiable covered information only with customer consent, or under a "chain of responsibility" approach whereby parties

that receive covered information may disclose such information without consent to another party only for a primary purpose; and (5) must ensure that the covered information they collect, store, use and disclose is reasonably accurate and complete and use reasonable safeguards to protect it.

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 policing those entities who receive information. The decision affirmed the PUC's jurisdiction over utilities and authority to require utilities to extend those rules to third parties under contract with utilities. The Commission can order termination of data access for third parties who exhibit a "pattern and practice" of violating privacy rules.

- **Colorado Public Utilities Commission (CPUC):** The Colorado Public Utilities Commission has amended 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.

## Conclusion

As innovation rapidly drives down the cost of new energy sources – solar, electric vehicles, storage, and energy management – the energy sector is poised for a transformation similar to that in telecommunications. This transformation provides consumers enormous opportunities to save energy, and realize value from demand response and other services, while also providing leading states an important economic opportunity. Enabling consumer data access is a key lever to achieve this change.

California, Texas and now Illinois have provided early leadership and initial results are encouraging. Mission:data looks forward to working with stakeholders in other states to build on this progress. We encourage policymakers to move quickly to unlock the benefits of energy data for all consumers and their authorized energy management service providers by

- Providing consumers easy access to the best available information about their energy use, including activation of the HAN/PAN radios upon installation of the smart meter, and the ability to easily share that data with energy management service providers of their choice in machine-readable formats that are consistent nationwide and consistent with the best industry standards).
- Providing consumers and third parties detailed tariff and pricing information in machine readable formats;
- Providing this information free of charge, as a component of basic utility service;
- Ensuring that the authorization process is easy and simple for consumers and that third parties can lead this process.

For more information, please contact the Mission:data Coalition at [info@missiondata.org](mailto:info@missiondata.org).

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**MISSION:DATA**  
empowering energy savings