

MEMBER ENGAGEMENT TECHNOLOGY

Promises and Challenges for Co-ops

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Member Engagement Technology: *Promises and Challenges for Co-ops*

Customer engagement technologies can help co-ops and their members make sense of the steady stream of AMI data by making it accessible and actionable.

Pilots are often as much about what went wrong... as what went according to plan.

Analytics for Better Member Relationships

A key factor that sets electric cooperatives apart from other energy distributors is the value placed on maintaining deep and positive relationships with member-owners. However, today's members are increasingly bombarded with third-party offerings that may diminish their view of the co-op as their sole, trusted energy advisor. Fortunately, co-ops have a valuable asset at their disposal that third-party vendors lack and that they can leverage to better understand member needs and deepen engagement with co-op programs and services: meter data.

The roughly 7 to 8 million AMI meters deployed at co-ops across the country generate thousands of terabytes of data every year, enough information to store hundreds of millions of digital songs or hundreds of thousands of digital movies. Customer engagement technologies can help co-ops and their members make sense of the steady stream of AMI data by making it accessible and actionable. They also promise to help co-ops better target program and service offerings based on the unique needs of underlying member segments that are discoverable through analytics.

In 2016 and 2017, NRECA and two partner cooperatives set out to evaluate one such member engagement technology called non-intrusive load monitoring (NILM). A focus of research for more than three decades, NILM applies advanced analytics to disaggregate whole-home energy data into usage categories or even individual appliances. This allows members to better understand the systems and appliances that most impact their energy

bills so they can make more informed decisions about new equipment purchases, behavior changes, special rate structures, co-op programs, or other co-op offerings that may help in managing their bills.

This information can further be used to improve member engagement by providing a range of services, including personalized savings recommendations, high bill diagnoses, and real-time home and appliance health monitoring. NILM also aims to help utilities lower program costs and enrollment effort through better member targeting.

NRECA's pilot was the first test of this technology in the co-op world, encompassing multiple service territories and thousands of meters, but—for reasons beyond NRECA's control—the vendor backed out of the North American market, and, therefore, the pilot, before the technology had been fully deployed. Still, NRECA learned about several key challenges to implementing NILM technology in particular and member engagement technology in general.

Pilots are often as much about what went wrong—the challenges encountered, the blind alleys pursued—as what went according to plan. Deploying member engagement technologies is certainly no exception and, in fact, may present unique challenges to co-ops.

This report provides the story behind NRECA's recent efforts to advance member engagement technology through pilots and begins to document the systemic, structural, and inherent challenges that co-ops may face in trying to realize their promise. A future NRECA report—available late in 2017—will thoroughly examine the benefits,

barriers, and best practices associated with deploying member engagement technologies, helping co-ops navigate the waters to a new set of technology opportunities.

NRECA’s Member Engagement Pilot

In 2016, NRECA’s Business and Technology Solutions (BTS) group contracted with U.K.-based vendor ONZO to pilot its specific brand of NILM-driven member engagement technology with distribution cooperatives around the nation. Through the pilots, NRECA aimed to demonstrate innovative member engagement approaches and answer several important questions:

- Will a fully integrated mobile + web member engagement experience yield measurable improvements in member engagement and program participation?
- Will disaggregated and actionable energy information drive increased energy or demand savings? Will it drive increased member satisfaction?

- Is the technology reliable and easy to deploy?
- Will the technology help cooperatives better target key member segments for special rates and programs?
- Would personalized analytics of member AMI data spur privacy concerns?

ONZO proposed a two-pronged solution for participating co-ops, encompassing a product used by members called “Personalized Customer Engagement” and a member segmentation service used by utility staff called “Personalized Customer Insights.” The former provides members with an itemized breakdown of their consumption, comparisons with neighbor energy use, and efficiency tips (Figure 1). The latter uses analytics to target member groups that might benefit the most from programs, such as HVAC load control, smart thermostats, or special rate classes for electric vehicles (Figure 2). Results in Figure 2 were used to target members for load control programs.



Figure 1: Screenshot of ONZO Mobile App with Bill Breakdown by Appliance

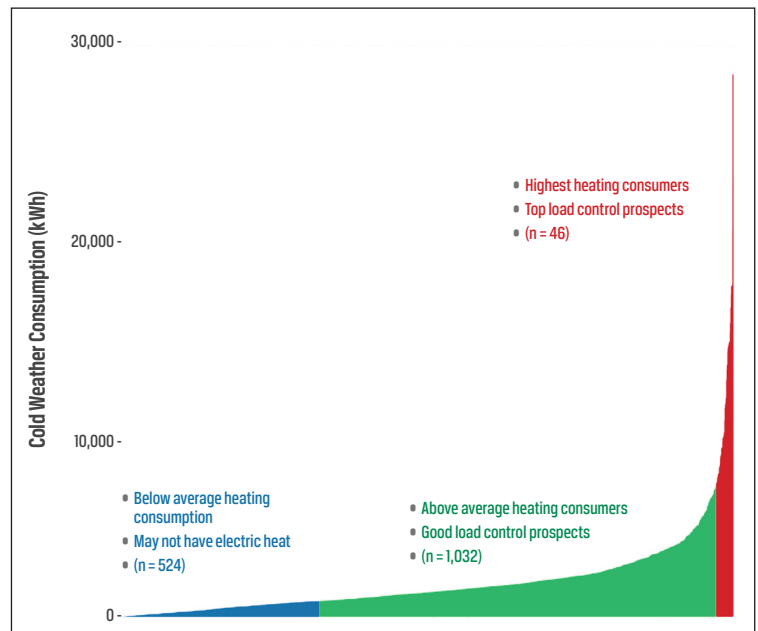


Figure 2: ONZO Segmentation of 1,602 MVEC Members Based on Electric Heating Load

Update on NILM Technologies

Although the ability to collect device-specific, disaggregated energy use already exists for some products like smart appliances and smart plugs, these technologies are limited, expensive, and many years away from widespread adoption. NILM is an attractive alternative; it is a relatively inexpensive way to provide disaggregation information that otherwise would not be available to co-op members without a smart home.

TODAY, MORE THAN 30 COMPANIES OFFER NILM PRODUCTS

Some can disaggregate AMI data, while others require their own dedicated metering hardware installed in the home. Prominent vendors that disaggregate AMI data include Bidgely, Ecotagious, EEme, Onzo, and Home Energy Analytics (HEA). These tools attempt to identify general end-use categories and large peak loads such as HVAC, water heaters, and dishwashers. Companies that require their own dedicated metering hardware to be installed include Neurio, Sense, Smappee, and Whisker Labs.

Current pricing for these technologies ranges from \$250 to \$300. These tools conduct fine-grained disaggregation by recognizing patterns in rapidly sampled data, with intervals below one second. On the whole, in the last five years, the

industry has seen a growing trend toward using device-specific, disaggregated energy use to provide services—focusing more on convenience, comfort, security, and entertainment, in addition to energy efficiency.¹

HOW NILM WORKS

Despite the broad range of NILM offerings on the market, all NILM solutions utilize the same basic process (Figure 3²). They must first acquire whole-home electricity use data. This can be done in a few different ways, depending on the desired sampling interval and available metering hardware.

With AMI meters, NILM providers can acquire 15-minute to 1-hour data. To identify loads more accurately, a shorter sampling interval is required, and additional hardware needs to be installed in the home. The next step is to extract the appliance's unique energy consumption signature. Finally, the algorithms use the extracted signature to classify appliances and estimate their energy consumption.

HOW WELL NILM PERFORMS.

Although several companies have introduced NILM products to the market, only limited information about the accuracy of current offerings is publicly available. Despite the major leaps forward in the

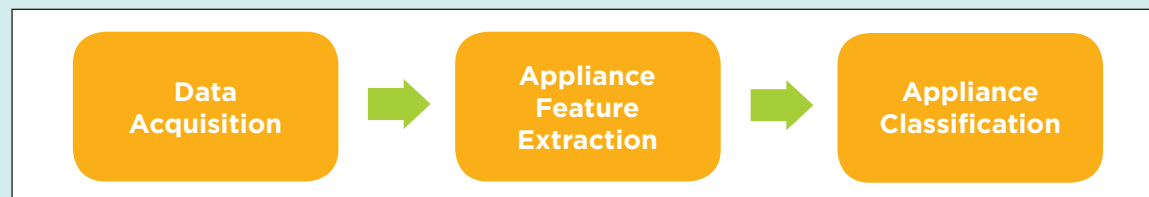


Figure 3: Three Stages of the NILM Process

Continued

1. Fehrenbacher, Katie. "Five Trends for the Smart Energy Home of the Future." Greentech Media. January 9, 2017.
2. Faustine, Anthony, Nerey Henry Mvungi, Shubi Kaijage, and Kisangiri Michael. "A Survey on Non-Intrusive Load Monitoring Methodologies and Techniques for Energy Disaggregation Problem." March 13, 2017.

Update on NILM Technologies (Cont.)

NILM field, no one company has “cracked the code” to providing accurate, device-level energy use data. AMI solutions show reliable performance for large peak loads and spotty performance on everything else.

NILM technology is evolving rapidly, however, and accuracy is expected to continue to improve. Some promising results have recently been published. Using AMI data collected in 1-second intervals from 10 homes over 77 weeks—without additional hardware or input from consumers—EEme achieved average hourly accuracy figures ranging between 90% and 99% for tracking large loads such as dishwashers, refrigerators, dryers, electric vehicles, and air conditioners.³

EXPECTED ENERGY SAVINGS

One of the primary benefits of NILM is to help consumers and businesses save energy and money. But exactly how much can the co-ops and their members expect to save when deploying these technologies today? A review of 12 studies on the performance of NILM technologies⁴ found that they can reduce electricity consumption by 4.5% on average.

Despite these promising results, important questions remain regarding the effectiveness of NILM technologies in reducing energy consumption. Do NILM technologies save more energy than aggregate feedback technologies and, if so, does

fine-grained disaggregation yield better results over coarse approaches using AMI data? Will the energy savings benefits persist long-term?

THE NILM VALUE PROPOSITION FOR CO-OPS

Directly driving energy savings is only one of several value propositions for NILM technologies. There are many other potential benefits worth further investigation by co-ops, some of which may indirectly lead to energy savings. A few pilots have been conducted to understand whether NILM technologies can improve member engagement. Bidgely conducted a member-engagement pilot from June to December 2013 and obtained positive results: 90% of participants used the platform at least once every week for 8 minutes on average. Consumers also showed high satisfaction levels: 86% of users reported they would recommend the service to others.⁵ Two other pilots reported similar positive member engagement results using similar disaggregation tools.⁶

NILM is likely an improvement over aggregate consumption information that customers receive today, especially for motivated users. However, the jury is still out on NILM’s performance and member satisfaction benefits for co-ops. Cooperatives are advised to further investigate NILM technologies to determine the value delivered by NILM technologies to co-ops and their members.

3. Haskell, B., G. Fisher, and D. McCartney. “Performance Evaluation of EEme’s Energy Disaggregation Algorithm Based on 1-Second Whole Home Use Data.” Technical Report Prepared by Pecan Street for EEme. April 2016.

4. Kelly, J. *Disaggregation of Domestic Smart Meter Energy Data*. Ph.D. Dissertation, University of London, Imperial College. April 2017.

5. Chakravarty, P., and A. Gupta. “Impact of Energy Disaggregation on Consumer Behavior.” In *Behavior, Energy and Climate Change Conference*, University of California-Berkeley. November 19, 2013.

6. Trabish, Herman K. “[What Do Utility Customers Want? There’s an App for That.](#)” *Utility Dive*. Nov. 9, 2015.

Co-op Motivations for Member Engagement Technology

Two distribution co-ops—Minnesota Valley Electric Cooperative and South Carolina's Horry Electric Cooperative—joined the effort, and planned to test the ONZO tools for both member and utility use. The co-ops were both interested in improving member engagement, but each had its own specific research questions.

MVEC was most interested in the utility-facing segmentation service to target members who would provide the greatest benefit to the co-op when enrolled in certain demand response (DR) and efficiency programs.

“It doesn’t matter so much if we fail. Not all will work out. But members know that we’re trying, and they view us more favorably because of that.”

— Eddie Webster,
Director of
Demand Response and
Program Development,
MVEC

MINNESOTA VALLEY ELECTRIC COOPERATIVE

Headquartered in Jordan, Minn., Minnesota Valley Electric Cooperative (MVEC) serves more than 41,000 members around and south of Minneapolis. Due to its proximity to a growing urban area, the cooperative’s membership has increased steadily over the past two decades. MVEC offers numerous demand-side management programs to its members, including the Energy Wise load control program for several major residential loads and electric vehicle charging, rebates for efficient appliances, and a Beat the Peak Energy Challenge, whereby participants can earn prizes for reducing their usage when peak notifications are sent out. Eddie Webster, Director of Demand Response and Program Development, managed the overall ONZO pilot for MVEC, and Sue Busch, IT Business Consultant, was in charge of data transfers and integration.

For the ONZO pilot, MVEC was most interested in the utility-facing segmentation service to target members who would provide the greatest benefit to the co-op when enrolled in certain demand response (DR) and efficiency programs. For example, ONZO was able to help MVEC identify members most likely to possess electric resistance heating so that those members could be targeted for the co-op’s Energy Wise load control program (see [Figure 2](#)). MVEC could then reach out directly to these members through various channels, including email, paper mail, and direct outreach from program staff.

On the member-facing side, MVEC was curious to see how effectively ONZO could disaggregate member data using

1-hour meter reads (this is the finest billing data resolution that MVEC has) and how the information would benefit members. ONZO’s member-use app, which offered energy “gamification,” conservation tips, and whole-home and device-specific data readouts, appealed to MVEC. “We are trying to see where the app space is now and we wanted to try something new, in part to help energy apps mature,” said Webster.

All of these elements supported the cooperative’s larger goal for the pilot: increasing member satisfaction. Advanced features—like device-specific, disaggregated energy use—may be interesting to a few members, but any member can benefit from a great experience connecting with his or her co-op. According to Webster, offering the perfect, one-size-fits-all technology tool is not MVEC’s end goal.

“It doesn’t matter so much if we fail,” he said. “Not all will work out. But members know that we’re trying, and they view us more favorably because of that.”

HORRY ELECTRIC COOPERATIVE

Horry Electric Cooperative (HEC) is a distribution cooperative headquartered in Conway, S.C., that serves 60,000 members near South Carolina’s northern coast. Penelope Hinson, Manager of Public Relations, Marketing, and Energy Management, coordinated the pilot for HEC; Brian Swart, Software Development Supervisor, led the IT coordination with ONZO. Like MVEC, HEC already had many tools at its disposal to connect with members when it joined the pilot, including its “MyEnergy” self-service portal, Apogee member engagement portals, and a Beat the Peak voluntary DR program. However, HEC staff were

interested in ONZO's member-facing web and mobile approach that included energy breakdowns, a "How I Compare" feature, and energy savings goals.

In addition, the cooperative was very interested in using ONZO's utility-facing service to identify problematic loads or members, including on-demand electric water heaters, electricity theft, new natural gas customers, and marijuana grow houses. Because ONZO ended the pilot prematurely, HEC was not able to evaluate the tool's abilities in any of these areas.

A Premature End

Unfortunately, after more than a year of pilot planning and integration efforts, ONZO decided to cease operating in the North American market. According to officials at the company, ONZO made the strategic decision to "focus on those customers and areas that are best-suited to the testing and development" of new products, meaning a pivot to "large-scale European utility projects." Although most research questions were unanswered, NRECA and the co-ops still learned about the challenges of deploying a third-party vendor technology.

The Challenges of Deploying Member Engagement Technology

Member engagement solutions like NILM rely on a steady diet of consistently formatted, standardized data. Successfully integrating these technologies into co-op operations requires significant collaboration and communication between co-op IT staff and the vendor to ensure that data is being transferred securely and in a well-documented format. Before ONZO's departure, staff at both MVEC and HEC spent considerable time learning how to integrate with the company's member engagement solution.

Although MVEC and HEC were in different phases of preparation and deployment when the projects ended, the main challenge that both faced was data integration—ensuring that data can be transferred regularly and securely with the third-party vendor in an agreed-upon format. MVEC and HEC had different experiences in this area, but technological as well as organizational obstacles affected both pilots.

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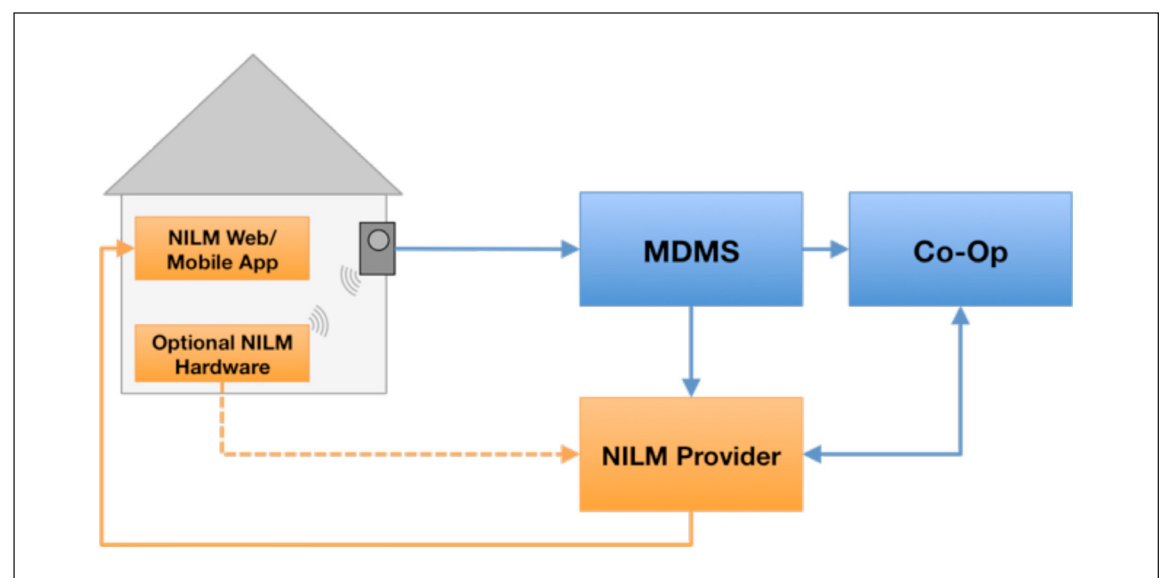


Figure 4: A Potential Data Flow for a NILM Implementation at a Co-op. Member engagement technologies like NILM can involve significant system integration efforts between the co-op, the NILM provider, and third-party meter data management vendors.

ONZO, like many vendors in the home energy management space, tries to be “meter-agnostic” and work with data in whatever form its customers can provide.

SECURING DATA ACCESS

Distribution cooperatives usually rely on IT vendors to provide critical data services such as member information and meter data management systems; these entities play a large role in the smooth integration between distribution co-ops and third-party technology vendors. Generally, the more direct, local control a distribution co-op maintains over its data, the easier the data integration process will be.

In the case of this pilot, both MVEC and HEC rely on information—or meter data management system (MDMS)—co-ops for meter data management services, but with important differences in implementation. MVEC’s member data (meter IDs, meter location coordinates, and program enrollments) is stored on MVEC-owned systems, so it was easy for staff to compile and provide that data to ONZO when needed and in the requested format.

MVEC’s interval meter data, however, is stored in a third-party MDMS and required the development of custom data integration between the MDMS and ONZO to transfer MVEC’s meter data in an automated fashion (e.g., a daily upload of meter reads for members wanting to use the ONZO app). This effort was significantly more difficult than the data transfer between MVEC and ONZO, and was a key challenge of MVEC’s pilot.

Negotiations about how to proceed delayed MVEC’s pilot start date by several months. ONZO, too, noted that, unlike its larger utility customers, the co-ops had fewer IT resources, putting more burden on ONZO staff to provide a solution. However, ONZO noted, integration is always a major hurdle no matter the size of the utility.

At HEC, IT staff maintain their own internal database of hourly AMI readings. They were able to transfer member and meter data from their internal systems directly to ONZO in an automated fashion, avoiding many of the challenges that MVEC encountered. Local access to and control of data can speed and simplify third-party vendor integration.

AGREEING TO SPEAK A COMMON LANGUAGE

ONZO, like many vendors in the home energy management space, tries to be “meter-agnostic” and work with data in whatever form its customers can provide. Flexibility means that ONZO can integrate with a variety of meter data formats, but it also can breed confusion and consume precious time from co-op IT staff who are already overburdened.

Both Busch from MVEC and Swart from HEC described challenges and significant iteration when identifying exactly how data should be structured. Both noted that the vendor did not provide a standard data template or preferred transfer mechanism, nor did the cooperatives have easy access to or support from ONZO’s technical staff. As Busch described it, she had to “start from scratch” and spend “a good chunk of time” developing data templates and identifying and vetting software that could automate the data transfer.

Prior to committing to the pilot, Swart was told by ONZO that they did not have specifications for data transfer, only to be notified weeks later of an evolving data specification. Swart and his staff were able to accommodate these changes and, despite the unexpected reworks, Swart felt the development effort to date was “low to medium.” In the end, both cooperatives were able to develop functional data transfer processes with ONZO, but would have benefited from more consistent guidance and technical support from the vendor.

Fundamentally, these experiences speak to the absence of robust industry interoperability standards. As Webster pointed out, this isn’t unique to the ONZO pilots. “Integrations and vendors collaborating with each other is always the most difficult part of these types of projects,” he said.

Similarly, Swart noted that a common communication protocol would simplify these kinds of projects and enable small utilities, which lack large budgets for

software installations, to participate. If, for example, cooperatives and their IT vendors like NISC and SEDC provided data access through a standard like Multi-Speak, then vendors would have a single, streamlined vehicle for transferring data with most co-ops.

LIMITED STAFF RESOURCES AND BUDGETS

Bringing new technology services to any electric utility requires involvement from program, marketing, and, particularly, IT staff. Both cooperatives had IT staff in leading roles on the pilots, including MVEC's Busch and HEC's Swart. HEC is unusually well-equipped to handle in-house development and data integration efforts, with three developers on staff. MVEC has significant experience in integrating new, member-facing technology solutions.

But MVEC and HEC are better equipped than most co-ops to undertake such technology-heavy pilots. Most co-ops and other smaller utilities are far more reliant on outside IT contractors and have limited capacity to bring large IT projects online. They may not have the in-house development capability to quickly integrate member engagement technologies. In fact, staff capacity constraints were a top reason given to NRECA by co-ops that declined to participate in this pilot.

According to HEC's Swart, "Vendors should know that, unlike large IOUs, co-ops will most often want to send the data and have the vendor do the rest, including data presentment to members and user interface. Most co-ops don't have in-house developers to do this, and it doesn't make sense for utilities with tens of thousands of members."

Cost is also an obvious concern should co-ops need to bring in outside resources (or add custom integration efforts to the scope of the vendor's services). G&T cooperatives

could play an important role in bringing costs down through group purchasing of technology solutions. Access might be provided through a reasonable monthly subscription fee, avoiding a time-consuming and expensive development process for every cooperative. Both Webster and Swart agreed that G&Ts would offer economies of scale to make technologies like this more feasible and affordable, as well as less burdensome on staff.

CYBERSECURITY AND PRIVACY

Although not an insurmountable obstacle to member engagement technology, data-sharing with third parties always raises security and privacy concerns. Neither pilot experienced challenges related to cybersecurity before they ended, but both co-ops took measures to protect themselves and their members.

Swart ensured that the data transfer procedure HEC was using was secure. He pointed out that none of the data sent to ONZO contained member names or addresses, and that ONZO never had access to HEC's system; the data transfer was one-way.

MVEC worked with ONZO to develop robust, legal contracts on exactly what data ONZO would have access to, what they were allowed to do with it (only analyze, never sell or share), how long they could store it, and security precautions they have implemented. Additionally, the co-op communicated clearly with potential participants on how their information would be used.

"Having that outward messaging in place provides comfort," noted Webster. The process might be simplified in the future if the industry embraced a standard checklist or other standardized tool for co-ops to follow to ensure vendors follow best-in-class security protocols.

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Lessons Learned and Next Steps

Given the premature end to the pilot, neither co-op was able to assess what and how much value member engagement technologies in general and NILM in particular offer. The ONZO pilot did, however, shed light on important challenges that prevent co-ops from deploying member engagement technology solutions that are becoming more commonplace at larger utilities.

In a follow-up to this report, NRECA will examine the solutions and best practices that will allow cooperatives to mitigate these barriers. This project will draw on the experience of co-ops and larger investor-owned utilities to chart a roadmap toward successfully implementing member engagement technologies at distribution co-ops.