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### **Consumer Perceptions of Smart Meter Data Privacy**

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#### **SUMMARY**

Smart meters collect data on electricity consumption that can be used to improve grid performance, identify and respond to outages, reduce costs and support dynamic markets with real-time pricing. As smart meter installation increases, so do issues concerning consumers' privacy and security of the data collected by the new technology. This report highlights findings from focus groups in Syracuse, Detroit, Houston and San Jose. The objective is to identify consumers' perceptions and opinions of privacy as it relates to data collected from smart meters and how that data is used and shared. Scenarios and questions were used to elicit participant views.

Several major issues were revealed by analysis of the focus group interviews: (1) There is a mixed awareness of what smart meters are, how they work, and how the data is collected and used; (2) Participants have varying levels of trust in utilities' motives for deploying smart meters, with some fearing that the smart meter would be used to control or interrupt their electricity use, or to raise rates; (3) There is confusion over the potential benefits of smart meter data, for instance whether it is necessary to buy new smart appliances to take advantage of energy savings afforded from the data; (4) Participants see a tradeoff between security benefits and privacy concerns regarding law enforcement having access to meter data and the need for clear privacy policies to control law enforcement access; (5) Many find new technologies complex and fear that each technology adds new risks to privacy and security.

Four important individual perceptions regarding data privacy as it relates to smart meters were revealed. These were: (1) perceived control over one's data; (2) perceived risk from collection, sharing and use of data; (3) the value of privacy to individuals; and (4) the perceived benefits to the consumer from having access to smart meter data. These dimensions will be used to identify clusters or segments with similar profiles.

#### **KEYWORDS**

Focus groups, perceived control, perceived risk, value of privacy, trust, data collection, data sharing, utilities, law enforcement, hacking

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## Introduction

Smart meter technology is a key component in facilitating two way flow of information and capturing near real-time data on household energy usage. This data can be used by utilities to automate meter reading and billing, detect and respond to outages, manage grid operations, and better match supply to demand. It can be used by consumers to manage energy use and save money. Yet despite the many potential advantages, collection and use of smart meter data also can create significant privacy concerns for customers.

Studies in online data privacy suggest that many individuals are not knowledgeable, assuming that privacy protections are stronger than they actually are [1]. The objective of this study is to identify consumers' perceptions of privacy concerns raised by the deployment of smart electric meters. Specifically, the study asked:

- How do consumers perceive privacy risks when presented with information about the nature of smart grid data collection and use?
- How do utility companies currently protect data privacy and how well do their policies and practices correspond to the privacy concerns of consumers?

## Methods

This report focuses on the first question. Focus group interviews were done between October 2015 and January 2016 with utility customers across the U.S. Two focus groups (8-10 participants each) were conducted in each of the following metropolitan areas with different levels of smart meter deployment:

- Syracuse- no smart meter installation
- Detroit– installation of smart meter ongoing by utilities
- Houston– smart meters installed in most homes
- San Jose- smart meters installed in most homes

A total of 76 participants, were selected to represent a cross-section of consumer demographics and experience with smart meters (Table 1).

**Table 1. Participant demographics**

	# of Participants		# of participants		# of participants
<b>Home Ownership</b>		<b>Education</b>		<b>Employment</b>	
Own	70	High school	9	Full-time	52
Rent	6	Some college	10	Homemaker	9
<b>Age</b>		2 yr degree	13	Part-time	3
18-33	11	College graduate	31	Retired	10
34-45	29	Post graduate	13	Unemployed	2
46-59	24	<b>Income</b>		<b>Smart meter</b>	
60+	12	<\$50K	7	Don't know	7
<b>Gender</b>		\$50-75K	33	No	27
Male	38	\$76-100K	20	Yes	42
Female	38	\$100-125K	6		
		\$125K+	10		

Scenarios were used to assist in illuminating potential issues. Participants interacted with four scenarios—the first two, plus two of the next three:

1. Video overview of smart grid by the Department of Energy  
<https://www.youtube.com/watch?v=JwRTpWZReJk>
2. Video advertisement for Bidgely's home energy management service.  
<https://www.youtube.com/watch?v=C1c012Ss9LU>
3. News story from Forbes describing the hacking of a home via a vulnerable electronic home system  
<http://www.forbes.com/sites/kashmirhill/2013/07/26/smart-homes-hack/#5eda5c9946a5>
4. A scenario developed by the researchers in which police search a home based on information received from the utility about high levels of electricity usage, leading them to suspect marijuana growing.
5. A scenario developed by the researchers in which a homeowner receives targeted advertisements about energy saving appliances after subscribing to their utility's energy saving program.

### Issues raised in the focus groups

Transcripts of the focus groups were reviewed and coded by two researchers. Several major issues were raised across the groups :

1. Knowledge and awareness of smart meter/smart grid
  - a. *How does it work?* "I want to know if with smart meter we'll have time of day metering implemented. I'm concerned about charges at peak time." "My city deployed smart meters for water and it's been nothing but problems. All of a sudden I have a bill of \$300." "They just have to walk in front of your house to read the meter."
  - b. *Sources of information:* "I learned about it from the Internet. Some information came in the bill before I got a smart meter." "I went on the Internet to understand about wind and solar." "My sister works for ITC. I heard about the smart grid from her." "I heard it at a policy conference."
2. Perception of (trust in) utilities
  - a. *Utility company motivations:* "I do not trust (utility company)." "Businesses rarely do things unless there is some economic advantage to them. It is more about getting more money as opposed to helping us." "I have no idea what kind of data they are pulling or what they are doing with it. The utility can increase my rates for various reasons."
  - b. *Utility control over energy use.* "Is this a way of controlling what we use?" "Your energy could be interruptible." "They can use smart meter data to pinpoint which home to shut off electrical power."
3. What are the benefits to consumers from access to meter data?
  - a. *Need to buy new appliances to benefit from access to usage data:* "I love my washer and dryer and will not change anytime soon. Some sort of device that can interface with older appliances would be useful." "One will have to buy a smart washer, stove and other appliances. It seems more appropriate for people who can afford this."
  - b. *How much effort is needed?* "Utility told me about unplugging devices, but I don't think about that and many things stay plugged in."
  - c. *What is the potential saving?* "I already turn off lights and my bill is under \$100. There's not that much I can save." "A bill of \$500 is quite an expenditure that I would like to reduce. Today you can only see your usage at the end of the month. The connection between your bill and your use is far apart, so it will help if you can check more frequently."
4. Law enforcement access to data
  - a. *Tradeoff between security (e.g., from criminals) and data privacy:* "It's alright (to share data) if there is some protocol. They need to disclose to the customer that they are sharing with the police." "It is a double-edged sword. You have a right to be protected against unreasonable search and seizure, but police have to be sneaky to catch bad guys." "I'm on the fence. I don't really like that everything is monitored, but it is comforting that there is some security."

- b. Need for disclosure and customer choice:* “They should give you a privacy statement. You have the option to opt out.” “There should be some agreement that should be signed.” “We should have the option to sign something that authorizes them to use our data. If you are doing something illegal and caught then it is on you.”
5. Ability to cope with technology
- a. Risks increase with each technology:* “You will drive yourself nuts if you thought of all the ways your identity can be compromised.” “I don’t want a smart house that turns on me and gets out of control. Some things are too much.”
- b. Technology is too complicated.* “My grandson is teaching me to use the Internet.” “I have a flip phone. I am anti-technology. I got here without a GPS.”

### Privacy perceptions of participants

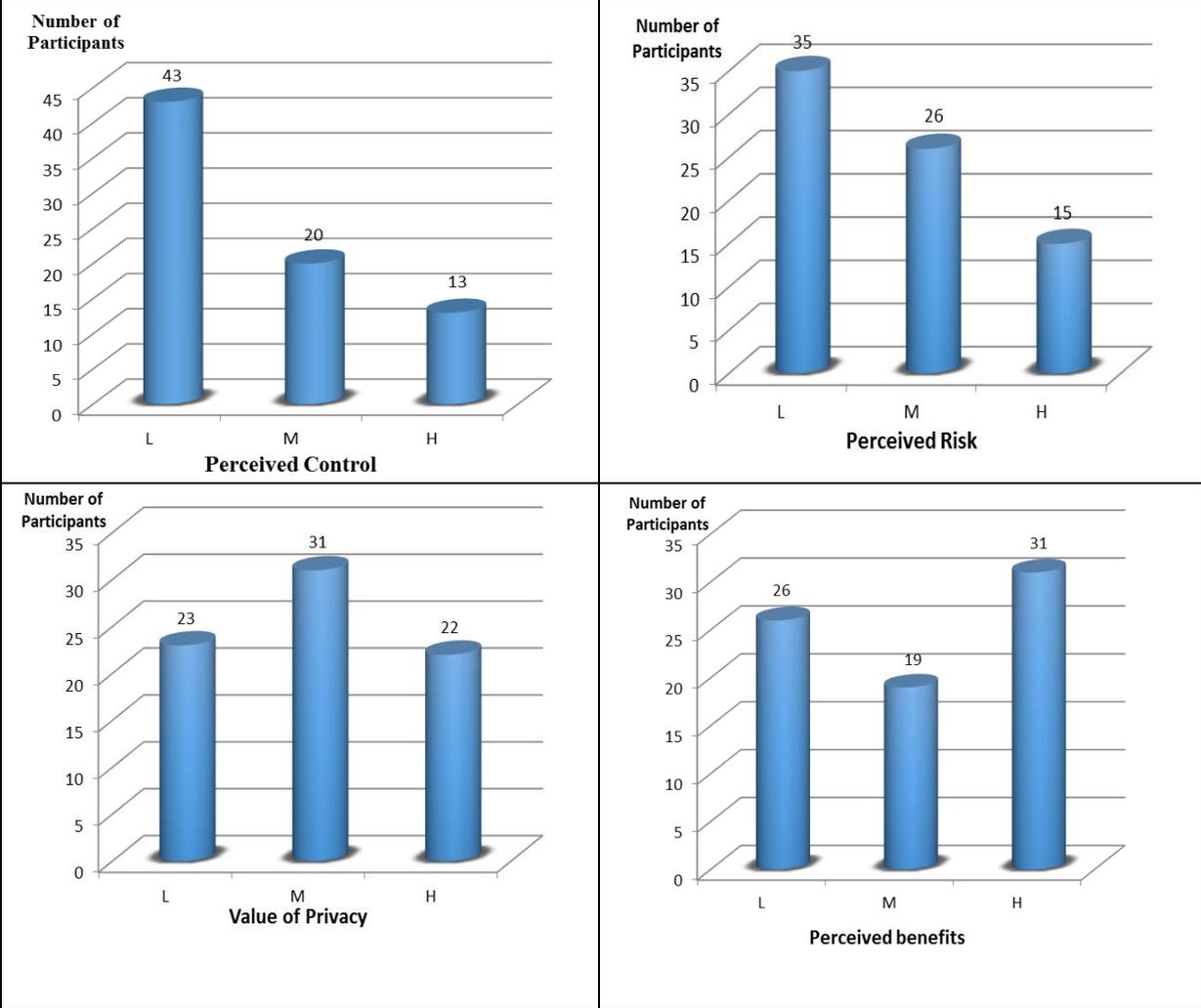
In addition to identifying common issues, we also coded the data to identify salient privacy perceptions of participants that characterize their views of data privacy as it related to smart meter data. These are: perceived control; perceived risk; value of privacy; and perceived benefits. Table 2 summarizes the meaning of these and illustrates them with quotes from the interviews.

**Table 2. Consumer perceptions of privacy**

Perceptions	Definition	Examples of high and low
Perceived control	The power to control access to one’s data and protect oneself from unwanted intrusions.	High: “Most things are safe if you have passwords. People have to take safeguards to protect themselves.”  Low: “If guys are really good they can hack into anything. Passwords are hackable.”
Perceived risk	Belief about the potential harm from a loss of privacy and likelihood of this occurring	High: “I have young children and see this as a threat.” “There are crazy killers and pedophiles out there. The more technology you put in the more insane people learn how to use it against you.”  Low: “This is what we can expect in the future. It wouldn’t sway me from purchasing a similar system.”
Value of privacy	Importance placed on protecting one’s privacy	High: “I don’t want my neighbor knowing the amount of energy I’m using. It’s like the water police in California. Very soon there will be an energy police”  Low: “I don’t have anything to hide. They can access all my data.”
Perceived benefits	Benefits the customer can realize from having access to their meter data	High: “I would love to know which devices in my home pull the most energy.” “I like the concept of living through my phone. I would use an app to check my daily energy consumption and identify which activities had a big impact on energy use”  Low: “It’s ridiculous to track how much power I use in a day. I don’t have time with a four-year old.” “I’m from an older generation where you turn off lights when you leave a room.”

Based on comments in the focus groups, we ranked each participant as low, medium or high on each of the four perceptions. Figure 1 shows the results of our rankings. These rankings were similar across the four locations.

**Figure 1. Rankings of consumer perceptions**



An initial look at the data compares the low and high scores for each perception. By a lopsided margin, participants feel that they have a low level control over who has access to their data or how it is used. This is different from research suggesting that consumers overestimate their ability to control access to their data [2].

On the other hand, twice as many participants feel that the level of risk of privacy loss is low than see it as high, even after seeing scenarios where privacy or security were compromised. One explanation is that people feel that their privacy is invaded in so many ways (e.g. intrusive online ads, stolen credit cards and other publicized breaches of large companies and government), that the additional threat from smart meters is not very high. Some also felt that even if their privacy were invaded, that the implications would not be too serious.

The value that participants placed on privacy was evenly split between low and high, with some expressing “I’ve got nothing to hide”, [3] while others were highly concerned about

“Big Brother”, in the form of government or corporations. Finally, the perceived benefits of smart meter data for managing energy use and lowering electricity bills were split closely between low and high. This seemed to depend on how much the person spends on electricity (hence, the potential savings), the time they have to monitor their use, and whether they enjoy using technology to manage their lives.

### **Discussion and implications for utilities**

We conclude that the tradeoff between the perceived benefits from smart meter data and the perceived risks will shape the individual’s overall attitude toward having the data collected, analyzed and shared by utilities. Higher perceived benefits and lower perceived risk will lead to more favorable attitudes and willingness to participate in energy management programs. In addition to this risk-reward calculation, consumer attitudes will be moderated by their perceived control over the data and the value they place on privacy. Higher perceived control will moderate concerns over potential privacy and security risks. Those who value privacy more will be more cautious towards data collection, sharing and use. They will demand a higher standard of privacy protection from utilities and other third parties with access to their data.

For utilities that are installing smart meters or already collecting consumer data, it is important to communicate to consumers the benefits they can expect to experience, such as better management of their energy use and resultant savings. Utilities should also explain to consumers how their data is used by the utility to improve their service, for instance by preventing or responding to outages.

Next, it is important to explain how the customer’s data will be used and shared with third parties. Above all customers should have control over the use of their data by opt-in or opt-out policies. Similarly, utilities should aim to communicate steps taken to protect customer data from unauthorized access, and do so in language that is clear and understandable by all.

Finally, it is critical that the utility earn the trust of the consumer in all of its interactions. There was a significant difference in attitudes toward local utilities among the focus group participants. If customers see utilities as self-motivated in ways that take advantage of the customer (e.g., by raising rates or cutting off power), there is little chance that the utility will be trusted on matters of data privacy, or be perceived as trying to help the customer save money or make better decisions on energy use.

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