STATE OF IOWA

DEPARTMENT OF COMMERCE

UTILITIES BOARD

FILED WITH
Executive Secretary
November 15, 2013
IOWA UTILITIES BOARD

IN RE: **PURPA STANDARDS IN THE ENERGY INDEPENDENCE AND SECURITY ACT OF 2007**	**DOCKET NO. NOI-2008-0003**

Comments of the Iowa Association of Municipal Utilities

The Iowa Association of Municipal Utilities (IAMU) appreciates the opportunity to submit the following information in response to the Board's, October 18, 2013 request for updates on smart grid technology in NOI-2008-0003. Our comments update our answers to questions posed by the Board in its March 9, 2010 order and describe other relevant developments. Part A of our comments provides updates on a Department of Energy Smart Grid Investment Grant, a time-of-use rate analysis funded by the state energy office, and a voluntary time-of-use project in Sumner. Part B adds information about other smart grid projects undertaken by our members and known to IAMU. Part C contains summary comments about smart grid infrastructure under emerging market conditions.

A. Updated answers to questions posed in the March 9, 2010 order

IAMU submitted a description of two IAMU smart grid projects to the Board in a letter dated August 24, 2009 and in answers to questions posed in this inquiry, submitted on April 1, 2010. Our answers in the later submission focused on: (a) the status of the smart thermostat project; (b) the status of the dynamic pricing pilot that IAMU supported; (c) time of use pricing in Sumner, Iowa, which has been in place since 2004; and, (d) related questions posed in the March 10, 2010 order. The following are updated answers:

1) **Describe the Smart Grid related project or projects your organization or company is planning or implementing in Iowa, including details of scope, goals, features, technology, timeline, cost and benefits.**

1a. IAMU's Smart Grid Investment Grant from the U.S. Department of Energy (DOE Award DE-OE0000359)

On April 1, 2010, IAMU received the final, signed agreement for a $5 million Smart Grid Investment Grant (SGIG) from the Department of Energy. This grant provided funds to IAMU to support a demand response program entitled 2 Degrees 2 Save™, a demand response project using smart thermostats that the utility can ramp up by up to two degrees over the course of a load control event and pre-cool by two degrees to achieve a load reduction of approximately 2 kW per thermostat. The grant also funded the installation of automated metering infrastructure (AMI). The project featured a shared software platform, centrally-hosted at a cyber secure and physically hardened site in Denison, Iowa.

The implementation phase of the multi-year project is set to end at the beginning of 2014. The reporting period will continue through 2015. There are currently eight participants in the project; seven are located in Iowa and one is in Kansas. Six of the participants have installed smart thermostats and one has installed switches on air conditioner compressors. Two of the utilities have fully deployed AMI and two other utilities have AMI pilot projects. To date, 5,400 thermostats, 300 switches, and 9,400 smart meters have been installed as a result of this project.

There was significant attrition among the original 75 municipal utilities in three states that had provided letters of support/interest for the grant filing. Reasons varied widely among utilities choosing not to participate. Many have power suppliers that discourage peak load reduction programs or who "socialize" demand and transmission costs in such a way that effective demand response by one utility is viewed as shifting costs to others. These utilities may not have been able to capture the benefits of demand response, at least in the short run. For others, there were budget concerns that were difficult to overcome. Costs in the project, funded under the American Recovery and Reinvestment Act, came largely in the first two years, while the benefits stretch over a longer period. In at least a few other cases, utility governing

bodies (city councils and boards of trustees) were concerned about what might be an ideological dimension to customer smart-grid technology. Some individuals see "big-brother" in technologies that seem to extend the reach of the utility to the customers' side of the meter. Still other utilities seemed to doubt the need or future value pricing on a time-of-use basis. Finally, some utilities worried about cost recovery, since consumers typically get about 70 percent of the project benefits – primarily from heating and cooling savings associated with the thermostats. For a municipal utility, that should be a positive factor, but traditional ways of viewing the business as one of buying wholesale and selling retail are not easily overcome.

IAMU is convinced that the cost benefit analysis more than justifies participation in the project. The following is an example of a cost/benefit summary for a utility serving a little more than 3,000 customers:

> The 2-year cost for the utility to participate in the IAMU Smart Thermostat project would be about $162,000. Grant funds would cover 40 percent of that cost or $66,000, so the two-year cash outlay would be about $96,000. The utility would be expected to install 365 smart thermostats and 60 smart switches to control air conditioning load, with the potential to reduce peak loads by 525 kW.
>
> Joint operating costs and some additional installations continue beyond the original two-year period of the grant activity, so over ten years, the utility's total cost in today's dollars would be about $180,000. During that period, the utility would have reductions in demand and transmission costs of $235,000 NPV. That assumes that demand and transmission savings can be captured <u>only</u> during four summer months when AC control is used. The savings are based on a typical wholesale demand cost of $12/kW-month and the MISO average transmission rate of $2.38/kW/month[1]. Over the same ten-year period, the utility's customer-owners would see savings of $574,000 NPV in air conditioning and gas heating costs at current rates. Customer savings are derived from the value of the programmable thermostat.
>
> Another way to look at the value of the project is to compare the DR costs to supply-side alternatives. If the utility or its power supplier met its peak load growth

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[1] Excess regional generating capacity has brought the current market value down to near zero, but that does not mean the wholesale contracts of municipal utilities follow the market rate. Some IAMU members pay well over $16/kW-month. Also, the MISO average price understates costs for many IAMU member utilities. Those in the ITC zone pay more than $8/kW-month for network transmission. Some also pay rents called directly assigned facility charges for the final delivery path from the MISO grid over sub-transmission facilities and/or substations owned by another utility. The multiplier for those rates is typically determined by coincident peak demand.

with additional gas peaking capacity, the supply side cost would be substantial. If you assume a $650/kW cost for installed gas peaking capacity and add O&M and losses, the supply-side cost is about $920/kW. This compares to a present value of the DR project cost of less than $200/kW for an avoided kW of demand.

Beyond the dollar savings from these limited value streams of capacity and transmission savings, the project offers enormous risk management potential. Utilities with exposure to the MISO market face many uncertainties. For example, the smart grid tools in this project would give the utility instantaneous ability to reduce load when peak day markets hit $250 -$350/MWH. There is also the likelihood that market conditions will force the utility to implement time-of-use pricing. The project software and associated communications infrastructure provides the platform for implementing time-of-use pricing and for automating customer response to price.

The cost-benefit tool used for the calculation above, measures four benefits:

1. The value of avoided capacity and/or demand costs
2. The value of avoided transmission charges
3. The value to the customer of energy savings related only to the setback thermostat
4. The value of the ARRA grant

There are many other benefits not measured by the cost-benefit tool, some of which can be quantified. A more complete cost-benefit analysis would measure many of the following values:

1. Reduced risk or exposure to energy price volatility, e.g., the periodic aberrations in MISO market prices when energy jumps to $250 or $500 per MWH
2. Internal resource management
3. Keeping lights on and restoring service in a power event or forced outage
4. Minimizing stress on system infrastructure and deferring capital improvements
5. Improved customer communication and service, including key account cost reduction
6. Reducing transmission constraints (savings and earnings)
7. Loss reduction
8. Under voltage and under frequency protection
9. Non-spinning reserves
10. Avoided cost of auction revenue rights (ARR) required for new peak
11. Cold-load pickup
12. For utilities that own baseload (Neal 4/Walter Scott 4), the value of reducing load to increase sales during critical peak pricing events
13. Avoided fuel and operating costs for peaking generators OR ALTERNATIVELY opportunity to sell peaking capacity into the real-time market
14. Revenue from the MISO DR market
15. Long-term value of improved utility load factor in power supply contract

16. Avoided risk associated with incremental carbon emission costs
17. Value of joint action in purchase and operation of control devices, computer hardware, software licensing and maintenance, communications services, training, marketing, cyber-security compliance, and customer support
18. Value of future uses of software and communications platform for AMI functions, dynamic pricing capability, home area network services, capacitor control and other distribution automation
19. Potential revenue from utilities that are not currently participants, but that pay their share of fixed costs to gain access to the operating system
20. Value to customer of energy efficiency improvements associated with CFLs, home energy assessment, information exchange with customers
21. Value to customer of installation convenience payment
22. Value to customer of internet portal to set thermostat, review operating history of device, access price and/or cost information, and automate demand response to price
23. Value to the environment of measureable reductions in greenhouse gases and other pollutants
24. Value to the environment of avoiding construction of new power plants and transmission facilities
25. Value to the environment of improving efficiency of energy use, including avoiding use of least efficient generation during peak periods.

After resolving problems due to defects discovered in the thermostats and switches, preliminary results have verified expected demand reduction during the load control events held by the participating utilities. The grant has allowed IAMU to successfully demonstrate that demand response can be achieved by utilities at low cost. More complete results will be available in 2014 and 2015.

With regard to AMI, preliminary benefits realized include faster outage detection, ability to deal with high bill complaints, and reduced meter reading costs. More results will be available in 2014 and 2015. For further detail, see Appendix A for the case study submitted to the Department of Energy in August, 2013.

1b. Dynamic Pricing Project funded in part by a State Energy Plan Grant

Studies have shown that dynamic pricing can provide numerous benefits to utilities and customers alike by lowering the need for expensive peaking capacity, improving system reliability, and reducing power costs. IAMU embarked on a demonstration project for dynamic pricing rate structures in Iowa Utilities, funded in part by a grant from the federal funds flowing through the State Energy Plan administered by the Iowa Office of Energy Independence. This project demonstrated the impacts that a dynamic pricing system can have as compared to the

current rate structure. The project began in March 2010, and helped develop time of use rates for three municipal utilities. However, after completion of the rate analysis, it was determined that one of these utilities did not get sufficient time of use price signals from its power supplier to allow meaningful differences in peak and off peak prices.

Delays by vendors in AMI equipment delivery, and challenges with integrating billing systems and AMI have caused delays in the implementation of time of use rates. Equipment deliveries should be completed by the first quarter of 2014. Currently, two Iowa utilities have approved time of use rates set to be implemented in 2014.

1c. Time of use pricing in Sumner, Iowa

In 2004, Sumner Municipal Light Plant implemented time of use pricing on a voluntary basis. Thirty of the utility's 1,100 customers are currently on that rate. The utility uses electronic meters to measure time of use, though it does not currently have an automated system for collecting meter data. Meter data is downloaded to a hand-held instrument monthly. All but two of the customers on time of use rates are residential. A majority of those residential customers have shifted their consumption of electricity so that at least 75 percent is at the off peak rate of 3.5 cents/kWh. Several customers using electric heat-storage systems have shifted 80 percent or more of consumption off peak. One of these has winter consumption that is 95 percent off peak; another who maintains winter indoor temperature at 72 degrees is still able to limit consumption at the on peak rate of 10 cents/kWh to between 10 and 15 percent. The utility claims that installation of heat storage technology with the time of use rates has a payback of about three years. IAMU has received only limited information about Sumner's rates at this time. We will be utilizing data that Sumner has available to help in the design of dynamic or time of use rates described in 1c above.

1d. Related questions from the Board's October 2010 order

1d (1) What defines a customer focused smart grid project?

As envisioned and proposed to DOE, the 2 Degrees 2 Save™ project anticipated the possibility that some of the participants would install AMI and utilize the ZigBee wireless protocol to control thermostats via signals sent to the smart meter. Deployment of some smart meters was primarily included as a way to verify demand reductions and to facilitate DR using ZigBee enabled thermostats. Over the course of the grant, DOE approved the increased use of grant funds for AMI. The grant funded 40 percent of full AMI deployments in Algona and

Maquoketa and significant pilot projects in Cedar Falls and Atlantic, including self-healing, wireless data collection networks.

Communication over a two-way network using ZigBee never materialized. Industry agreement on the anticipated next generation of the protocol was not achieved, so the thermostats are controlled over a one-way communication system using 900 MHz paging. While "smart grid" typically implies two-way communication, it is worth pointing out that the project includes not only the installation of smart thermostats and the ability of the utility to address them, it also features a robust software platform that can support many smart grid and AMI functions, a secure communications system that gives the utility a means of communicating critical information to customers in real time, and a customer internet portal over which to view utility information and to automate demand response to future time of use pricing.

1d(2) Describe Smart Grid related projects your organization or company is currently implementing in other jurisdictions. Do these projects include data collection on the effects of the changes, and if so, are the data or reports readily available?

The 2Degrees 2 Save™ project includes one out-of-state utility, Kansas City Board of Public Utilities in Kansas. Data from that utility, which will have the largest deployment of thermostats among project participants, will be included in all project reports and readily available to the public.

1d(3) What information is your organization collecting about its Smart Grid projects and how do you plan to share information with others?

IAMU is collecting information about the cost of energy production, transmission, distribution, and market prices. This information is being used to help determine appropriate rate structures. IAMU is planning to collect consumer data to signify a change of behavior related to different rates. IAMU has shared this information through reports to funding agencies, newsletters, workshops, conferences, and publications. These same avenues will be used to share information about future results.

1d(4) Will your organization's project or projects involve redesigned electric rates or pricing proposals, such as critical peak pricing or other forms of dynamic pricing? If possible, provide details on how your proposed pricing compares with existing time-differentiated pricing, what changes in revenue may occur due to customer participation, and whether potential new or experimental pricing would require waivers of the Board's existing rules.

IAMU's projects involve redesigned electric rates. Project consultants in the time of use pricing project utilized MISO nodal pricing to develop recommendations for four-part, seasonally

adjusted prices: on-peak, off-peak, off-off-peak, and critical peak pricing. Currently, two utilities (Cedar Falls and Maquoketa) have approved time of use rates that are due to be implemented in 2014, though neither utility was included in the grant funded study. No waiver of existing Board rules is anticipated because this demonstration will only involve municipal utilities. These rates are beyond the jurisdiction of the Board.

B. <u>Other smart grid projects of municipal utilities known to IAMU</u>

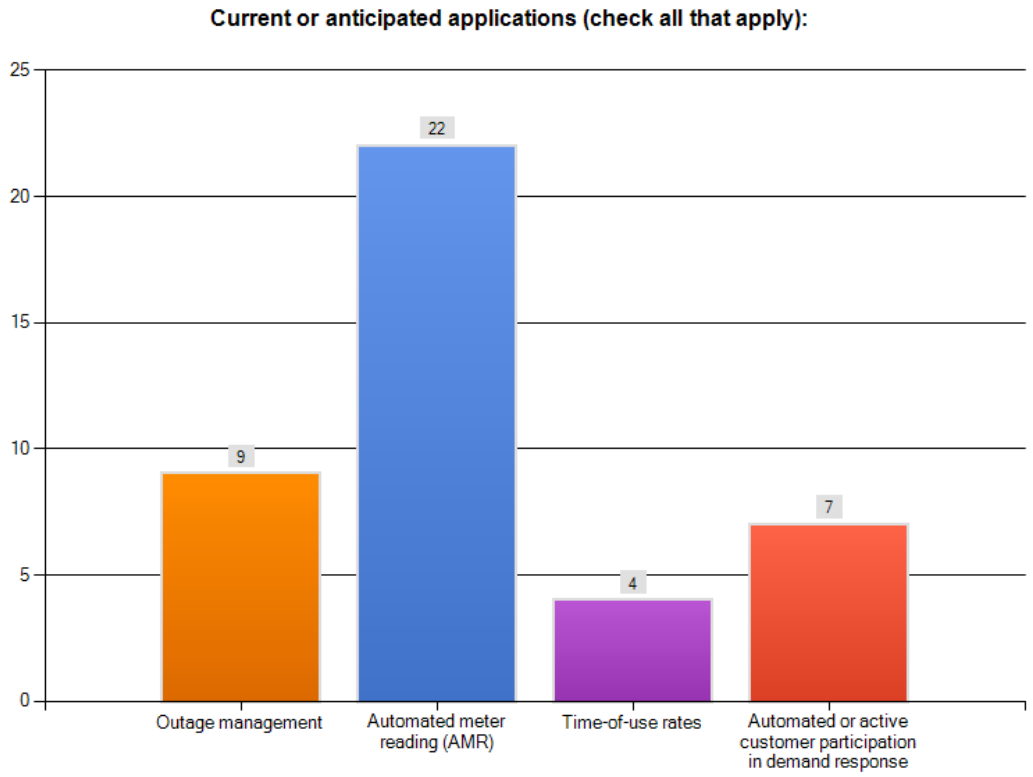
IAMU does not normally keep track of infrastructure planning or installations of our member utilities, unless the Association has been involved through a grant, joint purchase, or other coordinated effort. To provide some indication of what other smart grid projects members might be pursuing, IAMU sent out a survey to 136 municipal electric utilities in the week preceding this filing. Links to the survey were also published in our newsletter, the *Informer*, so a few responses also came in from water or gas utilities. In just over 24 hours, we received 71 responses. Of those, 53 indicated that they had not installed smart grid technology. Half of the other 18 responded that they had installed automated meter reading (AMR) technology, which does not meet our definition of smart grid. However, we think AMR is worth noting, since many AMR meters recently or currently being installed are smart-grid ready, so utilities making these installations may be doing so as part of a plan to add two-way communications at a later date. We tested that assumption in our survey.

Pocahontas has installed AMI technology for AMR and demand response. Two others, Spencer and Muscatine report installing AMR/AMI technology currently used for AMR, but for future use in outage management, remote connect/disconnect, time of use rates and other demand response technologies. Six others indicated that they have plans to install AMI: Webster City (for outage management, AMR, time of use rates, and demand response); Sergeant Bluff, Lake View, Mt. Pleasant, and Sanborn (for demand response, outage management, AMR); and, La Porte (AMR and future time of use rates).

Nine respondents indicated that they had installed AMR technology: Wilton, Story City, City of West Liberty, Villisca, Gowrie, Montezuma, State Center, Afton, and the City of Walker Water Department. Whether these systems are up-gradable to perform smart grid functions is unknown.

Cedar Falls and Atlantic, two of the SGIG grant participants indicate great satisfaction in the use of AMI for outage management. Atlantic plans to expand their pilot project to take advantage of this function.

The following graph from survey data shows current or anticipated applications of AMI by survey respondents:



C. Conclusion

Using smart grid technology to reduce peak demand through time of use pricing and direct control of load makes sense. MISO has projected a capacity shortfall in 2016. In the event the shortfall materializes, the auction price for capacity will go from its current, near-zero level to a price that at least approaches the cost of new generation to meet the anticipated demand, also called the cost of new entry or CONE. For Iowa (MISO zone 3) the 2014 CONE is $705/kW or $58.75 per kW-month. By comparison the cost of avoiding a kW of coincident peak demand using smart thermostats in the 2 Degrees 2 Save™ program ranged from less than $10/kW-month to as little as $3/kW-month, depending on the number of devices deployed. In PJM, Baltimore Gas & Electric successfully bids its smart thermostat load reduction into the market. In fact much of the demand growth in PJM is covered by demand response.

While IAMU does not yet have data to measure the cost of peak demand reduction using time-of-use pricing, indications from what is already known are that the resulting DR and load impacting energy efficiency will be effective and much lower in cost than new generation.

Smart grid technology, including smart meters, the networks to collect and analyze the data and programs to automate demand response are cost-effective investments.

Other benefits from AMI are proving to be highly valued, including outage prevention. That feature alone had led to increased deployment by one SGIG grant participant. Both energy and capacity markets will undoubtedly lead to adoption by more and more utilities in the near future.

Respectfully submitted,

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Appendix A

In 2010, IAMU received a grant award the Department of Energy to help fund smart grid projects in several interested member municipal utilities. Below is a case study of some of the lessons learned in the development and installation of municipal smart grid systems in the form of Advanced Metering Infrastructure in Iowa.

The Department of Energy envisions a smart grid as a two-way communication system applying technology, tools, and techniques to ensure reliability, maintain affordability, reinforce global competitiveness, fully accommodate renewable and traditional energy sources, potentially reduce the carbon footprint, and integrate future advancements and efficiencies.[i] More simply put, Iowa municipal utilities see the smart grid as a system allowing them to gather more data from throughout their distribution systems to help the utility and its customers utilize resources more efficiently and effectively. For this purpose, a number of municipal utilities in Iowa have begun to dip their toes into the burgeoning world of smart grid by installing Advanced Metering Infrastructure (AMI) in their communities.

AMI is a metering approach that better integrates consumers into the grid. It provides consumers with increased details about their electricity usage and the information to use resources more efficiently and lower their monthly bills. AMI enables utilities, with added tools and information, to detect problems on their distribution systems and to operate them more efficiently.[ii] AMI goes beyond Advanced Meter Reading (AMR) Systems, which allow utilities to read meters remotely. Some of the added features that an AMI system has over a traditionally metered system, or even an AMR System, include the ability to integrate consumer-owned generation, provide for remote connection and disconnection of customers, implement time of use based rates to more accurately mirror the real-time market rates that utilities face for energy supply, and provide for real-time consumption data for customers.

These are just some of the expected benefits that Algona Municipal Utilities hopes to realize when it completes its AMI installations for its 3700 customers. They started this project "as a way to read electric and water meters in real time so that we could gather consumption data immediately and use that data to see if there were any outages or issues with our customers. Since we've started, we've learned a lot more about the things we can do, so there are many benefits in addition to outage management. One of the other great things we are going to be able to do, which is really key for us, is water leak detection. This will be a more efficient way to catch leaks and reduce and stop the waste of a natural resource." said John Bilsten, general manager of Algona Municipal Utilities. Although the Department of Energy grant did not provide funding for AMI water meters, some utilities that offer multiple services, like Algona, have invested in smart grid technology for their entire system.

Algona hopes to mirror the success of the Smarter Sustainable Dubuque's Smart Water Pilot Study. In this study, the City of Dubuque installed smart water meters for a portion of its households, and gave those customers access to a web portal that showed their consumption, along with information on conservation actions, and leak detection. The pilot showed that customers reduced their usage by 6.6%, saving money for the customer, and the city in treatment costs. In addition, leak detection was almost 10 times greater in households with the smart meters compared with the rest of the city.[iii]

However, Algona faces one of the challenges that municipal utilities face that investor-owned electric utilities and electric cooperatives don't have when it comes to smart grid. Many municipal utilities provide electricity and water; some provide natural gas as well. Not only do they have to replace the electric meter, but the gas and water meters as well, which significantly add cost. In such utilities, replacing only electric meters does not reduce the meter reading cost, since the water meters still need to be read. For this reason, Cedar Falls Utilities, which provides electric, gas, and water services in the city limits, and only electric service in the rural part of its service territory, decided to do a pilot project, consisting of approximately 1900 meters, in its rural area.

Installing a system that can handle multiple AMI data streams, such as water and electric, has been a challenge for municipal utilities, cost aside. Compatibility of system components and meter brands has been an issue. Bilsten stated, "I think what we found was the biggest challenge, initially, was electric meters that would read our water meters. We could find all kinds of systems that would read water meters. We could find all kinds of systems that could read electric meters, but the integration of the two wouldn't work together. That was the biggest driver for us, so we ended up switching meter vendors." Even after choosing a vendor that had a solution for both water and electric AMI meters, compatibility issues have remained. Vendor delays in the delivery of the technology that reads the meter, the module that enables the electric meter to read the water meter, have caused project delays in Atlantic Municipal Utilities, which is installing approximately 800 AMI meters, primarily in their rural service area.

Compatibility issues have been challenging in other facets of the project, aside from electricity and water meter reading. Cedar Falls Utilities is currently working through integrating their operating AMI system with their billing and outage management systems. "I would say that it is moderately hard to integrate all of these systems. It's expensive, but I don't think it would be cheaper if we had something different. It's just the state of the industry" commented Ken Kagy, principal engineer of Cedar Falls Utilities. Algona Municipal Utilities found it useful to involve all parties in conversation from the project inception. "We have found that it has not been overwhelmingly difficult, primarily, because we had at day one, in addition to talks with the prospective vendors, we also had conversations with the billing system people, so when we made the decision, we made it together. So we knew at the start that the technologies would mesh, that they would work

together. We're still working through some of that, but so far it seems that it's a pretty painless process," said John Bilsten.

Aside from compatibility issues with the technology, financing advanced metering infrastructure has also been a challenge. The grant funding from the Department of Energy has been essential in the implementation of AMI in Iowa municipal utilities. "We'd been watching this for years and trying to determine the business case, and if we could make it work. With the grant coming along, it helped the business case." However, "the cost of doing this, even with the grant, is still a fairly expensive program," commented Steve Bernard on Cedar Fall's 1.3 million dollar AMI project. "The grant funds have really been a benefit to us, because we would not have been able to afford to do this today, or in the scale that we're doing it without those funds," added John Bilsten. None of the municipal utilities felt that the cost of installing AMI would have a significant impact on customer rates. While there might potentially be a slight initial cost of service increase, they thought savings would offset it.

The communications aspect is another area that has provided some complication for utilities. There are a variety of communication systems options that utilities needed to evaluate when selecting their AMI systems. The two main types of AMI communications systems are Power Line Carrier (PLC) and wireless systems. Power Line Carrier is a method where electronic data is transmitted over power lines back to the substation, then relayed to a central computer in the utility's main office. This would be considered a type of fixed network system—the network being the distribution network which the utility has built and maintains to deliver electric power. Such systems are primarily used for electric meter reading. Some utilities have also interfaced gas and water meters to feed into a PLC type system.[iv] Within wireless communication systems, the radio frequency (RF) mesh network is the most popular option among municipalities in Iowa. An example of the RF mesh network installed in Algona, Atlantic, and Cedar Falls, is presented in Figure 1.

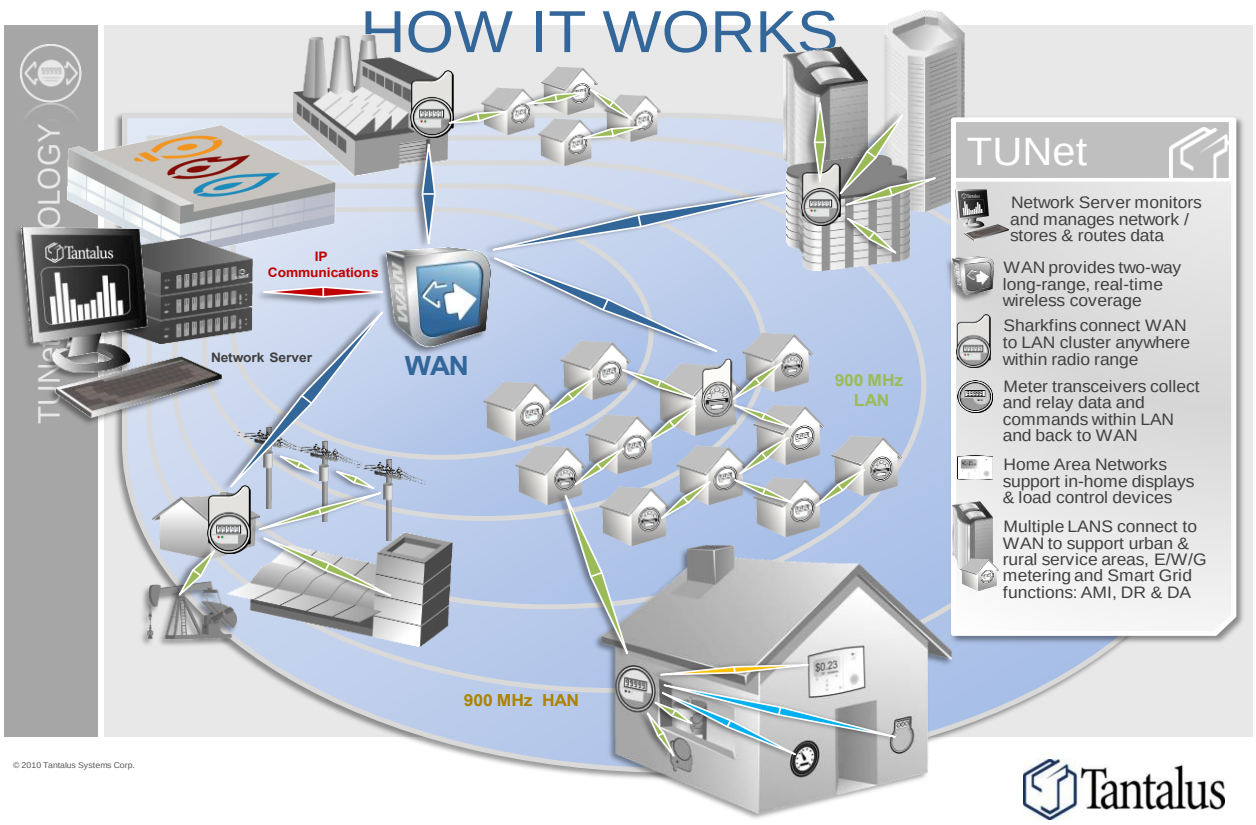

Figure 1. Tantalus AMI system installed in Algona, Atlantic, and Cedar Falls Utilities

Some utilities, such as Algona and Cedar Falls have their own telecommunication systems, which is beneficial in selecting a RF mesh network communication system. Cedar Falls did need to install some communication towers, since their AMI system is primarily in their rural area, but both utilities are using their fiber-optics network to bring back the data from their data collection system. The fiber optic backbone connects to a wireless 900MHz collector system that then goes out and reads each of the meters. There is a combination of the wireless system with the collector system that ties to the existing fiber optic system.

Atlantic Municipal Utilities initially planned for a two way communication system over Power Line Carrier, but after reviewing proposals from vendors, they "concluded that the two-way power line carrier technology we proposed to use does not have the capabilities, nor the benefits, that we could realize from an RF Mesh network. Earlier, we also had concerns about the ability of a mesh network to cover the rather hilly area we have in our service territory, but our research has shown that the technology will, in fact, be capable of reaching all of the targeted customers," said Allen Bonderman, former general manager of Atlantic Municipal Utilities, and now retired.

Securing AMI from a cyber-security perspective, has been an important consideration for municipal utilities, and one of their criteria for selecting the vendors for their AMI

contracts. Customer data privacy, metering and billing database integrity, access to remote connection and disconnection, load management, and theft are real utility concerns. The utilities have learned that it was important to assemble teams with expertise in addition to their own personnel. Many smaller utilities do not have all of the resources in house to deal with cyber security. "It's a real big thing. We requested our vendor provide us what they're doing for security, plus we're working with our billing consultant and our hardware/software consultant. We're making sure we have all the security in place, and we're using our own internal IP addresses to communicate with meters and with the collectors. So we're not using customer modems, we're not using anything public, we're using our own private network," said Bilsten. Larger utilities have more resources to deal with cyber security. "It kind of grew out of the data security that we already do. I'd say that we're already fairly far down the path to being secure with our data department, because we have a communications department, and we have a lot of people on staff that are tuned into that. The vendor that we went with is very big on security, and we had some initial consults with them. Their approach was a secure approach from the beginning," commented Ken Kagy.

While there have been some challenges, primarily in the planning stages, there have been some early successes in the implementation. Utilities have been pleasantly surprised with the ease of installing the meters and data communication equipment for the AMI system. Some utilities, including Cedar Falls and Atlantic, have hired contractors to install the meters for the utility, since they didn't have the manpower to do most of the installation. However, because of early success, Cedar Falls ordered an additional 500 meters and will be installing these meters with utility staff. Other utilities have used their own staff for equipment installation. Algona discovered that they could install the electric meters faster than they anticipated. Bilsten said, "We originally didn't know that we'd be able to allocate the time that we've been able to, based on our construction season. The electric meter side of our business – the majority of our meters- our meter sockets have what we call a bypass on them, so we are able to change the meter without interrupting the electric service to our customer. That's really nice, and we don't have to schedule them, and we're not creating any inconvenience to them. It's enabled us to install these quicker than we originally had planned."

While the installation of meters and meter reading systems is currently ongoing in various Iowa municipal utilities, there have already been some realized benefits. Algona Municipal Utilities has had significant savings in meter reading. They've been able to take a full time meter reader and cut that position's time in half related to meter reading, gaining a half time person to do other tasks in the electric distribution department. Using the AMI system, they have also received several notifications of attempts to tamper with the meter. Cedar Falls has been able to use their AMI system to collect meter data reading, when bad weather conditions prevented the meter reader from reaching certain areas. They have also realized some benefits in outage detection as well. "We have better insight into what is

happening now. So if an electrician pulls the meter so he can work on something in the house, it may generate a call from us to the customer, saying 'we noticed your power is off. Is something wrong?' We have had some alarms that have gone off in the middle of the night and we've been able to go out and fix them before the customer even knew it was out. It helps to be proactive," commented Ken Kagy. The AMI system has also helped them deal with high bill complaints. In one case, they used the hourly usage data and overlaid it with degree day information to help the customer understand where the high bills were coming from.

By and large, customers have been receptive to the new meters. "We are the community-owned utility and there is a general acceptance that we really do work in the best interest of our consumer owners, so for that reason, we really have not seen a concern," explained John Bilsten. Utilities expect more customer feedback, when the systems are fully installed and operational and further benefits can be realized at project completion in December 2013. The utilities expect to see significant reductions in meter reading costs. These utilities hope to provide better information to customers, by giving them access to real time usage data and allowing them to make better choices when it comes to their electricity consumption. In turn, the utilities hope to improve cost of service allocations, and provide improved rate structures. Algona and Cedar Falls plan to offer a time of use rate to customers, as does Maquoketa Municipal Utilities, who are installing 3500 AMI meters. The utilities also expect to see improved customer relations by providing more information on bills, as well as immediate detection of outages which will expedite repairs. In short, these utilities are leading the way for the two-way communication system envisioned by the Department of Energy. Through the application of technology, tools, and techniques, these utilities are working to ensure system reliability, maintain customer affordability, reduce the overall carbon footprint, and integrate future advancements and efficiencies in the electrical grid.

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[i] "The Smart Grid: an Introduction. Prepared for the US DOE by Litos Strategic Communication. Contract No. DE-AC-26-04NT41817. 2009.
[ii] Ibid

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