The Good, The Bad and The Ugly: Smart Meter Technology

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Abstract

Technology has swept through the United States since the turn of the century, winning the hearts of people of all ages around the world. One line of products in particular bears the name “smart”, and is designed to make life easier by electronically solving problems. These computers are becoming apart of our everyday lives, essentially controlling pieces of our most private communications. Up for debate is Smart meter technology, and if it can be trusted to be in complete control of energy usage in America. The research in this document will explain in detail what smart meters are, how they differ from traditional meters, advantages and disadvantages of smart meters, smart meters and politics, the role of cyber security with smart meters, and extended uses of smart meters beyond energy control.

Keywords: smart meters, smart grid

What is Smart Meter Technolgy?

Smart meters are innovative and advanced utility meters that can record business or residential utility usage in real time, and in great detail. These meters identify energy consumption in more detail than a conventional meter. In a networked energy services smart grid system, each meter can use power lines to signal and communicate with its peers in a webbed network (Michels, 2012).

Smart meters are installed in almost every home in the UK and growing across America, but concerns about their operation and efficiency have been raised. They have the ability to send electronic meter readings to energy suppliers automatically giving real time feedback on energy usage and what it is costing (Mifflin). By using wireless mobile type technology, smart meters can work in a variety of different ways to send and receive data. The ultimate question is, will a smart meter save money on monthly energy costs? Smart meters are typically only in use a small portion of the time because they only send and receive short messages at set intervals throughout the day. It is believed that the meter itself will not save money, but the user can start to change behavior so that energy use is maximized for use during peak times.

It is further believed that the technology will lead to the creation of new innovative tariffs and personalized plans tailored to fit the lifestyles of those interested in maximizing energy consumption. In fact, prepayment plans can be made more flexible as an incentive to encourage energy conservation. The whole premise behind using meters that are now deemed smart is to conserve energy and ultimately save on energy costs to the consumer, which is the ultimate advantage to using them.

What is the difference between Smart Meters and Traditional meters?

Smart meters are most commonly used to record consumption of electric energy in intervals of an hour or less. The information is used to communicate between the utility and the customer so that energy consumption is optimized, resulting in cost savings for both the utility and the customer.

Traditional meters are only capable of recording consumption and consequently do not take into account any energy generated by a household. Smart meters can calculate whether or not there is a surplus of energy, which can be sold back to the grid, however, that is an option for more technically savvy consumers. Smart meter technology today can measure the use of many products and is an added feature for being able to send usage information between utilities and customers on a regular basis, and it is deemed safe. It would benefit utilities to promote the use of smart meters as a way to operate more efficiently, as well as a way to provide consumers with real-time information about the consumption of products used in everyday life. The metered technology would be a welcomed commodity to families and those on fixed incomes (Jones, 2011).

Traditional electric meters have been used since early in the late 19th century. The first meters operated on liquid movements, analogous to a sand watch. This style of metering has survived without major changes or technological advancement for more than 100 years (Regassa, 2011). Traditional meters work independently to provide accurate readings used to determine costs for service. Over time these meters slow down giving mis-readings and must be calibrated, which could mean decreased bills for the consumer. For traditional metering to be monitored, a greater number of technicians may

be necessary to maintain the accuracy of the device, which causes billing and processing to be more expensive and makes peak time usage hard to measure (Jones, 2011).

Many believe there is no difference between a traditional meter and a meter that is considered smart enough to monitor two-way consumption. However, in addition to taking service trucks off the road, there are significant differences that prove to save money for the utility and the consumer, such as time of usage and whether storm damage is interrupting service. Traditional meters have been a measure of accuracy and economical way for utilities to track usage. These devices are powered by electricity, meaning no electricity service, no costs to be tracked. If the electricity services are not working, the meter does not turn and no charges are applied however, in today's society reliability is one of the most important measures of accuracy. Electric meters are important and should be managed accordingly to achieve high reliability levels at the lowest possible cost (Beatty, 2012).

It has been said that traditional electric meters have done nothing more than keep track of how much energy is consumed, which is not bad because that is their purpose, tracking consumption. The meters are read every month and then usage is billed to the consumer. While smart meters are capable of providing many benefits for energy management and savings, a disadvantage is that there is no immediate provision of benefits upon installation. Some of the more noticeable differences between traditional and smart meters are usability, costs, accuracy, sensitivity and battery effects, which obviously gives the traditional meter an advantage. Older analog meters on average are accurate within 3 percent, according to E-How researchers (Mano, 2013). They are more sensitive to the shocks and bangs of rough usage, and they are less durable.

Advantages and disadvantages of Smart meters

Smart meters report usage daily through radio transmitters installed on each device, which is much more sophisticated and explains the difference in cost. Each transmitter has the ability to communicate with other meters to create net grid information – called a smart grid, which makes its way back to the electricity provider. Every operational aspect is controlled through radio frequency so customers are not interrupted by failed equipment and the utility does not make unnecessary visits to correct problems with faulty equipment. Smart meters are digital by nature, requiring less moving parts, which makes them durable, providing more accuracy for greater periods of time between calibration check-ups. The technology allows customers to keep an eye on things as they happen and if an unusual or substantial increase in power consumption is noticed, changes can be detected without sending technicians to investigate (Burke, 2013).

Convenience and reliability have proven benefits for customer service. These meters come with built in outage detection, which can let the utility know immediately when something is wrong and the customers does not have to initiate contact with the company for many problems. When power goes out, problems are detected at the substation transformer site, which could be several miles away from the meter spot. With smart meters, the technicians are given a better idea of the source of the problem. Also, average repairs times are minimized. Sometimes it still may be necessary to report an outage, however, the meters can help when detecting early system complications, eliminating some of the costly man-hour time exhausted by troubleshooting.

Smart meters use programmable solid-state meter technology that provides two-way communication between the meter and the utility. Using secure wireless network technology, smart meters record hourly meter reads and periodically transmits the readings through a radio frequency network. The only negative impact discovered during this research are questions surrounding radio frequency health challenges. In fact, smart meters operate well below the Federal Communications Commission's adopted Maximum Permissible Exposure (MPE) limits for radio transmitters of all types (PGE.com). Even though smart meters are on the outside of homes and businesses, each meter records information for about 100 seconds in total to regularly communicate energy consumption data. While functioning outdoors for a short period of time doesn't sound dangerous, there's still no definitive proof that the meters' frequencies won't interfere with health care treatments, especially dealing with outpatient care equipment like pacemakers (EPB.com).

In addition to the consumer, smart meters provide advantages to the electric utility that include, eliminating manual meter reading, monitoring the electric system quickly, making it possible to use power resources more efficiently, providing real-time data used for balancing electricity load and reducing power outages or blackouts; enabling dynamic pricing; and avoiding the capital expense of building new power plants. These are benefits that can help in optimizing income with existing resources.

In comparison to the retail industry, the Wall Street Journal spoke on extending the use of smart meters beyond utilities. When scanners were introduced to retail, they were initially thought of as a way to cut back on labor costs, but soon were discovered as a tool that could be used for inventory control. Hydro One uses smart meter technology

as a means of asset protection by testing each piece of equipment individually to find out if they need to be serviced before it fails to operate. Vendors like Oracle and IBM have found ways to offer services to others, using smart meter technology. For instance, IBM developed a way for wind farms to maximize their resources by using weather information to predict the output of wind turbines. There are also companies like Retroficiency Inc., which use the recorded energy data as a tool to help consumers cut their energy bills (Smith, 2013).

Who are the key players of U.S. smart meter systems?

According to Smart Grid News, the key players are screened and qualified by industry experts and the list is published each year. In an article titled "Meter Maker Shakedown: The 5 that will Survive" published in 2009 lists the following front runners (Berst, 2009):

- Echelon
  - A huge company in Europe with several years of experience in the U.S. marketplace taking different approaches to the hardware than most others. The company saves on the costs of putting a radio into every smart meter and the cost of troubleshooting meters that cannot communicate because of difficult reception. The company's largest customer is Duke Energy – the largest electric power holding company in the U.S., supplying and delivering energy to more than 7 million customers.
- Elster
  - A leading manufacturer in Advanced Metering Infrastructure (AMI) and integrated metering and utilization solutions to the gas, electricity and water industries. Elster is a U.S. based private company that has a 170-year-old history where a number of times its ownership has changed hands. The group supports both Automated Meter Reading (AMR) and AMI systems.
- General Electric
  - GE is one of the biggest players in the Green industry globally. It generated $18 billion in Ecomagination revenues in 2009, investing about $1.5 billion. GE is strong across most Green Sectors today particularly in the area of Smart Grid and Energy Efficiency. GE is not that big in the Smart Meter market but with its overarching scale, it has quickly won a number of contracts like the one with Florida Power and Light.

- Itron
  - The largest manufacturer of smart meters in the world with great market share in the U.S. Itron is one of the biggest independent smart grid companies in the world with 8,000 utility customers. It has used its expertise in making smart meters for gas and water to win large contracts in the electric smart meter market as well.
- Landis+Gyr
  - A Swiss-based private company is in a leading position in the European market and is winning contracts in the US. Landis+Gyr is amongst the top 5 smart meter manufacturers inviting bids from companies around the world such as Toshiba, ABB, Honeywell, GE and other Private Equity companies.

The smart meter industry saw a large influx as industrial companies such as Siemens, ABB, Schneider Electric and others began merging with smaller independent companies. The drive for energy efficiency and maximum reliability was and still is the driver for this technology.

As of 2009, that list was accurate, now there are 25 companies to watch in the AMI market (smartgridnews.com). The market is expanding quickly, and researchers expect the growth to snowball – global smart meter installations are projected to double by 2016. Vendors are beginning to compete over an astronomical $66.3 billion in contracts across 35 emerging market countries by 2023, but that hasn't stopped companies from securing smart meter contracts now. U.S. based vendors are working on deals at home and abroad, where there are increasingly more smart metering opportunities (Savenije, 2013).

Politics and the role of cyber security with Smart Meters

Next to health care radiation complications, cyber security for the smart grid seems to be the principal issue for this metering system. The Canadian cyber security expert, David Chalk, eliminated any idea that the smart grid security was intelligent

enough not to be hacked. In an interview, he said, "There is not a power meter or device on the grid that is protected from hacking – if not already infected – with some kind of Trojan horse that can cause the grid to be shut down or completely annihilated (Sol, 2012)." There is no proof of a computerized system on this planet that cannot be hacked. Knowing that the system that feeds our country with energy can be hacked and potentially black out the entire country at any moment brings a fearful and negative connotation to smart meters. In addition, a hacked system can damage billions of dollars of energy equipment, leaving citizens without energy for extended periods of time.

In conjunction with security, privacy is another problematic debate amongst Americans and smart meter technology. The fear that big brother is watching is how some Americans view smart meters. To have a system that can track your energy usage, means that someone knows when you're cooking, watching TV, going to sleep, on vacation and more. Citizens of America have a major reason to raise suspicions, as the San Francisco Chronicle revealed information about both the San Diego Gas & Electric and Pacific Gas & Electric companies providing energy use data to the U.S. government and third parties (Baker, 2013). A couple in North Bend, Washington actually sued the Tanner Co-op electric utility because they believed the technology is an invasion of privacy. Companies think more education on what the meters can accomplish, will ease the trust of the American people (Porter, 2013).

Conclusion

Smart Meters are supposed to be more dependable and easier to maintain when compared to traditional meters, but in reality they can also be called less trustworthy and more expensive, when there are indications of failure. People have good reason to

promote the revocation of a nowhere near perfect smart technology system that is used to control their utilities, but utility companies also have good reason to fight for what will save more money in the long run. Nonetheless, AMI technology is a significant advancement for the energy sector and the world. Due to security issues that could indicate failure, smart meters may need to "dumb it down" a bit by sticking with traditional meters, and using only some of the characteristics of the smart technology. In my opinion, smart meters in its current use should not be the way of the future for the energy industry. Instead the grids and meters should be used to specialize in smaller and more feasible tasks. Military bases, college campuses, and big companies with plants and factories should be ran on smart meters, but controlling the energy provided to every household in the United States could be a developing disaster.

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