Will Smart Meters Ripen or Rot?
Five First Principles for Embracing Customers as Co-creators of Value

Peter C. Honebein, Roy F. Cammarano, and Kat A. Donnelly

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AUTHORS

Peter C. Honebein, Ph.D. is a principal with Customer Performance Group, LLC and an adjunct professor at Indiana University and the University of Nevada, Reno. All correspondence regarding this paper should be directed to him at peter@honebein.com. Roy F. Cammarano is a principal with Customer Performance Group, LLC. Kat A. Donnelly, P.E., is an independent consultant and associate of Customer Performance Group, LLC.

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Introduction
Today, utilities around the world are preparing their fields for the smart grid. If we imagine the installation of smart meter systems as planting the seeds for a future crop of energy efficiency solutions, we must create the ideal environment for proper growth and harvesting. In other words, will smart meter systems ripen or rot on the walls of the world's homes and businesses? Will customers find value in the services a smart meter system offers? With business cases weighted toward operational benefits, there is a significant risk that societal benefits, such as demand response, energy efficiency, and load shifting, will remain underdeveloped and underutilized. The same is true for customer-oriented services, such as online presentment, in-home displays, and other information- and convenience-based products. To ensure that multi-billion-dollar investments in smart metering benefit society, utilities, along with customers, regulators, utility executives, and vendors, must engage in smart planning. How smart? So smart that it balances the humans who will co-create value with smart metering technologies and the technologies themselves – a symbiotic relationship known as the "socio-technical link."

The human element is something that utilities and their regulators have found hard to embrace. For the past 100 years, the industry has focused on safety and reliability. This, quite understandably, created what Centerpoint Energy's COO Tom Standish calls a "paternalistic culture," in which the utility knows what is best for its customers. Value, in terms of the energy required to power great economies, was what utilities created and what customers consumed.

Today, a new expression of value is beginning to emerge, one of collaboration in which customers are seen as co-creators of value. As co-creators of value, customers contribute their knowledge, skills, and attitudes to unlock the value embedded in goods and services. For example, a hybrid car, when it is not being driven, does not deliver value. It is only when the customer puts the car into use, commuting, traveling, or running errands, that value is co-created. In other words, value is co-created only when the knowledge and skill of the organizations building hybrid cars is combined with the knowledge and skill of a customer accomplishing a task with that car. The better the knowledge and skill of the both parties, the more value that is co-created.

In the energy industry, demand response is like the hybrid car described above. Value creation, the reduction of demand on certain days, depends upon the knowledge, skills, and attitudes of customers. Demand response is a high priority, illustrated by Congress expressing the position that demand response and its enabling technologies play a crucial role in developing the smart grid. Other federal regulators overseeing wholesale power and regional markets require planning and implementation of demand response programs. States play a significant role in demand response policy setting since the state Public Utility Commissions (PUCs) oversee approval of retail rates and utility infrastructure investments. In fact, state level policies vary, but programs are under way in most states.

If the energy industry is to embrace customers as co-creators of value, how and when should it proceed with the social side of smart meter systems? This article distills from various

multidisciplinary conferences, workshops, research papers, and case studies the *first principles* for designing the social side of the smart metering equation. The first principles are:

1. Embrace customer-centered design
2. Blend rational and emotional experiences
3. Engage customers in small, observable steps of adoption
4. Segment by observable customer actions
5. Use action research to drive emergence and evolution of solutions

Think of first principles as a checklist that smart metering stakeholders (regulators, utilities, interveners, and vendors) use to craft, criticize, evaluate, revise, and judge business cases, regulatory filings, advice letters, strategic plans, and roadmaps associated with smart meter initiatives. In other words, if one does not see the first principles integrated into these controlling documents, then the risk of smart meter rot increases.

1. Embrace customer-centered design

Have you ever pushed a door that was meant to be pulled? Turned on a faucet expecting cold water, but out came hot? Set what you thought was the back-left burner on a stove to high, only to learn later that it was a different burner you set? Accidentally deleted important files on your computer because you mistakenly pushed the wrong key or clicked the wrong button? If you have ever experienced these or similar situations, you are keenly aware of what customer-centered design IS NOT. If fact, when customer-centered design is successful, you probably don't notice anything at all. Things just seem to work right.

Customer-centered design means designing experiences from the customer's perspective. Essentially, one stands in the customer's shoes and asks how a customer would perceive this cue, accomplish that task, use, adopt, and enhance this product, and so on. The design process might also involve engaging customers as codesigners, in which customers have a role in generating requirements, designs, scripts, and prototypes for a product or service. Most importantly, customer-centered design means that there are well-established feedback loops between customers and designers so that products and services are designed iteratively with the customer's in mind.

If we take to heart Tom Standish's earlier claim that utilities have a paternalistic culture, embracing customer-centered design will be a challenge for the industry. Other industries have set customer expectations for what a good customer experience is, in terms of data accessibility, self-service, proactive communication, and customer support. While the utility industry is investing significant resources to ensure that the technology works, we must not forget to allocate resources that ensure the experience enables customers to perform. Customers are becoming more sophisticated and are learning to expect more from their utility. But will they know how to use what the industry provides to them to unlock greater value from their energy services? For example, if a utility expects to co-create value with customers, they must offer customers greater convenience, choice, and control—three key aspects of customer-centered design. It will be up to the smart utility to embrace customer-centered design as means of enabling smart meters to ripen.

2. Blend Rational and Emotional Experiences

Have you driven a Toyota Prius lately? This vehicle offers customers a very rational driving experience in terms of its extremely high miles-per-gallon and the monetary savings associated with that economy. And customers need to change their driving behaviors to achieve the highest fuel economy, another rational behavior. However, while there are other hybrid vehicles that match the Prius' economy, the Prius is the runaway best seller. Why? Perhaps because it has such a distinct, emotionally-oriented design that stands out in traffic and allows the customer to easily express their social self-concept and identity to others.

Motivating and enabling customers to change to and maintain desired behaviors requires one to blend rational and emotional experiences into the design of their products and services. A rational customer experience enables a customer to accomplish tasks (which we call *customer performance*). An emotional customer experience engages a customer in feeling good while they are involved in accomplishing that task. Emotional experiences include such influencing factors as social networks and norms, individual belief systems, social status and identity, social context, and psychological characteristics. As shown in Figure 1, a customer experience blends rational and emotional qualities.
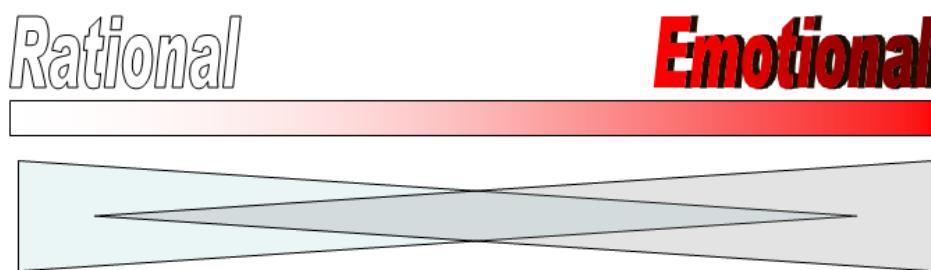

Figure 1: The rational and emotional experience blend

While customer experiences should try to achieve a 50-50 blend, the utility industry has historically designed customer experiences from a more rational position. For example, look at the meters that are attached to houses in a neighborhood. Are they same color as the house? Is the meter on one home different than the meters on the other homes? Now look at the cars on the street. Are they, in the words of automaker Henry Ford, "any color so long as it's black?" If you see variety, then you see emotional design shining through. What about a utility's paper bill or its website? Do they not only provide the information customers need, but look good as well?

A shining star of emotional design is emerging through several small start-up service providers who are bringing emotional design to online presentment, in-home displays, network and automation technology, and distributed generation. For instance, third-party services providers are emotionally enhancing the simplest service that the utility provides: the bill. These service providers embrace emotional design by providing customers with useful visual and textual information about energy usage, energy efficiency tips, and even comparisons with their neighbors. In some cases, they are even employing social media marketing tools to establish active and growing communities of customers who desire greater energy efficiency. These social networks act as trusted advisors and provide models of acceptable and appropriate behaviors, including what technologies to buy and what services to use. Enhancing the emotional qualities of services that smart meters enable smart meters to ripen.

3. Engage customers in small, observable steps of adoption
People do not change their behavior easily. After all, changing behavior is hard. One has built up years of experience doing something a certain way, and it has become automatic and easy. Let us demonstrate what we mean. Fold your arms in front of your chest. Good. Now fold your arms in front of your chest *the opposite way*. Does it feel funny? Unnatural? Just plain wrong? Now imagine that from this day forward, you had to fold your arms the opposite way. Would you be able to easily adopt this new behavior?

Research shows that to change a person's behavior, it is best to take it in small steps. A classic experiment conducted in the 1960's asked homeowners to display their support of safe driving on their property. Homeowners who were asked to display a large sign in their yard typically refused. However, homeowners who first agreed to display a small sign in their window were much more likely to agree to display the large sign in their yard when asked. Small observable steps ultimately led to a significant change in behavior.

Now, think about utility customers changing their behavior to participate in demand response. Do you think that when your smart meter system is installed and you have your first peak day you can get all your customers to immediately drop demand between the hours of 11 AM and 6 PM by 12%? Yeah, we don't think so either. Before you can get to this desired performance, if that's the goal you need to hit, you need to engage customers in smaller steps that will lead to larger changes in behavior. You might start with something simple, like incenting customers to sign up for a free demand response notification program, whether it is by email, text message, an in-home display, or some other cool technology. You might then ask customers to sign up other people who live in their home for notification. Then when you notify customers, you might set a very low, achievable goal for how much they should reduce. After a few peak days, you slowly increase the goal to a level that achieves your megawatt reduction objectives. Through small observable steps, the industry can engage customers and enable smart meters to ripen.

4. Segment by Observable Customer Actions
In a New York Times article, the authors of the book Freakonomics explore the difference between what people say they do and what they actually do. For example, consider the hand washing behavior of doctors. An Australian research study showed that doctors *said* they washed their hands 73% of a time, but when observed by researchers, they only washed 9% of the time. Now, extend that behavior to regular people. Ask any large group of people whether they always wash their hands after going to the restroom. Without a doubt, the answer will be a resounding yes. However, when one observes hand washing behavior in restrooms, one will likely find the number of people actually washing their hands quite less than the people who said they would wash their hands. How about demand response? How many of you will reduce your electricity consumption 12% on the next demand response day?

Customer performance segmentation is the process of determining which group or groups of customers are most likely to adopt a new behavior. After all, an organization typically does not have the resources to influence the behavior of all customers – it must divide and conquer, allocating resources to those customers who have the greatest likelihood of co-creating value. To segment customers, one can group customers by where they live (geographic), their age, gender,

race, and income (demographic), their lifestyle and personality characteristics (psychographic), and the observable and tangible things customers do (behavioral). While segmentation will involve all of these factors, actual behavior is the most important.

Most utilities are already collecting observable behavioral criteria to segment customers. For example, utilities record the amount of energy a customer uses each month, allowing classification as low, medium, and high consumers. Upon installation of a smart meter, there are a variety of other data points utilities can collect about actual customer behavior and usage. Customers who want to view their data online should be incented to sign up for a My Account-type of service. Customers who want to be notified of demand response events will need to sign up for a notification service. Customers who acquire an in-home display (IHD) or programmable communicating thermostat (PCT) will need to securely register and connect that device to their smart meter's Home Area Network (HAN) interface. Collecting this behavioral data helps one better predict the likelihood of demand response participation and identify customers who are willing to help smart meters to ripen.

5. Use action research to drive evolution and emergence of solutions
Customer behavior is a complex system. It is a system in which anything can happen. Consider the story of David Phillips, the "*Pudding Guy*." Healthy Choice, a marketer of packaged food products, wanted to change customer behavior to buy more pudding. To do this, they created a promotion. The promotion involved rewarding customers with airline miles for each can of pudding customers purchased. Mr. Phillips figured out the airline miles were worth more than the price of the pudding, and subsequently bought over 12,000 pudding containers, at a cost of just over $3,000, that enabled him to earn 1.2 million frequent flyer miles. Healthy Choice sold a lot of pudding, but didn't necessarily achieve the desired strategy of conditioning many customers to buy pudding, since Mr. Phillips cornered the market. As humorous as this story is, the lesson is clear: no matter how well one thinks through their strategies for changing customer behavior, or how well they are tested by focus groups, there will be potholes in the roadmap during actual implementation as customers seek to maximize their own value. To quickly fill these potholes and move on, utilities must use *action research*.

Action research is a methodology whereby systems are put into actual service with actual customers on a large scale. It not only affords the opportunity for single-loop learning, which involves modifying actions based the difference between expected and actual outcomes, but double-loop learning as well, which questions the assumptions and models that led to the actions. It relies on clear performance metrics and targets (the expected outcomes), rapid feedback of results (the actual outcomes), and a culture where small failures are tolerated (and learned from) and rapid turnaround of iterative solutions is enabled.

An example of action research in a utility context comes from the pages of Wired magazine in 2007. Southern California Edison (SCE) was interested in notifying customers about demand response events. Their initial solution involved the low-cost channels of email, text, and phone notification. However, this initial solution didn't achieve the results they desired – illustrating the single-loop principle involving feedback of results. For the next solution, SCE first questioned the theory driving their first solution – illustrating the principle of double-loop learning. The first solution was based upon *intermittent notification*: a customer is notified, and then that

notification disappears. If an action is not immediately taken, then the likelihood of an action being taken in the future diminishes, since the customer gets distracted, forgets about it, and so on. The next solution SCE adopted was based upon *continuous notification*. In this design, a wirelessly-activated, glowing orb continuously (and subtlety) indicated the desired behavior. A green glow indicated do nothing, while a red glow meant reduce demand. This solution, while more costly, increased customer participation in demand response. Through this type of action research, effective solutions will evolve and emerge to better enable smart meters to ripen.

Conclusion
At this time it is unclear who the champion of these five principles will be: governments, public utilities commissions, utilities, third-party product and service marketers, or customers themselves. Regardless of who takes the lead, the paternalist culture of the industry must change to embrace the customer as a co-creator of value. Smart meter systems are a marvelous technical innovation that offers tremendous value for demand response, energy efficiency, and load shifting. However, if the industry continues to think of these systems as technical panaceas, they will surely rot, rather than ripen, on the walls of residences and businesses around the world.

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