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Smart grid consumer engagement

Smart grid consumer engagement: lessons from North American utilities

A report for Natural Resources Canada

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Executive summary

This report explores smart grid consumer engagement lessons and success factors based on North American utilities' experiences to date. It was developed through secondary research and interviews with representatives of North American utilities. The report describes the relevance of the smart grid to residential consumers, and discusses the challenges that have precipitated a new approach to consumer engagement. It identifies success factors for effective smart grid consumer engagement. Finally, it describes the types of practices that enable successful smart grid deployment, with specific examples from ten North American electric utilities.

Smart grid technologies and the new approach to consumer engagement

Smart grid technologies offer exciting possibilities for electricity system stakeholders. For electric utilities and electricity system operators, they provide tools to address peak demand, to improve system reliability, and to manage distributed generation and energy storage technologies. For consumers, smart grid technologies can provide new opportunities to manage electricity use, to control bills, and to sell power back to the grid. According to the U.S. Department of Energy (2009):

> *In the smart grid, consumers will be an integral part of the electric power system. They will help balance supply and demand and ensure reliability by modifying the way they use and purchase electricity. These modifications will come as a result of consumers having choices that will motivate different purchasing patterns and behavior. These choices will involve new technologies, new information about their electricity use, and new forms of electricity pricing and incentives.*

In the last five years, dozens of North American electric utilities have begun to deploy consumer-facing smart grid technologies, beginning with smart meters. These initiatives have encountered mixed success; in some cases, consumer resistance and negative media attention have compromised the credibility of the smart grid. As a result of these early experiences, utilities now recognize the importance of pairing smart grid technology deployment with effective consumer engagement initiatives – to promote awareness and support, to minimize complaints, and to drive the active participation of consumers in the electricity system.

Utilities now realize that consumers will not automatically understand and accept smart grid technology. Furthermore, they understand that they can only gain consumers' support and active participation if they create a positive customer experience at all stages of technology deployment. In light of these new realities, utilities are moving towards a new approach to consumer engagement. They are transitioning to a model of customer service and sales that puts customers first.

Improving the smart grid customer experience

The "customer experience" covers the sum of how customers engage with a company or product/program not just in a single interaction, but over the entire duration of their interactions. Utilities with the most effective smart grid consumer engagement programs have considered the customer experience, and have sought to improve it at each stage of smart grid deployment.

Based on primary and secondary research, the report identifies four general success factors that contribute to the smart grid customer experience and increase the likelihood of smart grid project / program success. It also identifies specific strategies within each success factor, supported by examples from ten North American utilities. These success factors and strategies are summarized in the table below.

Executive Summary Table 1 Summary of lessons for improving customer experience

Success factor	Strategy
1. Understand and respond to consumers' needs	a) Conduct market research. b) Provide information to those who need it, when they need it. c) Develop programs and services that create value for customers. d) Invest time and money into marketing and education.
2. Go further in providing customer-centric programs and services	a) Develop a range of programs, use a range of marketing tools. b) Make it easy to participate. c) Track your success. d) Take small steps, and learn from your experience.
3. Take consumer concerns seriously	a) Anticipate and prevent problems. b) Train customer service representatives. c) Work with individual customers to address their concerns.
4. Use the smart grid to build relationships	a) Build relationships with your customers. b) Partner with other organizations on education and engagement.

As smart grid deployment progresses, utilities can be expected to continue to play a key role – though not the only role – in consumer education and engagement. There is ample reason to believe that utilities will rise to the challenge of providing smart grid programs that "work" for consumers. Already, consumer-facing smart grid initiatives are improving in leaps and bounds. However, as technology advances, consumer engagement will need to advance just as quickly. To keep pace in the smart grid era, utilities will thus need to institutionalize "customer experience" within their core business model.

Introduction

Smart grid technologies offer exciting possibilities for electricity system stakeholders. For electric utilities and electricity system operators, they provide tools to address peak demand, to improve system reliability, and to manage distributed generation and energy storage technologies. For consumers, they offer new opportunities to manage household energy use. They can also enable connection of renewable energy sources to the grid, improve power quality, prevent and reduce the length of power outages, and create opportunities for new rate plans.

In the last five years, dozens of North American electric utilities have begun to deploy smart grid technologies, and they have experienced mixed consumer acceptance; in some cases, consumer resistance has been significant. As a result of these early experiences, utilities now recognize the importance of pairing smart grid technology deployment with effective consumer engagement initiatives – to promote awareness and support, to minimize consumer complaints, and to drive the uptake and use of these technologies. In a survey of global utilities, 66% of respondents said that the impact of smart grid technology in place by 2030 will be limited by weakness in consumer engagement (PwC, 2012).

This report explores smart grid consumer engagement lessons and success factors based on North American utilities' experiences to date. It was developed through secondary research and interviews with representatives of North American utilities. It focuses on residential customers (consumers). The methodology is described in Appendix B.

The first part of this report describes the relevance of the smart grid to residential customers, and the importance of consumer engagement. It also discusses the smart grid engagement challenges that have precipitated a new approach to consumer engagement.

The second part of the report draws on North American utilities' experiences to identify success factors for effective smart grid consumer engagement. It describes the types of practices that enable successful smart grid deployment, with specific examples from ten North American electric utilities.

Smart grid technologies and the consumer

What is the smart grid?

There are many different definitions of the smart grid. Most agree that the smart grid is not an end in itself; it is a means to many ends.

According to the Smart Grids European Technology Platform (2012), "The smart grid is an electricity network that can intelligently integrate the actions of all users connected to it – generators, consumers and those that do both – in order to efficiently deliver sustainable, economic and secure electricity supplies". According to the Canadian Electricity Association, it is "the addition of two-way communications, control and automation capabilities to the existing power grid to make it more reliable, flexible, efficient, clean, safe and customer-friendly" (Canadian Electricity Assocation, 2012).

The smart grid tools and technologies that are the means to these ends are diverse and continually evolving. They include physical components: hardware, software, and communications networks. They also include the "soft infrastructure" of standards, customer engagement, and behaviour change.

How is the smart grid relevant to consumers?

Smart grid technologies and tools can enable consumers to understand their electricity use, manage their electricity bills, and sell power back to the grid. According to the U.S. Department of Energy (2009):

> *In the smart grid, consumers will be an integral part of the electric power system. They will help balance supply and demand and ensure reliability by modifying the way they use and purchase electricity. These modifications will come as a result of consumers having choices that will motivate different purchasing patterns and behavior. These choices will involve new technologies, new information about their electricity use, and new forms of electricity pricing and incentives.*

This report focuses on the components of the smart grid that have the most direct impact on consumers, enabling them to become active participants in the electricity system. These components and the opportunities they create for consumers are described in Table 1.

Smart grid technologies also generate long-term benefits for consumers and society that are less evident on a day-to-day basis. Other smart grid technologies work alongside the components in Table 1 to:

- increase electricity system reliability and reduce outages;
- improve electricity system efficiency and reduce the need for new generation; and
- facilitate the shift away from fossil fuels.

These important long-term benefits of the smart grid are accrued gradually, and are more difficult to demonstrate to consumers.

Table 1 Smart grid components that are most relevant to consumers, and their benefits

Component	Description and benefits for consumers
Smart meters and advanced metering infrastructure	Smart meters operate digitally and allow for automated transfer of energy use information between consumers and utilities. They enable frequent measurement and transmittal of interval data to utilities, and can also receive information from utilities. Advanced metering infrastructure (AMI) typically refers to smart meters, the communication networks that connect them to utilities, and the utilities' centralized data management and control systems. Smart meters and AMI are the backbone of the smart grid, and are required for dynamic pricing, smart appliances, home energy management systems, and the integration of electric vehicles and distributed generation. They can also benefit consumers by enabling outage detection and restoration, and by improving the accuracy of electricity bills.
Dynamic pricing	Dynamic pricing incentivizes consumers to lower their usage during peak times, when electricity demand is highest. Dynamic pricing schemes include: • Time-of-use pricing (TOU): prices vary by time period, and are higher in peak periods. They are fixed, and known in advance. • Critical peak pricing (CPP): time-of-use prices are in effect except for certain peak hours (12-16 days per year), when prices are higher. • Real-time pricing (RTP): prices may change hourly; customers receive price signals on a day-ahead or hour-ahead basis. Dynamic pricing lowers wholesale market prices in the short run, and avoids the long-term need for new generation. Customers who shift their use to off-peak hours may reduce their electricity bills.
In-home displays, portals, and energy information tools	These tools allow consumers to view the information from smart meters in easy-to-understand formats, and using a range of platforms and devices – in-home displays, computers, and/or smart phones. They provide near real-time information, and can also include charts, energy efficiency tips, and analytical tools (e.g. to compare energy use to other households). In-home displays, portals, and energy information tools allow consumers to track their energy use in detail and to understand their electricity bills. They can also help consumers manage energy use and identify opportunities to reduce electricity costs.

Component	Description and benefits for consumers
Demand response	Demand response (DR) refers to the capacity for consumers to adjust the demand for electricity at a given moment, using real-time data. DR includes automated changes in energy use in response to price signals, using "smart appliances" or home energy management systems. DR also includes direct control of residential loads by utilities; for example, devices installed on water heaters or air conditioning units enable utilities to turn them on and off remotely.[1] Demand response enables consumers to manage energy costs by shifting energy use to off-peak periods, when prices are lower. Consumers often receive incentives for participating in programs that involve direct control of loads by utilities.
"Smart home" energy management systems / home area networks	In the "smart home", "smart appliances" will be able to respond to price signals from smart meters and optimize electricity use (within limits set by consumers). Smart appliances will be networked together and will communicate with home energy management systems (also known as home area networks, or HAN). Consumers will be able to operate equipment remotely and adjust their energy-related settings through home energy management systems. Home energy management tools will enable consumers to shift electricity use to off-peak hours, and to manage their electricity use and costs.
Facilitation of distributed generation	The smart grid can facilitate distributed generation (e.g. small-scale solar and wind power) by allowing for movement and measurement of electricity in more than one direction. With net metering, small distributed generators can sell their locally generated power back to the grid – and get accurately paid for it. A system of controls and meters can help to safely connect distributed generation to the grid, and to provide data about its operation to utilities and owners. Using micro-grids and islanding, communities can even use locally generated energy resources if the central grid is down. Smart grid technologies that facilitate distributed generation can enable consumers to sell their locally generated (often renewable) electricity back to the grid.

[1] Other forms of demand response exist, but they do not depend on smart grid technologies.

Component	Description and benefits for consumers
Facilitation of electric vehicles and energy storage technologies	Vehicle-to-home technologies (V2H) can enable the two-way flow of electricity between homes and electric vehicles or plug-in hybrid electric vehicles. Vehicle-to-home technologies can enable consumers to recharge their vehicles at off-peak hours, when prices are lowest, and supply the stored electricity back to the home during on-peak pricing periods. With net metering, consumers could also have the option of selling stored power back to the grid during on-peak hours. In-home energy storage technologies could allow consumers to store power from wind and solar generation for later use. They could also allow consumers to purchase electricity at off-peak periods for use during peak periods.

Consumer engagement in utility-led smart grid programs

History and challenges

Historically, electric utilities focused on "wires and poles", rather than on sales and services. Few utilities had consumer-oriented marketing departments. Fewer still had consumer education strategies. In alignment with this trend, many utilities' early attempts at smart grid technology deployment focused on the hard infrastructure of technology, rather than the soft infrastructure of consumer engagement. Several of these early attempts provided powerful lessons about the importance of consumer education and engagement.

Though utilities have learnt from the basic lessons provided by these early experiences, consumer engagement is still consistently identified as the most serious impediment to smart grid implementation (Electric Power Research Institute, 2010). Utilities are struggling to understand consumer motivation and to discuss the issues in consumer terms (Electric Power Research Institute, 2011). Ongoing challenges include: overcoming low levels of smart grid and electricity system understanding, addressing consumer concerns about the smart grid, and demonstrating the value of the smart grid to consumers – without creating unrealistic expectations.

We present three examples of utilities whose early attempts at smart grid technology deployment reflect shortcomings in addressing these challenges. Two utilities (Central Maine Power and Pacific Gas & Electric) focused very little on consumer education and engagement during their initial smart meter rollouts, at which time smart meters were mandatory for all customers. Even after the development of smart meter "opt-out" options, they faced persistent complaints and lengthy lawsuits. In a third example, Xcel Energy's bold statements about the consumer benefits of the SmartGridCity created significant problems as project costs increased and the early "promises" remained unfulfilled.

Low levels of smart grid and electricity system understanding

North Americans have a limited understanding of the smart grid. In a 2011 survey, almost half of Americans reported that they had not heard the terms smart grid and smart meter. Another 20% had heard the terms but did not have even a "basic" understanding of them. In Canada, smart meter awareness is significantly higher, due to large scale deployments in Ontario and British Columbia. However, Canadians report low levels of understanding of the "smart home" and "smart grid". In 2012 survey of Canadian consumers, 65% reported a "basic" or "complete" understanding of smart meters, while only 27% reported understanding the smart grid (Figure 1).

In the United States, consumers who have a higher level of understanding are more likely to support and participate in smart grid programs. Consumers who have smart meters in their homes report significantly higher levels of support for the smart grid than those who do not (Smart Grid Consumer Collaborative, 2011b). Consumers who are more knowledgeable are also more likely to change their energy usage to meet specific goals.(Electric Power Research Institute, 2010).

Low levels of consumer understanding are a significant challenge for utilities seeking to deploy smart grid technologies and programs. In the short-term, this lack of understanding will increase the likelihood of consumer misinformation, confusion, and smart grid opposition. Confusion and misinformation contributed to the problems encountered by Pacific Gas & Electric during smart meter deployment (Box 1). In the long-term, lack of understanding will limit the extent to which consumers are able to become active participants in the electricity system.

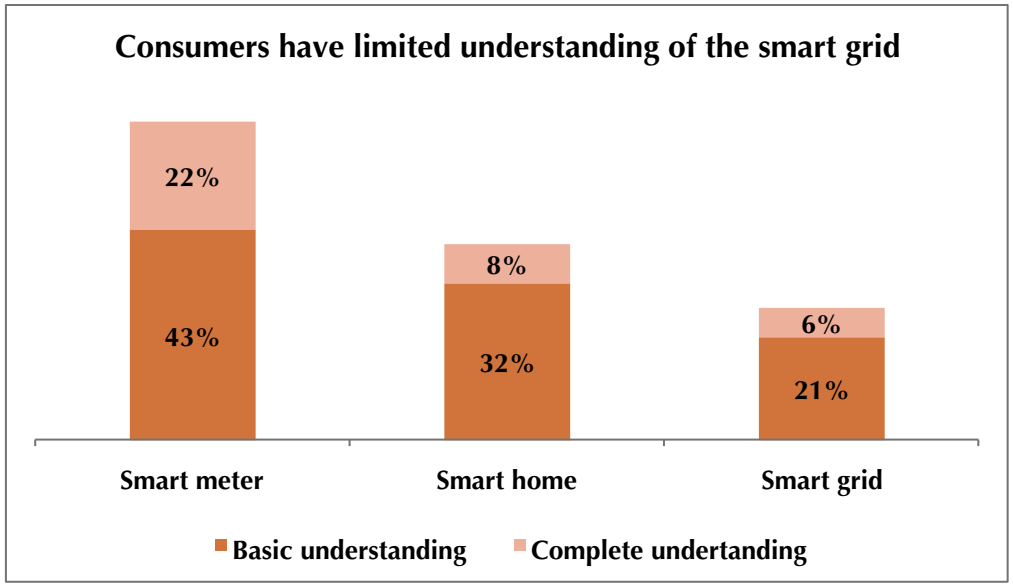

Figure 1 Smart grid consumer awareness in Canada (data from Smart Grid Canada & Independent Electricity System Operator, 2012)

Box 1 Pacific Gas & Electric

Pacific Gas & Electric, Smart meter deployment faces class action lawsuits

In 2009, PG&E did not proactively engage customers during the initial stages of smart meter deployment, and received hundreds of complaints about skyrocketing bills. They faced widespread suspicions that the meters were malfunctioning, and were hit with a class action lawsuit over the matter from Bakersfield residents. The Public Utilities Commission (PUC) investigation found that smart meters were accurate, but reported that PG&E performed poorly in providing customers with the necessary education related to smart meters. PG&E later developed broad internal capabilities to engage with customers, including a dedicated smart meter customer call center and training for smart meter customer service representatives (PG&E, 2010). According to the Director of PG&E's Smart Meter Program,

"Originally, people viewed the implementation of the smart grid and the deployment of smart meters as a purely technical change… In actuality, moving toward a smart grid is a very substantial transition that requires dialogue and education between utility and customer base."(Mitchell, 2012)

Concerns about the smart grid

Consumers also have specific concerns about the smart grid. In a 2011 survey of over 1,000 American consumers, almost half of respondents identified that they were highly concerned about the cost of smart grid technologies, and the corresponding benefits to them (or lack thereof). About one third of respondents reported being highly concerned about data and billing accuracy, and data privacy. Though concerns about the health impacts of radio frequency emissions were somewhat less common, 9% still reported being "highly concerned" (Figure 2).

Central Maine Power (Box 2) faced multiple lawsuits related to consumer concerns about privacy and health impacts of radio-frequency emissions.

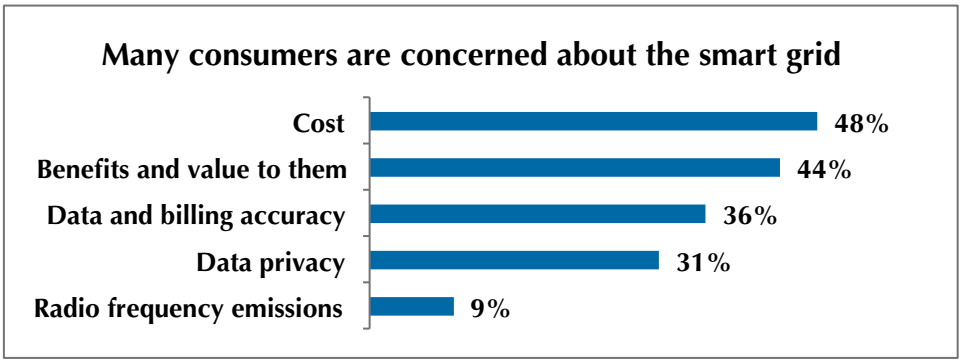

Figure 2 Aspects of the smart grid with which consumers are highly concerned (data from Zpryme Research & Consulting, 2011)

Box 2 Central Maine Power

Central Maine Power (ME), Smart meter deployment faces multiple lawsuits

Central Maine Power (CMP) began installing digital meters in 2010. There was no extensive outreach prior to deployment due to high customer satisfaction with the utility in the past (Smart Grid Consumer Collaborative, 2011c). To the utility's surprise, the smart meter rollout elicited widespread negative feedback – and multiple legal challenges. In the first lawsuit in early 2011, customers claimed that the installation violated their property ownership rights. After CMP provided an opt-out choice for customers (in response to a PUC mandate), customers alleged that the opt-out fee violated customers rights. Finally, customers took to the courts regarding the health impacts of smart meters. According to a spokesman for CMP,

"It was stunning to us when we ran into the response that we got. We did not see it coming." (Regalado, 2011)

Demonstrating smart grid benefits

For the majority of consumers, the most important smart grid benefits are those related to controlling electricity use and saving money. At the same time, over 80% of consumers report that they find *many* smart grid benefits to be important – including benefits related to system reliability, environmental protection, job creation, and upgrading aging infrastructure (Smart Grid Consumer Collaborative, 2012a).

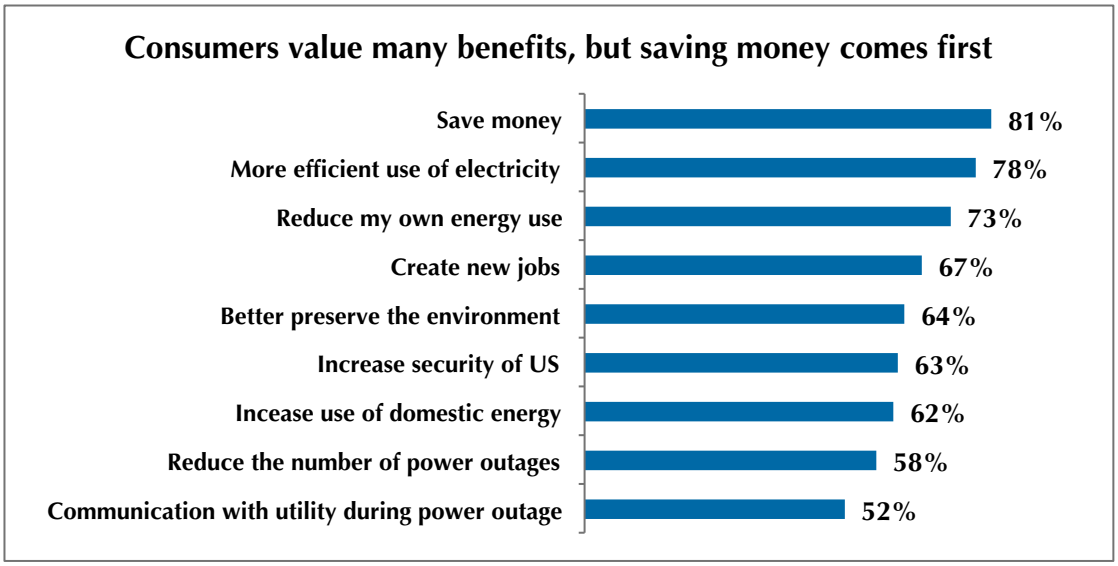

Figure 3 Smart grid benefits that consumers identify as very important (data from Zpryme Research & Consulting 2011)

However, many utilities are only at the early stages of smart grid deployment, and these benefits are not yet evident. While smart meters are the backbone of the smart grid, smart meters alone deliver only minimal visible benefits to consumers. Utilities face the challenge of conveying the long-term importance of the smart grid, without overpromising in the short-term.

Xcel Energy's SmartGridCity initiative (Box 3) promised more than it could deliver and consequently faced deep criticism from consumers, the media, and regulators.

Box 3 Xcel Energy, Boulder

Xcel Energy (CO), SmartGridCity faces widespread pushback

In 2008, Xcel planned to turn Boulder into an "international showcase" of the smart grid model with smart meters, dynamic pricing, personalized in-home energy management devices, and infrastructure to support distributed generation technologies. Xcel initially promoted SmartGridCity as the "city of the future" that would "transform the way energy is delivered and managed" (Smart Grid Consumer Collaborative, 2011c). Xcel assured customers that most of the cost would be covered by private partners.

Xcel received significant consumer and media pushback as project costs skyrocketed from $15M to $45M, and benefits remained largely invisible. In 2009, Xcel asked the PUC for permission to raise rates of all Colorado customers to recoup their investment. After a lengthy process, the PUC gave Xcel permission to recover two-thirds of the costs. At the same time, the Chairman mourned,

"This was supposed to be a shining city on the hill, and it looks like it's a dead end." (Jaffe, 2011)

As of July 2012, disputes about cost recovery were ongoing, with the City of Boulder arguing that Xcel should not be able to recoup the final $16.5M because consumers do not yet have the promised in-home energy management capabilities. At the same time, Xcel has demonstrated reductions in transformer overloading outages, and in complaints related to voltage issues (Kanellos, 2010).

"Xcel made some mistakes in the way it (over)sold SmartGridCity... SmartGridCity is (mostly) a technical success [and] a PR disaster." (Berst, 2011)

A new approach to consumer engagement

Electric utilities understand that their relationships with customers are changing. These relationships will continue to evolve as smart grid deployment progresses.

As part of smart grid deployment, utilities will be asking consumers to help balance supply and demand, and ensure reliability by modifying the way they use and purchase electricity. In turn, utilities will be seeking to provide consumers with information and choices that motivate new patterns of electricity use.

In this situation, utilities need customers far more than customers need utilities. Furthermore, customers are ultimately those who pay for smart grid initiatives. Without their support, the smart grid cannot exist and cannot deliver its promised benefits (Smart Grid Canada, 2012).

Utilities now realize that consumers won't automatically understand and accept smart grid technology. Furthermore, they understand that they can only gain consumers' support and active participation if they create a positive customer experience at all stages of technology deployment.

In light of these new realities, utilities are moving towards a new approach to consumer engagement. They are transitioning to a model of customer service and sales that puts customers first. In the next section, we discuss the basic elements of the new customer-centric orientation, and the practices that support these elements.

Improving the smart grid customer experience

Across North America, the smart grid is leading to a fundamental shift in utilities' approach to engaging consumers. This shift is characterized by increasing attention to the smart grid "customer experience".

The "customer experience" covers the sum of how customers engage with a company or product/program not just in a single interaction, but over the entire duration of their interactions. Companies in a range of sectors have moved towards a focus on customer experience, and have been rewarded with higher customer referral rates and customer satisfaction (Stravity Group, 2009). Focusing on customer experience means considering the following:

> *"What's it really like to be your customer? What is the day-in, day-out 'customer experience' your company is delivering? How does it feel to wait on hold on the phone? To open a package and not be certain how to follow the poorly translated instructions? To stand in line, be charged a fee, wait for a service call that was promised two hours ago…? Or what's it like… [to] get everything exactly as it was promised? To be confident that the answers you get are the best ones for you?" (Peppers & Rogers, 2008)*

Utilities with the most effective smart grid consumer engagement programs have considered the customer experience, and have sought to improve it at each stage of smart grid deployment.

This section describes four success factors that contribute to the smart grid customer experience and increase the likelihood of smart grid project / program success. The characteristics of "success" and the methodology used to identify these success factors is described in Appendix B. For each general success factor, it also identifies a number of specific strategies and provides examples of the use of each strategy in North American utilities. More complete profiles of each of the ten utilities are included as Appendix A. A summary of the success factors and strategies is included in Table 2 in the Conclusion.

Success factor 1. Understand and respond to consumers' needs

To understand consumer needs and interests for a given smart grid initiative, utilities can conduct market research *specific* to the initiative. Surprisingly, as of 2010, it was not yet the norm for utilities to conduct market research; a 2010 survey of 24 utilities indicated that only 43% had ever conducted market research to assess their customers' knowledge or perceptions of the smart grid (Electric Power Research Institute, 2010).

Responding to consumer needs and interests involves providing the right information to consumers at the right time. It also means developing programs and services that provide value to consumers. Finally, it means investing time and resources in marketing and

education, to ensure that consumers understand and take advantage of the opportunities to participate in the smart grid.

Strategy 1. a) Conduct market research specific to each smart grid project

Utilities should use market research to better understand consumers in their service territory, and to identify consumers' needs and interests specific to the initiative in question.

There are general trends that all utilities are likely to discover through market research. For example, most North American utilities in the early stages of smart grid deployment will find that most consumers have a very low level of smart grid knowledge, but are generally supportive of the smart grid once they understand its long-term benefits. At the same time, there may be important differences in attitudes and awareness from one utility to the next, due to differences in demographics, socio-economics, culture, media influences, etc.

More importantly, consumers needs and interests will vary based on the smart grid project in question. For example, smart meter deployment does not require that consumers understand the electricity system, or have a sense of the relative electricity use of different appliances. However, projects involving home energy management systems will only be successful if consumers are motivated to manage their electricity use and have appropriate tools to do so. Consumers' needs are thus dramatically different for the two types of projects.

As utilities develop smart grid projects, they must first consider what consumers need and want *in connection to a particular smart grid project*. Then, they must develop communication materials and services that respond to these interests and needs. Box 4 provides examples of the market research conducted by utilities as part of smart meter, load shifting, and dynamic pricing programs.

Box 4 Conducting market research

1.a) Conduct market research specific to each smart grid project

Sacramento Municipal Utility District conducted extensive front-end research as part of their dynamic pricing pilot program design. They investigated how consumers could understand the new rates and be motivated to participate. They tested how consumers would react to different words, and asked consumers how the utility could help them save with the new rates. They found that:

- Saving money is the most universal motivator, though some customers were driven by the environmental message.
- Many utility terms are scary, stodgy or off-putting to customers. For example, "critical peak" sounds like an emergency.
- Customers have no idea how much electricity their appliances use, and want very concrete examples – *what* should I turn off, and *how much* will I save?

1.a) Conduct market research specific to each smart grid project

BC Hydro has conducted multiple types of market research as part of their ongoing smart meter deployment.

- Tracking research (ongoing public opinion polling) helped BC Hydro understand the changes in consumers' smart grid awareness and support over time.
- In-depth research and periodic focus groups have provided insight into the opinions of different groups of customers, and helped BC Hydro understand why people believe what they believe about the smart grid. In an initial focus group of smart meter sceptics / opponents, people had very low awareness about smart meters and could not explain why they were opposed.

BC Hydro found shifts in public opinion as the economy changed. In early 2011, consumers were interested in the benefits related to climate change mitigation, prevention of electricity theft, and outage notification. In 2012, climate change was a lower priority and consumers were most concerned about electricity rates and costs.

Powershift Atlantic (Atlantic Canada) used best practice research, baseline telephone interviews, one-on-one interviews, and focus groups to develop their load shifting program. Powershift is also conducting quarterly surveys with program participants. They found that:

- Consumers had very little awareness at the start of the project.
- Consumers are very interested in supporting wind and renewable energy, though they also want to save money down the road. They are genuinely interested in being part of the solution for a more sustainable future.
- Customers are willing to participate in the research and demonstration project without a financial incentive (recognizing that the program ought not require the customer to make any sacrifices).
- Customers want updates about the program's activities and results, and want some technical understanding of how it works.

Strategy 1. b) Provide information to those who need it, when they need it

Several utilities described the importance of communicating directly with those who are impacted by smart grid projects, at the time they will be impacted. This means communicating with customers through direct mail, bill inserts, telephone calls, door hangers and/or in-person visits at specific points in time. Utilities suggest that this is the most effective way of ensuring that messages are received by customers. It may also prevent unnecessary involvement of third parties (e.g. media outlets looking for controversial stories, or retailers looking for new customers).

Many utilities have used staged messaging strategies (e.g. 90-60-30 day plans) to prevent information overload and ensure that consumers have the right information at the right time (Smart Grid Consumer Collaborative, 2011c). Staged messaging strategies also help to manage consumer expectations about the immediate benefits of the smart grid. Many utilities have downplayed the deployment of smart meters, as smart meters alone provide minimal direct benefits to consumers. Newmarket-Tay Power's core message was that "business" would continue as usual; the utility would be changing meters, but nothing else would change. With time-of-use rate plans and more advanced smart grid consumer applications, consumers have a greater opportunity to manage their electricity bills, but also require more information, education, and tools.

Box 5 provides examples of how utilities provided the right information at the right time as part of smart meter and time of use deployment.

Box 5 Providing relevant information

1.b) Provide information to those who need it, when they need it

San Diego Gas & Electric (SGD&E) built on a 90-60-30 day communication strategy for smart meter deployment:

- 90 days in advance, SDG&E discussed the deployment with elected officials. Officials were happy to be informed and provided very little negative feedback.
- 60 days in advance, SDG&E was visible at community events with smart meter displays and information about DSM programs.
- 30 days in advance, customers received a mailed letter. 3 to 5 days in advance, customers received an automated phone call.
- With installation, customers received a door hanger inviting customers to call with questions.

  3 to 5 weeks after deployment, SDG&E went door-to-door answering questions and handing out information about DSM programs. Customers were pleasantly surprised to receive this follow-up visit.

1.b) Provide information to those who need it, when they need it

Hydro One (Ontario) communicated directly with customers before, during and after the smart meter deployment and migration to time-of-use (TOU) rates. They explained how and when customers would be impacted using direct mailings, bill inserts, and door hangers at pre-determined times. For the TOU migration:

- Customers received a direct mail package 30 days in advance of the transition to TOU, with a letter, brochure, and TOU decal.
- After TOU rates came into effect, they received their last Regulated Price Plan bill, with a bill insert TOU reminder.
- Their first TOU bill included a bill insert to help them understand their new bill.
- Hydro One monitored bill changes after the switch and pro-actively phoned customers whose bills had increased dramatically to explain why.

Communication materials conveyed two simple messages:

- You are now being charged TOU prices. You can view your electricity use information the day after you use it.
- Shift your electricity use from on-peak to off-peak and mid-peak periods when possible to manage your bills, reduce strain on the electricity system, and help the environment.

Communication materials also identified specific strategies that consumers could use to shift their electricity use to off-peak periods.

Strategy 1. c) Develop programs and services that provide value to consumers

There are many ways in which consumers can benefit from the smart grid, as described in the section, Smart grid technologies and the consumer. However, consumers do not automatically benefit from early smart grid deployment projects. Smart meters alone provide limited visible benefits to consumers, as do upgrades to transmission and distribution infrastructure. Utilities must thus develop smart grid programs and services that provide tangible value to consumers.

Many utilities have paired smart meter deployment with online portals that enable consumers to access their electricity use data. Online portals can help consumers manage their electricity use, and appreciate the benefits of smart meters. (Though most utilities report lukewarm responses to these online portals – particularly since data are typically not real-time, or when portals do not include useful analytic tools.)

Several utilities have also rapidly moved beyond smart meters and online portals, and are seeking to provide additional value to customers. Utilities are helping consumers understand and manage their electricity bills with new rate plans and billing cycles, in-home

devices, sophisticated analytical tools, mobile applications, and weekly summary emails. Improved outage mapping and online connection-disconnection and moving day services are also demonstrating the value of the smart grid to consumers.

Box 6 provides examples of how utilities are developing programs and services that provide value to consumers.

Box 6 Providing value

1.c) Develop programs and services that provide value to consumers

Sacramento Municipal Utility District is working on applications that will be available to all customers, including:

- A revamped online portal to add bill alerts, notes, and other features to help consumers decipher what affects their load.
- A program for consumers to borrow in-home displays from the utility or the library, and explore how electricity loads and costs change as appliances are turned on and off.

Newmarket-Tay Power (Ontario) accompanied smart meters and time-of-use pricing with a switch to monthly billing, based on calendar months. It received very positive feedback about this switch, since consumers think in calendar months (rather than mid-month to mid-month).

Kansas City Power & Light sought to create value for consumers at the time of smart meter deployment. It provided customers with a welcome kit that included instructions for accessing the online energy management portal and the option to receive a free In-home display.

San Diego Gas & Electric developed a mobile application that includes online bill pay functionality and an outage map. It also improved the connection and disconnection system, so that electricity services can be started, stopped or transferred all online.

PowerStream (Ontario) is actively pursuing next generation smart grid programs to help consumers manage their electricity use. This includes:

- Working with Nissan Canada to demonstrate “electric vehicle to home” (EV2H) systems, where fully or partially charged electric vehicle batteries can provide power to homes, and help Ontario homeowners on time-of-use rates.
- Conducting a Home Area Network pilot project involving 1,700 customers. The pilot will provide consumers with different methodologies to remotely control loads in homes.

1.c) Develop programs and services that provide value to consumers

Reliant Energy's (**Texas**) "eSense" tools provide customers with a range of smart grid technologies, services, and programs to help them manage energy use. For example:

- Consumers can remotely control their home's energy setting using an advanced programmable thermostat.
- Consumers can choose from two dynamic pricing plans: a traditional time-of-use rate plan and a more simple version that provides a discount off of a standard flat rate for off-peak use.

Smart phone apps, iGoogle gadgets, weekly summary emails, text message alerts, and online portals enable consumers to interact with the energy data. Using the "Neighborhood Compare" tool, households can compare electricity usage with other homes.

Strategy 1. d) Invest time and money in marketing and education

As utilities' move beyond smart meters and ask consumers to play an active role in the smart grid, they will need to invest significant time and money into marketing and education. Consumers will not change the way they use electricity until they have the tools to do so, the knowledge to use these tools effectively, and the motivation to participate. Utilities' smart grid technologies and programs will provide the tools for electricity management. However, utilities will also need to use marketing and education to provide the motivation and knowledge to accompany these tools.

Special efforts may be needed to ensure that low-income consumers and other disadvantaged groups are able to gain the same benefits from the smart grid (Darby, 2010). Low-income consumers have less awareness of the smart grid than the general U.S. population, and have less knowledge of actions to increase their homes' energy efficiency.

Utilities have not historically been known for their cutting-edge marketing strategies, as most have not had to compete for customers. However, leading utilities are now starting to take marketing very seriously. They are hiring skilled marketing professionals to join their smart grid teams, and/or are working with carefully selected external marketing firms on smart grid initiatives. For many utilities, investing significant time and money into marketing and education may require a fundamental shift in attitude. A significant shift may also be required among regulators, who will be asked to approve larger marketing and education budgets.

Box 7 provides examples of utilities that are investing time and resources into marketing and education.

Box 7 Investing resources

1.d) Invest time and money into marketing and education

Powershift Atlantic worked with external marketing firms to move towards a whole new level of communication. Armed with the results of market research, they developed simple visual diagrams to help consumers understand the project, and focused on the benefits related to wind energy. They tested and re-tested their communication materials so that the messages "stuck", and the colours and images reinforced the messages.

PowerStream has sought to address the need for smart grid communication in non-utility terms with next-generation education and engagement materials including:

- Six simple and attractive smart grid case studies for consumer education that address different aspects of the smart grid, from smart meters and home energy management tools to electric vehicle to home technologies. Each case study clearly explains the challenge, the solution, and the benefits.
- An interactive Power for Tomorrow booth at community events that showcases new technologies and services related to renewable energy, smart grid and electric vehicles.
- YouTube videos, a blog, and the "Follow the smart grid to win" social media contest.

Kansas City Power & Light set an objective to have each customer receive 10 smart grid-related messages before exchanging their meter. In response to market research indicating that consumers expected to save 30% through in-home displays, KCP&L sought to manage expectations regarding saving money. Instead, they developed messaging that focused on control and choice.

As part of the goal of enabling customers to be "smart energy consumers", KCP&L has established interactive educational projects, including the Smart Grid Innovation Park and Project Living Proof Demonstration House. These interactive displays have attracted more community interest than anticipated.

Sacramento Municipal Utility District responded to consumers' feedback during focus groups and positioned dynamic pricing program as an opportunity for customers to save, with environmental benefits as a secondary message. SMUD also conducted a thorough education campaign as part of recruitment, providing high-level explanations of the program, information about the electricity use of different appliances, and specific recommendations for reducing peak use (e.g. recipes that use less electricity). Preliminary results confirm the importance of education; in a survey just after recruitment, customers who felt they understood the purpose of the dynamic pricing program were significantly more likely to be satisfied with it.

Success factor 2. Go further in providing customer-centric programs and services

In recent years, utilities have been designing new demand side management programs, improving customer service strategies, and developing new touch points for communicating with customers. Effective smart grid consumer engagement will require that utilities go further in developing customer-centric programs and services.

This means developing programs, services, and communication tools to meet the needs of diverse consumers. It requires programs that make it easy for consumers to participate, and solid metrics to evaluate the success of these programs. Finally, it will involve trying new things (in a manageable way), and learning from experience.

Strategy 2. a) Develop a range of programs, use a range of marketing tools

Different consumers have different motivations, capabilities, patterns of behaviour, and communication preferences (Smart Grid Consumer Collaborative, 2011b). Utilities will thus need to develop a range of programs and marketing strategies for different segments of consumers.

For examples, for smart grid programs that involve tracking household electricity use, not all consumers will be able to access energy use information using the same tools. In a 2012 survey, 42% of low-income consumers in the U.S. reported not using the internet (Smart Grid Consumer Collaborative, 2012b). Consumers should thus have the opportunity to choose smart grid programs that provide energy use information in the format that is most useful to them – whether that is through an in-home device, on the internet, by text message, or through a smartphone application. Special consideration to the needs of low-income consumers may also be required as part of program design.

To drive participation in smart grid programs, utilities should go beyond traditional tools to market their smart grid programs, accounting for differences in motivation and communication preferences. For example, utilities are supplementing direct mail and bill inserts with outbound calling campaigns, outreach to local media, engagement at community events, and digital marketing. They are making use of all existing "touch points" with consumers, as well as non-utility touch points (e.g. schools) for marketing.

Finally, the most successful utilities have developed both creative programs and marketing strategies. Community energy saving competitions, neighbourhood comparison tools, mobile smart grid technology road shows, and web-based games are among the tools that define the new era of customer-focused engagement.

Box 8 provides examples of utilities that have developed a range of programs and used a range of marketing tools.

Box 8 Developing a range of programs and marketing strategies

2.a) Develop a range of programs, use a range of marketing tools

Reliant Energy's e-Sense Smart Energy Solutions tools provide customers with a range of smart grid technologies, services, and programs. Consumers can remotely control their home's energy setting using an advanced programmable thermostat. They can choose from two dynamic pricing plans: a traditional time-of-use pricing plan and a more simple version that provides a discount off a standard flat rate for use during off-peak hours. Smart phone apps, free iGoogle gadgets, weekly summary emails, text message alerts, and online portal analytical tools enable consumers to interact with energy data in different ways.

Sacramento Municipal Utility District is piloting both "opt-in" and "opt-out" dynamic pricing programs. For the opt-in program, SMUD achieved an extremely impressive 15% enrolment. They used a range of enrolment tools: direct mail business reply cards, outbound calling campaigns, and online enrolment tools. Preliminary results suggest that it was important to provide this range, since different demographics enrolled using different tools. The opt-out program has significantly higher participation, with only about 3-4% of customers choosing to opt out.

SMUD is also exploring how several smart grid technologies and education tools can help low-income customers, through the "Energy Insights Weatherization Pilot". The pilot includes four treatment groups: weatherization energy assessment only (control group); energy assessment with in-home display; energy assessment with Nest learning thermostat; and energy assessment with online charts and educational tools. The pilot will help SMUD develop smart grid programs that address the unique needs of low-income customers.

Wright-Hennepin Electric (WHE – Minnesota) has used a range of communication tools to promote smart grid programs, to keep in touch with customers, and to provide information about saving energy.

- WHE promoted the MyMeter online portal through bill inserts and broader marketing, as well as through the call center and energy auditors. They found that most customers were referred to MyMeter from the call center.
- WHE is supplementing its traditional newsletter with blogging, Twitter, Facebook, text message alerts, and a LiveChat service. These tools are designed to reach younger customers who are less likely to read the newsletter.
- WHE organized two "Littlest User" residential energy saving competitions. WHE customers can track competitors' progress online, and can read about their energy saving strategies.

Strategy 2. b) Make it easy to participate

Making enrolment as simple and clear as possible increases the likelihood that interested customers will participate; Amazon's "1-click" order process may provide inspiration to utilities. Customers appear more likely to sign up for programs with simple structures that are easy to understand, and that are explained clearly by marketing materials.

Furthermore, more and more utilities are making smart grid programs the default, with opt-out options. Utilities report that they have received surprisingly little pushback from the customers who choose to "opt out" of demand response and dynamic pricing programs.

Box 9 provides examples of utilities that have successfully used simplicity in program design and marketing, and that have made it easy to participate.

Box 9 Simplifying participation

2.b) Make it easy to participate

San Diego Gas & Electric customers are automatically enrolled in the "Reduce Your Use" demand response program. The seven Reduce Your Use events in the summer of 2012 each included more than 500,000 participants, for average bill credits of $17. Events also led to a five-fold increase in customers viewing their energy data online.

Powershift Atlantic has moved from a full participation agreement to a shorter form participation agreement for commercial customers, to make it easier for customers to participate.

Sacramento Municipal Utility District's "opt-out" dynamic pricing pilot programs have faced minimal pushback, to the utility's surprise. Preliminary results suggest that the opt-in and opt-out programs have similar levels of customer satisfaction.

Strategy 2. c) Track your success

As utilities design new and innovative smart grid programs and services, they will also need to develop evaluation plans to track their success. Smart grid programs and services will likely have multiple goals, and will thus require multiple evaluation metrics. For example, for programs that provide consumers with home energy management tools, utilities may want to track success based on participant recruitment, satisfaction, changes in knowledge, *and* changes in energy use as a result of the program. Utilities may also benefit from evaluating individual program components (e.g. enrolment processes, educational materials). Different programs with different goals will require different evaluation metrics and tracking mechanisms. Developing these metrics

and tracking mechanisms as part of program design will help utilities justify their efforts, demonstrate their success, and continually improve their programs and services.

Box 10 provides examples of how utilities are tracking their success.

Box 10 Tracking success

2.c) Track your success

San Diego Gas & Electric evaluated their smart meter deployment based on the customer complaint rate. Overall, they had a very low (0.16%) complaint rate for their smart meter deployment.

BC Hydro is tracking smart meter refusal rates and public support. As of October 2012, public opinion polls showed that program support was about 51%, and the smart meter refusal rate was 4%.

PowerStream conducted customer satisfaction surveys to evaluate the communication materials used for smart meter deployment and time-of-use migration. Survey results suggest that customers were adequately aware and informed thanks to the materials they received.

Wright-Hennepin Electric's MyMeter online portal has achieved 17% participation, though they have not systematically tracked how often participants use the portal. Preliminary evaluation suggests that use of the portal is associated with a 3% reduction in energy use.

Strategy 2. d) Take small steps, and learn from your experiences

Smart grid deployment should involve new and creative strategies for consumer engagement. While it is important to try new things, utilities report the value of taking small steps in both technology deployment and in consumer engagement.

This means rolling out changes one at a time, so that consumers have a chance to understand and adapt to the changes. For example, in Ontario, utilities valued being able to deploy smart meters well before transitioning to time-of-use pricing. They were better able to explain the two changes separately, address consumer concerns, and iron out any technological kinks.

Taking small steps also involves using pilot projects as testing grounds, before investing resources in widespread deployment of new strategies. Finally, utilities will need to learn from their experiences to improve their smart grid programs, services, and consumer engagement tools.

Box 11 provides examples of how utilities are moving slowly and learning as they go.

Box 11 Learning from experience

2.d) Take small steps, and learn from your experiences

Newmarket-Tay Power (NT Power) valued being able to make changes one at a time. From a technical and a consumer engagement perspective, NT Power found it very valuable to roll out technologies in small steps, with continual communications. NT Power completed smart meter deployment in the spring of 2007. The utility then rolled out TOU pricing to its 30,000 customers over a 14-month period, starting in December 2007. This phased approach to deployment was easier to administer, and easier for consumers to accept.

Powershift Atlantic began by rolling out the program to a small group of 50-60 "uber-friendly" consumers (utility employees). This enabled them to test the technology and establish supporting tools and processes. Then, Powershift added 50-75 "friendly" consumers (volunteers from home shows and events). Only after these two small steps did Powershift recruit "regular" consumers to participate.

San Diego Gas & Electric's "Biggest Energy Saver" pilot contest involved 25 households and was extremely successful; participants were saving 40%, interacting with each other, and working toward prizes. However, the follow-up San Diego Energy Challenge involving 500,000 customers has not been as successful in engaging people. In the future, SDG&E will try using segmentation to target customers with high bills and the greatest motivation to save energy.

San Diego Gas & Electric also revised their communication materials (flyers and letters) numerous times in response to feedback.

What can happen when utilities move too quickly on deployment?

Kansas City Power & Light gave away in-home displays (IHDs) at the time of smart meter installation. Customers were happy to receive free IHDs. However, the IHD technology did not work immediately with the new AMI infrastructure. After ironing out the technological kinks, KCP&L hired ambassadors to go door-to-door, track the IHDs that were not working, and try to fix them. They estimate that 100 IHDs were simply thrown away after consumers found them to be non-functional. KCP&L plans to move more slowly on future initiatives.

Success factor 3. Take consumer concerns seriously

Almost every smart meter deployment experienced customer complaints, typically related to data privacy and security, overbilling, rate increases, radio frequency-related health impacts, and/or meter job losses (Smart Grid Consumer Collaborative, 2011c). Even if consumer concerns are largely matters of perception (e.g. about billing accuracy), they are nonetheless very significant for electric utilities. Particularly at this very early stage of smart grid deployment, matters of perceptions

can "go to the very credibility of the smart grid effort" (Canadian Electricity Assocation, n.d.).

Utilities unanimously emphasize the importance of taking consumer concerns seriously. They have anticipated problems, and sought to prevent them through proactive engagement. Knowing that a small fraction of consumers will always have concerns, they have developed systematic approaches to escalating and addressing concerns. Effective strategies have included training of customer service representatives, and one-on-one attention for the most concerned consumers. Factors outside of utilities control may create problems even for the most well-prepared smart grid deployments[2]. Nonetheless, there is a lot that utilities can do to minimize and effectively address consumer concerns.

Strategy 3. a) Anticipate and prevent problems

Utilities need to think through each aspect of smart grid deployment, and anticipate likely concerns. They can then prevent wide-spread complaints through pre-deployment education that addresses potential concerns.(Smart Grid Consumer Collaborative, 2011c) Consumers do not automatically understand the connection between the smart grid, aging infrastructure, and the avoidance of costly new generation sources – but they can develop an appreciation of these connections through utility education.

Utilities can also work with stakeholders, experts, and politicians to ensure that as many groups as possible understand and support smart grid deployment. Finally, utilities should establish clear strategies for addressing each likely complaint, and processes for escalating the complaints that are most difficult to address. Box 12 provides three examples of how utilities have anticipated problems, and prevented them to the extent possible – and provides one example of the outcomes of not expecting the unexpected.

Box 12 Anticipating and preventing problems

3.a) Anticipate and prevent problems

PowerStream anticipated that smart meter deployment would be accompanied by a significant increase in calls to the call centre, and increased staffing levels accordingly. They were pleasantly surprised that calls to the call centre were relatively low.

San Diego Gas & Electric conducted systematic outreach to elected officials as part of smart meter deployment. They also developed procedures for addressing and escalating complaints. Finally, they sought to be proactive, transparent and flexible in all communications, e.g. by posting complete and up-to-date information on the website, and by revising flyers and letters in response to feedback.

[2] For example, Pacific Gas & Electric's smart meter deployment occurred during an extremely hot summer, which may have enhanced consumer concerns about bill increases tied to smart meters.

3.a) Anticipate and prevent problems

Hydro One anticipated concerns related to bill increases and health impacts, and developed strategies to address them. Hydro One automatically called customers whose bills increased significantly after smart meter deployment to explain the reason for the higher than expected bill. (Most increases were due to adjustments for past electricity use not covered in previous, estimated bills).

Customers with questions and concerns related to the health effects of radio-frequency emissions were provided a report on the topic by an independent expert. They were also provided information on alternative options, including installing a cellular point-to-point meter.

Hydro One worked cooperatively with the Ontario Ombudsman's Office to ensure a full understanding of the nature of billing complaints and Hydro One's approach in addressing them.

What can happen when utilities do not expect the unexpected?

BC Hydro's smart meter deployment received widespread negative media attention, because of a small but vocal group of smart meter opponents. Misinformation spread fast with few checks on its validity.

The most visible opposition focused on health impacts including a complaint to the Human Rights Tribunal by those who feel radio-frequency has a negative impact on their health. Once the media controversy had begun, some experts were no longer willing to get involved for fear of becoming a target.

Customers also expressed concerns about bill increases during the first winter of installations. Although the majority of the customers did not yet have smart meters and BC Hydro's rate structure had not changed, there were thousands of calls from customers who felt their bill had increased. This unanticipated volume of calls created a significant backlog at the call center.

Strategy 3. b) Train customer service representatives

Consumers with concerns will end up speaking with customer service representatives (CSRs) first. Customer service staff should thus be trained to provide a positive customer experience, and to address concerns to the extent possible. CSRs should be receptive to all feedback, and treat all customer complaints as legitimate. Furthermore, CSRs should be specifically trained to respond to common concerns. This may involve developing first- and second-order answers to common concerns, call center scripting, and/or smart grid education for CSRs. CSRs should also have a clear sense of when to escalate customer concerns to more senior staff within utilities.

Utilities may also benefit from involving CSRs in the design of smart grid programs, tools, and marketing materials. CSRs generally have a

good sense of how consumers will respond to information, and where they will have trouble with tools and services.

Box 13 highlights a few of the many utilities that provided specific smart grid training to customer service representatives.

Box 13 Training customer service representatives

3.b) Train customer service representatives

Wright-Hennepin Electric trained customer service representatives to respond to questions and concerns regarding smart grid programs, and to discuss the benefits of the smart grid. CSRs also play a key role in driving uptake of the MyMeter online portal and demand response programs. Finally, CSRs participated in the development of the MyMeter online portal. Because CSRs are on the front line, they understand what customers are looking for and can anticipate the "pain points" for a product or service.

Kansas City Power & Light hired and trained community residents to be smart grid ambassadors. Ambassadors assisted with community outreach and education, including going door-to-door providing welcome packages and answering questions.

BC Hydro established a dedicated smart meter call centre team, and spent significant time training CSRs to respond to a broad range of customer enquiries. CSRs were trained to understand the different questions customers had related to the new technology and to escalate customer complaints when appropriate.

In addition, installers were trained to temporarily postpone meter installation if a customer requested it, to allow them time to get more information about the program.

Strategy 3. c) Work with individual customers to address their concerns

Even with the best education and engagement campaigns, most utilities will encounter a very small minority of vocal, deeply concerned customers. Utilities have benefited from providing these consumers with one-on-one, personal attention. Providing prompt, individualized attention also prevents these customers from forming vocal groups of concerned customers, and reduces the likelihood that they will bring their concerns to the media.

Box 14 provides examples of how utilities have worked one-on-one with consumers to address their concerns about smart grid technologies.

Box 14 Working with individual customers

3.c) Work with individual customers to address their concerns

San Diego Gas & Electric sought to be extremely responsive to customer concerns. They worked one-on-one with the small number of customers who were most concerned about health impacts or bill increases. For example, they conducted audits in people's homes to identify why their use had increased. They emphasize the importance of working with individual customers, rather than groups of customers.

Wright-Hennepin Electric's customer service representatives spend time with individual customers to understand and address their concerns. Using MyMeter, CSRs can help customers understand their bills. Utility staff have also visited customers' homes to help them understand why their energy use has increased.

Success factor 4. Use the smart grid to build new relationships

As part of smart grid deployment, utilities are developing new touch points for connecting with their customers. They are also partnering with municipalities, universities, and community-based organizations on smart grid education and engagement programs. These relationships with customers and with partner organizations will be increasingly important as smart grid programs require more active consumer participation.

Strategy 4. a) Build relationships with your customers

In the past, most utilities have had minimal contact with their consumers. As part of the new approach to smart grid consumer engagement, utilities are looking to change that. They are reaching their customers in more ways, including in face-to-face interactions. They are also attending community events, supporting local organizations, and using corporate social responsibility programs to establish trust and goodwill and to maintain a visible presence in their communities.

Box 15 provides examples of utilities that are using smart grid projects as an opportunity to build new relationships with their customers.

Box 15 Building relationships

4.a) Build relationships with your customers

San Diego Gas & Electric thought of smart meter deployment as a once-in-a lifetime opportunity to connect with each customer. They decided what they wanted it to look and feel like, and committed to creating a positive customer experience before, during, and after deployment.

Newmarket-Tay Power held several "Town Hall" meetings to engage customers and answer questions about smart meters and TOU pricing. Senior staff from NT Power spoke to groups that ranged from 10 to 250 people, in different venues and at different times of the day. They explained the basics of the electricity system in simple terms, and put a face to the utility name. NT Power found that these events were very effective, and continues to find opportunities to hold information nights, talk to customers, and build relationships**.**

Powershift Atlantic recognized that for "behind the meter" projects, the customer does not need the utility – the utility needs the customer. This means that utilities must demonstrate that they are trustworthy, and invest time and resources to gain the "social license to proceed".

Strategy 4. b) Partner with other organizations on education and engagement

As of 2012, smart grid initiatives are predominantly being led by utilities.[3] However, building consumers' understanding of the smart grid and electricity system is a large task, and one that utilities need not tackle alone. A few utilities are developing partnerships with universities, environmental organizations, and other community-based organizations to educate and engage consumers about the smart grid. These partnerships can increase the effectiveness of education and the credibility of utilities in the eyes of consumers.

Furthermore, utilities' dominance of smart grid programs may change in the near future as "smart home" technologies become broadly viable. Retailers will play an important role in providing marketing and education for "smart home" products such as in-home displays, smart appliances, and home area networks. Technology developers will play an important role in creating "smart home" products that provide value to consumers.

Utilities and consumers can benefit from the participation of these third parties. However, enhanced industry coordination may be required to ensure that the smart grid provides value to all stakeholders. Utilities may need to work with technology developers and vendors to deliver effective messages, products, and services. Utilities may also need to

[3] Few utilities interviewed for this research discussed the role of third parties in smart grid consumer engagement initiatives.

work with regulators to ensure that standards create a fair and effective space for third party involvement.

The Green Button initiative is one example of how standards can support the creation of innovative applications that benefit consumers. Utilities' voluntary adoption of common technical data standards (supported by the U.S. National Institute of Standards and Technology) means that consumers can use an array of new third-party web and smartphone tools to make the most of their energy usage information.

Box 16 describes how utilities have worked with relevant organizations to build understanding and support of smart grid projects. Future research should further explore how industry coordination can enhance the success of consumer engagement initiatives as smart grid deployment progresses.

Box 16 Building partnerships

4.b) Partner with other organizations on education and engagement

San Diego Gas & Electric gave prominent environmental organizations small grants to provide smart grid and electricity system education on their behalf. These credible organizations helped to increase smart grid knowledge and support.

SDG&E was also one of the first utilities to launch a "Green Button" customer energy usage data tool. Through the Green Button program, SDG&E customers can download their energy usage data in a simple-to-read format. They can use SDG&E's companion mobile application, and they can use third-party services for analysis.

Kansas City Power & Light has built partnerships with community groups and leaders, and has attended neighbourhood association meetings, religious gatherings and other non-typical utility settings. KCP&L is also partnering with the University of Missouri to teach high school students about the smart grid and electricity system.

Hydro One identified relevant stakeholders in advance of smart meter and TOU deployment, and worked with them to address potential concerns. For example:

- Hydro One worked jointly with the Ontario Federation of Agriculture in conducting TOU bill impact studies on different agricultural segments to demystify the bill impacts of TOU prices.
- Hydro One also worked with Ontario's privacy commissioner to develop a gold standard for protecting privacy, as documented in the report, *Privacy by Design*.
- Hydro One made presentations to key stakeholder groups (Federation of Ontario Cottagers Association, Ontario Municipal Association, etc.) throughout the meter deployment and TOU migration period to ensure leaders were in a position to answer questions from their members and constituents.

Conclusion

Already, the smart grid is changing the way North American electric utilities do business. Upgrades to production, transmission, and distribution systems are improving the reliability and efficiency of the electricity system. At the same time, utilities are rapidly realizing that smart grid deployment is not just a matter of technology deployment. It will also require an unprecedented focus on communication, engagement, and relationship-building.

As part of smart grid deployment, utilities will be asking consumers to help balance supply and demand by modifying the way they use and purchase electricity. They will also be asking consumers to support large investments in smart grid infrastructure.

Early lessons from the field suggest that consumers will not automatically understand, support, and participate in the smart grid. Gaining their understanding, support, and participation will require a new, customer-centric approach to consumer engagement.

While, there is no single "right answer" to the smart grid consumer engagement question, there is a near-universal focus on providing a positive customer experience at all stages of smart grid deployment. As part of the new focus on customer experience, effective smart grid consumer engagement appears to be characterized by a few broadly relevant success factors. These success factors, and the specific strategies that accompany them, are presented in Table 2.

Table 2 Summary of success factors and strategies for improving customer experience

Success factor	Strategy
1. Understand and respond to consumers' needs	a) Conduct market research. b) Provide information to those who need it, when they need it. c) Develop programs and services that create value for customers. d) Invest time and money into marketing and education.
2. Go further in providing customer-centric programs and services	a) Develop a range of programs, use a range of marketing tools. b) Make it easy to participate. c) Track your success. d) Take small steps, and learn from your experience.
3. Take consumer concerns seriously	a) Anticipate and prevent problems. b) Train customer service representatives. c) Work with individual customers to address their concerns.
4. Use the smart grid to build relationships	a) Build relationships with your customers. b) Partner with other organizations on education and engagement.

As smart grid deployment progresses, utilities can be expected to continue to play a key role – though not the only role – in consumer education and engagement. There is ample reason to believe that utilities will rise to the challenge of providing smart grid programs that "work" for consumers. Already, consumer-facing smart grid initiatives are improving in leaps and bounds. However, as technology advances, consumer engagement will need to advance just as quickly.

Regardless of the specifics of their roles, utilities should work to respond to consumer needs, provide customer-centric programs, take concerns seriously, and build relationships with customers and stakeholders. In other words, to keep pace and remain relevant in the smart grid era, utilities will need to institutionalize "customer experience" within their core business model.

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Appendix A. Methodology

This report was developed based on a literature review, background research on the smart grid activities of over 40 utilities across North America, and interviews with North American utilities. The overall goal of the report was not to identify the best utilities and initiatives, but to identify general "success factors" and specific strategies that can help utilities to achieve superior results from consumer-facing smart grid initiatives.

Selecting utilities and evaluating "success"

Utilities were selected for inclusion in the research based on the "success" of their smart grid consumer engagement initiatives. In evaluating success, we considered a number of criteria. Table 3 provides an overview of the criteria considered. This framework considers the process and outcomes for the consumer, for the utility, and for the electricity system.

Table 3 Framework for evaluating the success of smart grid consumer engagement

Evaluation criteria	Components
Consumer receptivity	Change in understanding of smart grid technologies and how to use them
	Change in support for smart grid technologies
Participation	Enrolment in initiatives
	Ongoing use of technologies
Real and perceived problems	Customer complaints and their resolution
	Cases of inappropriate disclosure or use of data
Equity	Participation of low-income and hard to reach customers
	Rates that reflect delivered costs
Program delivery	Perceived effectiveness of delivery methods
	Perceived value of program
Energy and demand savings	Energy savings (kWh) and peak demand savings (kW)

We sought to profile utilities that illustrate a range of levels of "success" along these criteria – from near-zero complaint rates and high rates of participation, to lawsuits and widespread consumer and media pushback. We also selected utilities to illustrate a broad range of smart grid technologies, programs, and consumer engagement tools.

Based on background research on over 40 utilities, we developed a shortlist of 23 North American utilities that illustrated success (or notable lack of success) against the evaluation criteria. We requested telephone interviews with all of these utilities, and conducted interviews with nine utilities.

Interviewing utilities and identifying "success factors"

Telephone interviews provided an in-depth understanding of the strategies, lessons, and results in nine Canadian and American utilities with notable smart grid consumer engagement programs. These utilities are listed in Table 4. We also drew on background research to profile the activities and results of a tenth utility (Reliant Energy, Texas), with whom it proved impossible to schedule an interview. The ten utility profiles are included as Appendix B.

Table 4 Utilities interviewed

Utility name	Province or State
BC Hydro	British Columbia
Hydro One	Ontario
Kansas City Light & Power	Kansas
Newmarket-Tay Power	Ontario
Powershift Atlantic	Maritime Canada
PowerStream	Ontario
Sacramento Municipal Utility District	California
San Diego Gas & Electric	California
Wright-Hennepin Electric	Minnesota

For each utility, we interviewed the staff responsible for residential smart grid programs, and provided them with a discussion guide in advance of the conversation. Interviews addressed the context for smart grid deployment, the process of developing smart grid consumer engagement initiatives, the programs developed, and the marketing strategies used.

We also asked for information on the results of smart grid initiatives, in each evaluation area listed in Table 3. Utilities were not able to provide data for all of the evaluation criteria (nor were all criteria relevant to all smart grid initiatives). However, all of the utilities described notable results in at least one evaluation area. Table 5 identifies the most

notable results for each of the ten utilities profiled, organized based on the most relevant evaluation area.

Finally, we asked utilities to discuss the strategies that influenced their success in these notable areas – the practices that led to positive results, as well as those that did not. Based on utilities' descriptions of these strategies, we identified strategies and practices that were common to many of the "successful" initiatives. This analysis led to high-level "success factors" and specific practices to help utilities achieve superior results from consumer-facing smart grid initiatives (Table 2).

These success factors and strategies do not guarantee success, as factors outside of a utility's control may impact the results of smart grid initiatives (e.g. an unusually hot summer the year of smart meter rollout leading to higher bills); rather, they increase the likelihood of success.

Within the scope of this project, it was not feasible to investigate consumers' experiences working with their utility, thus the report only reflects utilities' views of programs. An investigation of consumer experiences would be an important supplement to this type of research, as consumers may have different views of utilities' programs and how successful they are.

Table 5 Relevant evaluation criteria and results for each utility

Utility	Evaluation criteria	Results
BC Hydro	Consumer receptivity	As of October 2012, program support was about 51% based on public opinion polls. The smart meter refusal rate was 4%.
	Real and perceived problems	A small but vocal group of smart meter opponents has generated widespread negative media attention and lawsuits. BC Hydro received thousands of calls about bill increases and meter malfunctions, though almost all concerns were unfounded.
Hydro One	Consumer receptivity	Hydro One worked with key stakeholder groups (Federation of Ontario Cottagers Association, Ontario Municipal Association, Ontario Federation of Agriculture) throughout the smart meter deployment and TOU migration process to answer questions, and dispel misinformation.
	Real and perceived problems	Hydro One received a very low number of inbound calls (2-3% of customers) regarding smart meter deployment and TOU migration; most calls were about personal issues, rather than general concerns about deployment.

Utility	Evaluation criteria	Results
		Hydro One worked with the Privacy Commissioner of Ontario to develop a gold standard for protecting privacy.
Kansas City Power & Light	Equity	KCP&L's smart grid pilot project includes the Green Impact Zone, a 150 inner-city block area that suffers from high levels of unemployment and poverty. It includes a focus on training residents, creating jobs, and enabling energy savings.
	Program delivery	KCP&L has built partnerships with community groups and leaders that have proven valuable for educating and engaging consumers.
Newmarket-Tay Power	Consumer receptivity	NT Power's core message was that business would continue as usual. They explained smart meters and time-of-use pricing in simple terms, and found that consumers were able to understand the message. They experienced few complaints.
	Energy and demand savings	In the 2010 study of the impact of time-of-use pricing on electricity use among 1,800 customers, they saw a 3% shift in electricity use from on-peak to weekend off-peak, and minimal conservation.
Powershift Atlantic	Program delivery	Powershift uses load shifting devices to cycle participating customers' appliances on and off, or up and down, without disrupting customers, in order to balance demand with variable wind generation. Powershift found that consumers want to support renewable energy, and are willing to participate in the project without a financial incentive.
	Participation	Powershift has reached its target participants and loads in some locations, and no one has left the program yet.
PowerStream	Consumer receptivity	Customer satisfaction surveys suggest that customers were aware and adequately informed about smart meter installation and time-of-use pricing thanks to the materials they received.
	Program delivery	PowerStream is pursuing next generation smart grid programs for consumers, including home area network and electric vehicle to home technologies.
Reliant Energy	Program delivery	Reliant's "eSense" tools provide a range of smart grid programs and services to meet the needs of different types of consumers.

Utility	Evaluation criteria	Results
		Reliant has also used innovative tools (e.g. smart home makeover sweepstakes and "Innovation Avenue") to market programs and educate consumers.
	Participation	There have been rapid increases in the number of customers enrolled in time-of-use rate plans and "Weekly Summary Emails" of electricity use.
Sacramento Municipal Utility District	Consumer receptivity	Throughout smart meter deployment, SMUD maintained customer satisfaction levels in the mid-90th percentile, and the complaint rate was less than 0.1%.
	Participation	SMUD is piloting both "opt-in" and "opt-out" dynamic pricing programs. The opt-in program, has achieved an impressive 15% enrolment, and the opt-out program has only had about 3 to 4% of customers choosing to opt out.
	Equity	SMUD is exploring how smart grid technologies and education tools can help low-income customers, through the "Energy Insights Weatherization Pilot".
San Diego Gas & Electric	Real and perceived problems	SDG&E had a very low (0.16%) complaint rate for their smart meter deployment.
	Participation	SDG&E customers are automatically enrolled in the "Reduce Your Use" Demand response program, and the seven Reduce Your Use events in 2012 each included more than 500,000 participants. Events also led to a five-fold increase in customers viewing energy data online.
	Program delivery	SDG&E gave environmental organizations small grants to provide smart grid education on their behalf. SDG&E is also working with municipalities, universities, and industry on the Smart City San Diego initiative
Wright-Hennepin Electric	Participation	The MyMeter online portal has achieved 17% participation, though WHE has not systematically tracked how often participants use the portal. WHE has also achieved an impressive ~50% participation in demand response programs.
	Energy and demand savings	Preliminary evaluation suggests that use of the MyMeter online portal is associated with a 3% reduction in energy use.

Appendix B. Utility profiles

BC Hydro: Smart meter deployment

BC Hydro's smart meter deployment began in mid-2011 and was already 90% complete by the end of October 2012. The utility serves 1.9 million customers throughout a geographically challenging service territory spanning almost one million square kilometers. In addition, British Columbia has a long history of social activism.

Although the vast majority of customers accepted the new meters, like in many other jurisdictions, a small but vocal group of smart meter opponents generated widespread negative media attention.

Provide information to those who need it, when they need it. BC Hydro attributes ongoing stakeholder and customer engagement as a key to success. Their multi-phase, multi-channel engagement plan included engaging local and provincial government, the regulator, opinion leaders, experts, and other key stakeholders in advance, rolling out a 90-60-30 customer engagement approach and proving ongoing updates and briefings to media. For example, BC Hydro met with communities in advance of installation to explain the need for the upgrade and to answer questions.

Train customer service representatives. BC Hydro established a dedicated smart meter call centre team and spent significant time training Customer Service Representatives (CSR's) to respond to a broad range of customer enquiries. CSRs were trained to understand the different questions customers had related to the new technology and to escalate customer complaints when appropriate.

In addition, installers were trained to temporarily postpone meter installation if a customer requested it, to allow them time to get more information about the program.

Anticipate and prevent problems. Although the vast majority of customers accepted the new meters, like in many other jurisdictions, a small but vocal group of smart meter opponents generated widespread negative media attention. Misinformation spread fast with few checks on its validity.

The most visible opposition focused on health impacts including a complaint to the Human Rights Tribunal by those who feel radio-frequency has a negative impact on their health. Once the media controversy had begun, some experts were no longer willing to get involved for fear of becoming a target.

Customers also expressed concerns about bill increases during the first winter of installations. While the majority of the customers did not yet have smart meters, and BC Hydro's rate structure had not changed, there were thousands of calls from customers who felt their bill had increased. This unanticipated volume of calls created a significant backlog at the call center requiring immediate action.

Conduct market research. BC Hydro has conducted multiple types of market research as part of their ongoing smart meter deployment.

- Tracking research (ongoing public opinion polling) helped BC Hydro understand the changes in consumers' smart grid awareness and support over time.
- In-depth research and periodic focus groups provided insight into the opinions of different groups of customers, and helped BC Hydro understand why people believe what they believe about smart meters and the smart grid. In an initial focus group of smart meter sceptics / opponents, people had very low awareness about smart meters and could not explain why they were opposed.

BC Hydro also found shifts in public opinion as the economy changed. In early 2011, consumers were interested in the benefits related to climate change mitigation, prevention of electricity theft, and outage notification. In 2012, climate change was a lower priority and consumers were most concerned about electricity rates and costs.

Track your success. As of October 2012 public opinion polls showed that program support was about 51% and the smart meter refusal rate was 4%.

Memorable messages include:

Don't underestimate the importance of customer communications, and combat misinformation quickly.

Customers' number one concern is cost.

Hydro One: Smart meter deployment and time-of-use migration

Hydro One began pilot deployment of smart meters in 2005, and deployed smart meters across Ontario from 2006 to 2012. As of the end of 2012, almost all of Hydro One's 1.2 million residential, small business, and seasonal customers have a smart meter and over 1 million customers have successfully been transitioned to Time-of-Use (TOU) pricing. Along with this change, customers now have access to their hourly electricity usage information, the day after they use it via a secure internet site. to 2011, Hydro One shifted residential customers to time-of-use pricing.

In 2010, Hydro One began the planning of its Advanced Distribution System (ADS) Project. The ADS project is a long-term initiative to identify and assess modern digital equipment, validate costs and benefits, and recommend changes that can be implemented over time to modernize the distribution system. The Owen Sound region of Ontario serves as the trial area for ADS technologies, to confirm their viability prior to more widespread deployment in the distribution system. This step-wise approach will ensure prudent investments for customers.

Provide information to those who need it, when they need it. Hydro One communicated directly with customers before, during and after the

smart meter deployment and migration to time-of-use (TOU) rates. They explained how and when customers would be impacted using direct mailings, bill inserts, and door hangers at pre-determined times. For smart meters, the main impact was a short power outage.

For the TOU migration, communication included:

- Customers received a direct mail package 30 days in advance of the transition to TOU, with a letter, brochure, and TOU decal.
- After TOU rates came into effect, they received their last Regulated Price Plan bill, with a bill insert reminding them about TOU rates.
- Then, their first TOU bill included a bill insert to help them understand their new bill.

The communication materials for TOU rates conveyed two simple messages:

- A reminder that you are now being charged TOU prices. You can view your hourly, daily and monthly electricity use information the day after you use it.
- Shift your electricity use from on-peak to off-peak and mid-peak periods when possible to manage your bills, reduce strain on the electricity system, and help the environment.

Conduct market research. Hydro One tested the effectiveness of their communication methods and materials after the initial deployment of 20,000 smart meters. They found that radio ads were not very effective, but that direct mailings were; 81% of customers described the smart meter letter and brochure as "somewhat useful" or "very useful". Hydro One also used focus groups to identify the needs around TOU prices.

Track your success. Hydro One tracked the effectiveness of their smart meter deployment and TOU migration based on the number and type of incoming calls to the call centre. They received a very low number of inbound calls (2-3% of customers); most calls were about pragmatic, personal issues rather than general concerns about smart grid deployment.

Anticipate and prevent problems. Hydro One anticipated concerns related to bill increases and health impacts, and developed strategies to address them. Hydro One automatically called customers whose bills increased significantly after smart meter deployment to explain the reason for the higher than expected bill. (Most increases were due to adjustments for past electricity use not covered in previous, estimated bills).

Customers with questions and concerns related to health effects associated with radio-frequency (RF) emissions were provided a report on the topic commissioned by Hydro One prepared by an independent expert. In addition, they were provided information on the options available to them including relocating their meter base (at their cost) which is the case for all Ontario electricity consumers, or installing a

cellular point-to-point meter (as opposed to RF mesh meters) as some customers believed these meters to be less of an impact.

Partner with other organizations to support smart grid deployment. Hydro One identified several relevant stakeholder groups in advance of smart meter and TOU deployment, and worked with them to address potential concerns. For example:

- Hydro One worked cooperatively with the Ontario Ombudsman's Office to ensure a full understanding of the nature of billing complaints and Hydro One's approach in addressing them.
- Hydro One worked jointly with the Ontario Federation of Agriculture in conducting TOU bill impact studies on different agricultural segments to demystify the bill impacts of TOU prices.
- Hydro One worked with the Privacy Commissioner of Ontario to develop a gold standard for protecting privacy, as documented in the report, Privacy by Design.
- Hydro One made presentations to key stakeholder groups (Federation of Ontario Cottagers Association, Ontario Municipal Association, etc.) throughout the meter deployment and TOU migration period to ensure leaders were in a position to answer questions from their members and constituents, and dispel smart meter myths and misinformation.

Memorable messages include:

Communicate to those impacted, when they are impacted, about what the impacts are going to be.

Understand your business, anticipate problems, and develop strategies to manage them.

Kansas City Power & Light: Smart grid pilot in the Green Impact Zone

Kansas City Power & Light's (KCP&L) smart grid pilot project involves smart meters, time of use rates (TOU), and home energy management tools. The demonstration area includes the Green Impact Zone, a 150 inner-city block area that suffers from high levels of unemployment and poverty. The project includes a focus on training residents, creating jobs, and providing tools that enable smart energy decisions.

KCP&L serves more than 800,000 customers in northwestern Missouri and eastern Kansas. It is a full-service energy provider and resource, and a wholly owned subsidiary of Great Plains Energy Incorporated.

Conduct market research. KCP&L used focus groups to gauge residents' understanding and motivations. They found that people are most worried about their budget, and are interested in saving money. They also found that consumers had very high expectations about home energy management devices. For example, people expected that an in-home display (IHD) would enable them to reduce their use by 30%.

Provide information to those who need it, when they need it. KCP&L set an objective to have each customer receive 10 smart grid-related messages before exchanging their meter. In response to the results of market research, KCP&L was very conscious of the need to manage expectations. Their messaging thus focuses on control and choice, rather than on saving money.

To address the goal of enabling customers to be "smart energy consumers", KCP&L has also established educational projects, including the Smart Grid Innovation Park and Project Living Proof Demonstration House. These interactive displays have attracted more community interest than anticipated.

Develop programs and services that provide value to customers. KCP&L sought to demonstrate the smart grid value proposition at the time of smart meter deployment. They provided customers with a welcome kit that included a light bulb, information about energy efficiency, and instructions for accessing the online energy management portal. They also offered interested customers a free IHD. KCP&L received only positive media attention, and only encountered one customer that didn't want a smart meter.

Take small steps, and learn from your experience. KCP&L learnt from its experience giving away in-home displays (IHDs) at the time of smart meter installation. While customers were happy to receive free IHDs, the IHD technology did not work immediately with the new AMI infrastructure. After ironing out the technological kinks, KCP&L hired ambassadors to go door-to-door, track the IHDs that were not working, and try to fix them. They estimate that 100 IHDs were simply thrown away after consumers found them to be non-functional. They plan to move more slowly in the future.

Make it easy to participate. KCP&L set goals for participation in each of their home energy management programs (online portal, TOU rates, IHDs, programmable thermostats, and Home Area Networks). Unfortunately, participation in the programmable thermostat and HAN programs has been limited by the conditions for participation; only 50% of consumers have central air conditioning, and not all consumers have internet.

Partner with other organizations on education and engagement. KCP&L has built several local partnerships that have helped KCP&L educate and engage consumers. For example:

- KCP&L has hired and trained two area residents to be smart grid ambassadors, and assist with community outreach and education.
- KCP&L has attended neighbourhood association meetings, religious gatherings and other non-typical settings. Effective outreach required going into the community where customers live their lives.

- KCP&L is partnering with the University of Missouri to teach high school students about the smart grid and electricity system.
- KCP&L is partnering with a vendor on Project Living Proof, a smart grid demonstration house that features home energy management systems, rooftop solar panels, and an electric vehicle charging station.

Memorable messages include:

Effective engagement required building partnerships with community groups and leaders. Outreach required us to go into the community where our customers live their lives.

Newmarket-Tay Power: Smart meter deployment and time-of-use migration

Newmarket-Tay Power Distribution (NT Power) was one of the first utilities in Ontario to deploy smart meters, and completed deployment in the spring of 2007. They began migrating customers to time-of-use (TOU) pricing in December 2007, and finished the transition in early 2009. To increase consumers awareness and acceptance of smart meters and TOU pricing, NT Power worked with both the Ontario's Ministry of Energy and Independent Electricity System Operator (IESO) to test different messages about smart meters and TOU rates.

NT Power serves about 30,000 customers in south-central Ontario (Greater Toronto Area).

Build relationships with your customers. NT Power held several "Town Hall" community meetings to engage customers and answer questions about smart meters and TOU rates. Senior staff from NT Power spoke to groups from a range of 10 to 250 people, in different venues and at different times of the day. They explained the basics of the electricity system in simple terms, and put a face to the utility name. NT Power found this form of consumer engagement most effective and continues to find more opportunities to hold information nights, talk to customers, and build relationships.

Provide information to those who need it, when they need it. In the early stages of implementation, NT Power's core message was that "business" (meter reading, billing, etc.) would continue as usual. First, NT Power communicated that the utility would be changing meters, but that nothing else would change. Then, NT Power communicated that TOU pricing would benefit the electricity system, with minimal impact on consumers. NT Power also continued reading meters for a full year after the shift, to reassure customers that the new technology was working properly.

Conduct market research. NT Power worked with the Ontario Ministry of Energy and IESO to test different messages about smart meters and TOU rates. They held numerous focus groups while developing

communication materials, and used surveys after deployment to evaluate the effectiveness of their communication tactics.

Take small steps, and learn from your experience. From a technical and a consumer engagement perspective, NT Power found it very valuable to roll out technologies in small, well managed steps. Changes can be challenging for consumers, and continual communications of the process proved important. NT Power rolled out TOU rates to its 30,000 customers over a 14-month period.

Train customer service representatives. NT Power's CSRs were engaged throughout the entire smart meter and TOU deployment, and were trained to answer the most common smart meter and TOU-related questions. In addition, all NT Power employees (line staff, metering staff) were trained to to answer basic questions about smart meter and TOU deployment.

Develop programs and services that create value for customers. NT Power accompanied smart meters and time-of-use pricing with a switch to monthly billing, based on calendar months. They received very positive feedback about this switch, since consumers think in calendar months (rather than mid-month to mid-month).

Track your success. NT Power conducted a detailed study of the impact of TOU rates on electricity use. In the 2010 study of 1,800 customers over 18 months, they saw a 3% shift in electricity use from on-peak to weekend off-peak; however minimal conservation was observed during the study period. This suggested either that electricity prices do not motivate changes in electricity use, or that consumers do not yet have the tools to manage their electricity use.

Memorable messages include:

A phased approach to deployment was easier to administer, and easier for consumers to accept.

Town Hall events provided the best communication channel within our service area; however other channels (e.g. ads, billing inserts) provided excellent re-enforcement.

We hadn't engaged customers as much in the past. Now we are still creating opportunities to get out there and talk to our customers.

Powershift Atlantic: Load management for integration of wind integration

As part of Powershift Atlantic, Canada's maritime electric utilities are undertaking a research and demonstration project that uses load shifting devices to balance customer demand with variable wind generation. The project uses devices remotely on water heaters, boilers, and refrigeration units that can be cycled on and off, or up and down, without disrupting participating residential and commercial customers. Powershift Atlantic has reached its target participants and loads in some parts of the region, and is still recruiting participants in other locations.

Launched in 2010 as a Clean Energy Fund project through Natural Resources Canada, PowerShift Atlantic is a four-year collaborative research initiative led by New Brunswick Power, in partnership with Saint John Energy, Maritime Electric, Nova Scotia Power, New Brunswick System Operator, the University of New Brunswick, and the Governments of New Brunswick and Prince Edward Island.

Conduct market research. The Powershift team used best practice research, baseline telephone interviews, one-on-one interviews and focus groups with residential and commercial customers as part of program development. Powershift conducts quarterly surveys with program participants to track satisfaction with the program.

Market research revealed that consumers had a very low level of awareness at the start of the project. It revealed that consumers are interested in supporting wind and renewable energy, though they also want to save money down the road. Customers were willing to participate in the research and demonstration project without a financial incentive, and wanted to receive information about the program's activities and results. Customers are genuinely interested in being part of the solution with renewables and a more sustainable future. Being socially responsible and action for the "greater good" are very important to customers.

Invest time and money into marketing and education. Powershift emphasized the importance of spending time and money on marketing, to gain the social license to proceed. They worked with external marketing firms to move towards a whole new level of communication. Armed with the results of market research, they developed simple visual diagrams to help consumers understand the project, and focused on the benefits related to wind energy. They tested and re-tested their communication materials so that the messages "stuck", and the colours and images reinforced the messages.

Make it easy to participate. Over the course of the pilot project, Powershift moved from a full participation agreement to a shorter form participation agreement for commercial customers. This improvement made it easier for customers to participate.

Take small steps, and learn from your experiences. Powershift began by rolling out the program to a small group of 50-60 "uber-friendly" consumers (utility employees). This enabled them to test the technology and establish supporting tools and processes. Then, Powershift added 50-75 "friendly" consumers (volunteers from home shows and events). Only after these two small steps did Powershift recruit "regular" consumers to participate.

Use smart grid deployment to build relationships. Powershift Atlantic recognized that for this type of project, the customer does not need the utility – the utility needs the customer. This is a major change. It means that utilities must demonstrate that they are trustworthy, and invest time and resources to gain the "social license to proceed".

Memorable messages include:

The customer doesn't need us. We need the customer.

Marketing firms aren't cheap, but if we're going to build a virtual power plant, we have to spend money on the social license to proceed. Traditionally utilities have done limited marketing. However, engaging customers in the future will require funding of marketing programs. This is a significant part of this transformation.

PowerStream: Smart meters, time-of-use pricing, and engagement tools

PowerStream was among the first Ontario utilities to deploy smart meters, with installation beginning in 2007. The migration to time-of-use pricing began in 2009, and was completed in 2011. PowerStream has developed a wide range of smart grid education and engagement initiatives, including social media contests, YouTube videos, fact sheets, and interactive displays. PowerStream is also undertaking pilot and demonstration projects involving home area networks (HAN), electric vehicle to home (V2H) technologies, and self-healing grid (FDIR) technologies.

PowerStream serves 355,000 customers in Ontario and is jointly owned by the municipalities of Barrie, Markham and Vaughan. In 2012, PowerStream was named by the Canadian Solar Industry Association as "Developer of the Year" for their current and planned solar projects.

Provide information to those who need it, when they need it. For smart meter deployment, PowerStream sent consumers information packages a few weeks ahead of time, and left them door hangers after the fact. For time-of-use rate migration, consumers received a welcome package and a reminder package.

Track your success. Customer satisfaction surveys suggest that customers were aware and adequately informed thanks to the materials they received.

Anticipate and prevent problems. PowerStream anticipated that smart meter deployment would be accompanied by a significant increase in calls to the call centre, and increased staffing levels accordingly. They were pleasantly surprised that calls to the call centre were relatively low.

Invest time and money into marketing and education. Consumer focus groups on the smart grid have revealed that consumers need to understand the smart grid in non-utility terms. PowerStream has sought to address this need in a few ways:

- PowerStream has developed six simple and attractive smart grid case studies for consumer education. They address different aspects of the smart grid, from smart meters and home energy management tools to electric vehicle to home technologies. Each case study clearly explains the challenge, the solution, and the benefits.

- PowerStream's interactive Power for Tomorrow booth at community events showcases new technologies and services related to renewable energy, smart grid and electric vehicles.
- PowerStream's YouTube videos, blog, and "Follow the smart grid to win" social contest also demonstrate the utility's commitment to next-generation smart grid marketing and education.

Develop programs and services that provide value to customers. PowerStream is actively pursuing next generation smart grid programs to help consumers manage their electricity use. For example:

- PowerStream is working with Nissan Canada to demonstrate "electric vehicle to home" (EV2H) systems, where fully or partially charged electric vehicle batteries can provide power to homes. PowerStream is interested how EV2H systems can assist with load optimization, and can help Ontario homeowners on time-of-use rates.
- PowerStream is also conducting a Home Area Network pilot project involving 1,700 customers. The pilot will provide consumers with different methodologies to remotely control loads in homes.
- Powerstream's Smart Meter "last-gasp" input to the Outage Management System enables faster response to outages and improves customers' access to information on outages.

Memorable messages include:

"Smart Grid technologies are helping us to build a social energy network in this province, so it is somewhat fitting that we are using a contest, in combination with the power of social media, to communicate this to consumers."[4]

Reliant Energy: Smart grid energy management and education tools

Reliant Energy has developed a range of smart grid programs and services to meet the needs of different types of consumers. Reliant has also used innovative tools to market programs and to educate consumers about the smart grid opportunities.

Reliant Energy serves about 1.6 million customers in Texas, and is owned by NRG Energy.

Develop a range of programs and services that provide value to consumers. Reliant's "eSense" tools provide customers with a range of smart grid technology, service, and program options. For example:

- Consumers can remotely control their home's energy setting using an advanced programmable thermostat.

[4] http://blog.powerstream.ca/2012/10/powerstream-contest-educates-consumers-benefits-smart-grid/

- Consumers can choose from two dynamic pricing plans: a traditional time-of-use rate plan and a more simple version that provides a discount off of a standard flat rate for off-peak use.
- Smart phone apps, free iGoogle gadgets, weekly summary emails, text message alerts, and online portals enable consumers to interact with the energy data. Using the "Neighborhood Compare" tool, households can compare electricity usage with other homes.

Reliant's time-of-use rate plans and the Weekly Summary Emails have been particularly successful so far; they are "setting new records every month in terms of the number of customers enrolled on them."

Use a range of communication tools. Reliant has also developed creative initiatives for marketing and education.

- In 2010, Reliant ran a smart home makeover sweepstakes to promote its smart grid services and technologies. Two Texas households won a $10,000 package with the latest in home automation and energy-saving tools and technologies (also, a flat-panel TV and iPad).
- More recently, Reliant's "Innovation Avenue" initiative engaged twelve real families on a neighbourhood block in Houston to demonstrate "how effortlessly advanced energy technology can empower their lives". Within six months, households reduced their electricity usage by 17%, on average. Profiles of the families help consumers connect to them on a personal level, while information on energy-saving tips, programs, and technologies promote Reliant's offerings. A video entitled "Real Street. Real Innovation" accompanies the web-based information.

Memorable messages include:

Reliant's Weekly Summary Emails and time-of-use rate plans are setting new records every month in terms of the number of customers enrolled in them.

Sacramento Municipal Utility District: Dynamic pricing and customer applications

Sacramento Municipal Utility District (SMUD) started smart meter installation in late 2009, and completed installation in 2012. Throughout smart meter deployment, SMUD maintained customer satisfaction levels in the mid-90th percentile, and the complaint rate was less than 0.1%. SMUD is now conducting pilot projects involving dynamic pricing, home energy management tools, and electric vehicle load control. The dynamic pricing pilot is testing different rate designs and incentives, as well as "opt-in" vs. "opt-out" enrolment.

SMUD is publicly owned utility that serves 1.4 million people (about 600,000 customers) in the Sacramento area.

Conduct market research. SMUD conducted extensive front-end research as part of their dynamic pricing program design. In focus groups, they investigated how consumers could understand the new rates and be motivated to participate. They found that saving money is the most universal motivator, though a number of customers were driven by the environmental message. SMUD also tested how consumers would react to different words. They found that a lot of terms used in the utility sector sounded scary, stodgy or off-putting to customers. For example, "critical peak" sounds like an emergency. An "event day" isn't really an event, in consumers' minds.

Finally, customers in focus groups clearly stated that they have no idea how much electricity their appliances use. They asked for very concrete examples about how to save – what should I turn off, and how much will I save? This helped SMUD design the program's marketing and education materials.

Invest time and resources into marketing and education. In response to the results of market research, SMUD positioned the dynamic pricing pilot as an opportunity for customers to save, and included the environmental benefits as a secondary message. SMUD also conducted a thorough education campaign as part of recruitment, providing high-level explanations of the program, information about the electricity use of different appliances, and specific recommendations for reducing peak use (e.g. recipes that use less electricity). Preliminary results confirm the importance of education; in a survey just after recruitment, customers who felt they understood the purpose of the dynamic pricing program were significantly more likely to be satisfied with it.

Develop a range of programs, use a range of communication tools. Make it easy to participate. SMUD is piloting both "opt-in" and "opt-out" dynamic pricing programs. For the opt-in program, SMUD achieved an extremely impressive 15% enrolment. They used a range of enrolment tools: direct mail business reply cards, outbound calling campaigns, and online enrolment tools. Preliminary results suggest that it was important to provide this range, since different demographics enrolled using different tools.

The opt-out program has significantly higher enrolment, with only about 3 to 4% of customers choosing to opt out. Though originally concerned about the "opt-out" program, SMUD was surprised to find that there was no pushback from customers. They were also surprised to find that the opt-in and opt-out programs had similar levels of customer satisfaction.

SMUD is also exploring how several smart grid technologies and education tools can help low-income customers, through the "Energy Insights Weatherization Pilot". The pilot includes four treatment groups: 1. weatherization energy assessment only (control group), 2. energy assessment with in-home display, 3. energy assessment with Nest learning thermostat, and 4. energy assessment with online energy usage charts and educational tools. The pilot will help SMUD develop smart grid programs that address the unique needs of low-income customers.

Develop programs and services that provide value to consumers. In addition to its pilot projects, SMUD is working on applications that will be available to all customers:

- They are revamping their online portal to add bill alerts, notes, and other features that can help consumers decipher what may be affecting their load.
- They have also developed a program that will allow customers to check out in-home displays from the utility or the library. This will give them a sense of how electricity loads and costs change over the course of the day, as consumers turn things on and off.

Memorable messages include:

Customers in focus groups were clear in stating that they had no idea how much electricity their appliances use. They asked for very concrete examples about how to save – what should I turn off, and how much will I save?

A lot of terms used in the utility sector sounded scary, stodgy or off-putting to customers. For example, "critical peak" sounds like an emergency.

San Diego Gas & Electric: Smart meter deployment and smart grid programs

San Diego Gas & Electric (SDG&E) began widespread smart meter deployment in late 2009 and completed smart meter installation in 2011, with very few complaints along the way. Customers have access to an online portal and mobile applications, and are automatically enrolled in the "Reduce Your Use" demand response program, launched in July 2012. SDG&E is also a leader in network integration of rooftop solar panels and electric vehicles, and has won several accolades for its smart grid program.

San Diego Gas & Electric is a regulated public utility that provides energy service to 3.4 million people through 1.4 million electric meters and 850,000 natural gas meters in the San Diego area.

Build relationships with your customers. San Diego Gas & Electric thought of smart meter deployment as a once-in-a lifetime opportunity to connect with each customer. They decided what they wanted it to look and feel like, and committed to creating a positive customer experience before, during, and after deployment.

Provide information to those who need it, when they need it. SDG&E built on a 90-60-30 day communication strategy for smart meter deployment:

- 90 days in advance, SDG&E discussed the deployment with elected officials. Officials were happy to be informed and provided very little negative feedback.

- 60 days in advance, SDG&E was visible at community events with smart meter displays and information about DSM programs.
- 30 days in advance, customers received a mailed letter.
- 3-5 days in advance, customers received an automated phone call.
- Installers left a door hanger inviting customers to call with questions
- 3-5 weeks after deployment, SDG&E went door-to-door answering questions and handing out information about DSM programs. Customers were pleasantly surprised to receive this follow-up visit.

Anticipate and prevent problems. SDG&E sought to be proactive, transparent and flexible in all of its communications. This involved posting all information on the website, and keeping this information up to date. It also involved developing simple communication materials (flyers and letters) that can be easily revised in response to feedback.

Work with individual customers to address their concerns. SDG&E sought to be extremely responsive to customer concerns. They developed procedures for addressing and escalating concerns, and worked one-on-one with the small number of customers who were most concerned about health impacts or bill increases. For example, they conducted audits in people's homes to identify why their use had increased. SDG&E emphasized the importance of working with individual customers, rather than groups of customers.

Track your success. SDG&E evaluated their smart meter deployment based on the customer complaint rate. Overall, they had a very low (0.16%) complaint rate for their smart meter deployment.

Develop programs and services that create value for customers. SDG&E has gradually been developing new, easy-to-use smart grid tools and programs.

- SDG&E customers are automatically enrolled in the "Reduce Your Use" Demand response program. The seven Reduce Your Use events in the summer of 2012 each included more than 500,000 participants, for average bill credits of $17. Events also led to a five-fold increase in customers viewing their energy data online.
- The My Account web portal and online services have been enhanced with charts and features, including a roof-top solar potential calculator.
- SDG&E launched a mobile application that includes online bill pay functionality and an outage map. They also improved their connection and disconnection system, so that electricity services can be started, stopped or transferred all online.
- Through the Green Button program, SDG&E customers can download their data directly and use SDG&E's companion

mobile application. They can also use third-party services for analysis of their energy data.

Partner with other organizations on education and engagement. SDG&E recognized the need to partner with other organizations to educate and engage consumers. For example:

- SDG&E gave prominent environmental organizations small grants to provide smart grid education on their behalf. These credible organizations helped to increase smart grid knowledge and support.
- SDG&E is working with municipalities, universities, and industry on the Smart City San Diego initiative. Projects include smart appliance testing, and a solar photovoltaic panel that will charge electric vehicles at the Zoo parking lot.

Learn from your experiences. SDG&E's "Biggest Energy Saver" pilot contest involved 25 households and was extremely successful; participants were saving 40%, interacting with each other, and working toward prizes. However, the follow-up San Diego Energy Challenge involving 500,000 customers has not been as successful in engaging people. In the future, SDG&E will try using segmentation to target customers with high bills and the greatest motivation to save energy.

Memorable messages include:

Smart meter deployment is a once-in-a-lifetime opportunity to connect with every single customer.

Utilities can't do this alone. We need multiple partners to help educate customers.

Wright-Hennepin Electric: Smart meter deployment and engagement tools

Wright-Hennepin Electric (WHE) finished deploying smart meters to all residential customers in October 2008, and encountered few complaints. WHE uses social media as well as traditional communication tools to reach consumers, and their online portal has helped consumers to manage their electricity use. WHE has also organized two successful residential energy saving competitions.

WHE is a member-owned, non-profit electric utility headquartered in Rockford, Minnesota that serves more than 46,000 homes, businesses and farms.

Provide information to those who need it, when they need it. As part of smart meter deployment, WHE provided direct mail letters to customers in advance of the change. They developed fact sheets, and a list of Frequently Asked Questions, and encountered very few complaints. (Only one customer did not want a smart meter.) WHE has also achieved an impressive ~50% participation in demand response programs, by targeting marketing to non-participants with high summer electricity bills.

Use a range of communication tools. WHE has used a range of communication tools to promote smart grid programs, to keep in touch with customers, and to provide information about saving energy.

- WHE promoted the MyMeter online portal through bill inserts and broader marketing, as well as through the call center and energy auditors. They found that most customers were referred to MyMeter from the call center.
- WHE is supplementing its traditional newsletter with blogging, Twitter, Facebook, text message alerts, and a LiveChat service. These tools are designed to reach younger customers who are less likely to read the newsletter.
- WHE organized two "Littlest User" residential energy saving competitions. In the first 4-month competition that involved 12 families from two utilities, WHE families achieved average energy reductions of 43%. In the second competition (that is ongoing), 31 families will compete against each other over a period of 3 months to reduce their energy use. WHE customers can track families' progress online, and can read about their energy saving strategies.

Track your success. The MyMeter online portal has achieved 17% participation, though they have not systematically tracked how often participants use the portal. Preliminary evaluation suggests that use of the portal is associated with a 3% reduction in energy use.

Train customer service representatives. WHE trained customer service representatives to respond to questions and concerns regarding smart grid programs, and to discuss the benefits of the smart grid. CSRs also play a key role in driving uptake of the MyMeter online portal and demand response programs. Finally, WHE involved CSRs in developing the MyMeter online portal. Because CSRs are on the front line, they understand what customers are looking for and can anticipate the "pain points" for a product or service.

Work with individual customers to address their concerns. WHE's customer service representatives spend time with individual customers to understand and address their concerns. Using MyMeter, CSRs can help customers understand their bills. WHE has also visited customers' homes to help them understand why their energy use has increased.

Memorable messages include:

Because customer service representative are on the front line, they understand what consumers are looking for and can anticipate the "pain points".

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