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DETROIT AUTO SHOW HIGHLIGHTS GROWING RANGE OF EVs

From economy models to luxury cars, electric vehicles (EVs) claimed their place alongside the usual displays of horse-power at the 2014 North American International Auto ShowRedirecting to a non-government site in Detroit. Almost all major automakers exhibited at least one gas-electric or full-electric vehicle.

No longer just a niche product for "super-green" consumers, alternative-fuel cars now offer the same features, much of the power and all of the slick design of conventional cars. Even Joel Klassen, an internal combustion engine devotee and graphic designer on Western's Public Affairs staff, was impressed. "The first hybrids looked more like science experiments," he admitted. "There wasn't much about them to excite car enthusiasts, but some of these designs are as good-looking as anything at the show. The all-electric Tesla Model S is the world's first premium electric sedan. It won high acclaim as Motor Trend's 2013 Car of the Year," Klassen added.

Joel Klassen pays his respects to DOE's entry into the auto show. (Photo provided by Joel Klassen)

Pictures taken by Klassen, who makes an annual pilgrimage to Detroit in January to attend the event, show the range of what is available in EVs. The Mercedes Benz Smart ForTwo Electric Drive, named one of the greenest cars of 2014Redirecting to a non-government site by the American Council for an Energy Efficient Economy, is the smallest, shortest plug-in electric car sold in the U.S., and the least expensive.

There are no shortage of options for those who like a flashier ride, from the Tesla to the high-performance, gas-electric Porsche 918 Spyder. Another big hit at the show was the handsome BMW i3 electric compact city car, with a range of up to 100 miles. The manufacturer claims it can sprint from 0 to 60 miles per hour in seven seconds—faster than many traditional gasoline vehicles on the market.

The EcoCar2 stood in contrast to all the glamor and gadgetry, as if to remind attendees that solid engineering must come first. The Department of Energy and General Motors are sponsoring a three-year challenge in which college students compete to reduce the environmental impact of a 2013 Chevrolet Malibu. The project is intended to advance the technology that will make EVs more efficient and affordable, and to train the workforce that will design and build tomorrow's electricity-powered fleet.

Even as the combustion engine continued to dominate the International Auto Show, the message from the auto industry to the utility industry is clear. The market for electric vehicles is growing and it is offering more options to appeal to more consumers. Utilities must prepare for the challenge and opportunity of meeting this new demand.

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MYMETER TURNS BELTRAMI ELECTRIC MEMBERS INTO CONSERVATION PARTNERS

Behavior-based energy-efficiency programs are, if not the final frontier, a country that utilities have only begun to explore, and Beltrami Electric CooperativeRedirecting to a non-government site in Bemidji, Minn., is an early pioneer.

The 20,000-meter public power provider is located in the north-central section of a state that has a history of policies promoting energy efficiency. In 2007, the Minnesota legislature updated its requirement by passing the Next Generation Energy ActRedirecting to a non-government site, mandating electric and natural gas utilities to reduce energy sales by 1.5 percent of average sales. "Changing the focus from spending a certain amount on energy efficiency to saving energy made conservation the program driver," said Beltrami Energy Services Manager Sam Mason.

For decades, Beltrami Electric Cooperative has employed load control as a way to deal with demand peaks caused by Minnesota's icy cold winters and hot, humid summers. (Photo by Heyer Engineering)

BEYOND REBATES

To explore programs that could help the utility meet its goal, Beltrami Electric formed a working group with eight other member co-ops of wholesaler Minnkota Power CooperativeRedirecting to a non-government site. Commercial and residential incentives for energy efficiency upgrades were already available through Minnkota, so the co-ops were interested in new approaches to reducing consumption. "Upgrading equipment and appliances is great, but that has high up-front costs, and people generally do it only when they have to replace something anyway," explained Mason. "We were looking for steps customers could take every day to reduce energy use, a program that was cost-effective for us and for our customers."

Behavioral energy-efficiency programs check many of those boxes, but the co-ops faced two challenges: finding the right program and getting the state to accept deemed savings. Deemed savings estimates energy and demand savings by multiplying the number of installed measures by an estimated (or deemed) savings per measure based on historical evaluations. This approach is often used with programs targeting simpler efficiency measures, such as reminding users to turn off equipment not in use.

COST-EFFECTIVE, TIMELY

In the pioneering spirit, Beltrami Electric undertook a pilot project using MyMeterRedirecting to a non-government site, an interactive demand-side management tool that gives customers access to their billing and energy information online. This feature appealed to Mason, who noted, "We looked at programs that use mail to communicate with customers, but MyMeter connects them with what is happening in their home right now. That gives them the power to make changes when it can make a difference on their bill."

Another advantage of MyMeter is that customers don't have to invest in costly new equipment. "All they have to do is spend a little time and attention," Mason pointed out. And they do, he added. "I know some customers who check their accounts every day."

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Beltrami Electric promoted MyMeter through its newsletter and newspaper ads. In the first year of the pilot, customer sign-ups exceeded 11 percent. Currently, participation is at about 16 percent, but Mason observed that it grows every time the region experiences extreme weather as it did in January.

MyMeter allows customers to access their real-time energy use data from personal computers, tablets or smart phones. (Photo by MyMeter)

TALKING IT OUT

As with any new program, customer service representatives had to go through training so they could teach new participants throughout the process, and to get the most out of the system's capabilities. MyMeter enables the customer and representative to log into an account at the same time, so they can discuss energy use issues looking at the same real-time data. The representative can ask what appliances are on, or if the customer has company—anything that might affect their energy use. "These are details the customer may not remember 30 to 60 days from now, when that big bill comes," Mason said. "Dialogue is a critical part of customer education."

Any call can turn into a learning experience for both consumer and utility. Customers may not know that their bills are usually driven up by big systems—space conditioning, water heating, large appliances, lighting—noted Mason. A mother may call on a snowy day, for example, thinking that the video games the kids are playing are causing her electricity use to spike. After a few questions, the representative discovers that the home has a heated water tank for livestock. "But whatever the problem turns out to be, our representatives can use that information on the next call," Mason said.

GETTING RESULTS

Co-op customers are using the information MyMeter provides, too. The overall energy savings among MyMeter participants versus non-participants averaged 3 percent, or 550 kilowatt-hours (kWh) per household. Households in the top quartile of energy consumption achieved 8-plus percent reductions. Beltrami Electric accounted for the impact of its other efficiency programs to avoid double counting, and conservatively claims total savings of 2.6 percent, or a full percentage point higher than the state requirement.

A case study by MyMeter calculated the first-year savings cost effectiveness at $.023 per kWh saved. That figure was further adjusted to $.07 per kWh under Minnesota's Average Savings Method that discounts for uncertainty in the persistence of behavioral program savings.

MyMeter's work with Beltrami Electric on the pilot project led the company to make more refinements in the evaluation component of the tool, which have now been integrated into the platform. The Minnesota Division of Energy Resources (DER) accepted the project's findings and now count savings claimed from behavioral programs toward utilities' mandated goals.

The other co-ops in the Minnkota working group have since implemented MyMeter. As for Mason, he is sold on behavior-based energy-efficiency programs, and on MyMeter specifically. "Now we have a tool that really helps customers understand their energy use and take control of it," he said. "I've been talking about conservation for years, and if I've learned one thing, it is that you have to engage the customer. Otherwise, the program will not succeed."

REPORTS HIGHLIGHT DIFFERENT ASPECTS OF UTILITY EFFICIENCY PROGRAMS

If energy-efficiency is the cheapest resource, it is also the most elusive. In the face of new regulations and growing public concern about the environment, utilities need to be willing to explore a variety of approaches to reducing energy use. Several studies released in 2013 offered much food for thought on designing effective energy-efficiency programs.

BREAKING DOWN ENERGY BEHAVIOR

The utility industry has seen a steady growth over the last five years in behavior-based energy-efficiency programs—strategies that use an understanding of how individuals consume energy to decrease energy demand. The American Council for an Energy Efficient EconomyRedirecting to a non-government site (ACEEE) recently completed the first comparative analysis of programs that focus on changing customer behavior to save energy. The Field Guide to Utility-Run Behavior Programs examines 281 of these programs offered by 104 energy providers and third parties between 2008 and 2013.

Researchers sorted all the programs into 40 different categories grounded in the behavioral and cognitive sciences that can be roughly grouped into three large families:

- **Cognition** programs focus on delivering information to consumers. General and targeted communication efforts, social media, classroom education and training fall into this group.
- **Calculus** programs rely on consumers making economically rational decisions. This group uses feedback, games, incentives, home energy audits and installation to shape consumer choices.
- **Social interaction** programs rely on interaction among people for their effectiveness. They involve social marketing, person-to person efforts, eco-teams, peer champions, online forums and gifts.

ACEEE recommends that program designers "stack" several strategies—at least one from each family—to engage multiple drivers of consumer decision making. For example, a designer might want to combine a home energy report with an audit program using a community-based social marketing approach. Holistic programs that simultaneously appeal to consumers through information, economic incentives, and social interaction are likely to have the greatest impact.

MILLENNIALS EXPECT SOCIAL INTERACTION

Social engagement played a starring role in the project that won a student competition hosted by energy management consulting firm DEFGRedirecting to a non-government site.

The Future of Energy 2020 tasked a group of New York University students to envision the future customer experience in the utility sector from the perspective of the Millennial Generation. The project took place in a finance class offered within the NYU Gallatin School. Students who attend this college within NYU pursue inter-disciplinary approaches to their education and have a reputation for thinking "outside the box."

Working with DEFG, Professor Peter Rajsingh asked students to tell a story centering on future interactions between customers and utilities in the year 2020. Students broke into small teams to conduct market research and trends analysis, and then presented their vision through a narrative and visual demonstrations of the future. The teams chose interactions ranging from new bill-paying options, to future energy management and advances in clean technologies, to a new paradigm for low-income consumers to earn energy credits.

Selected from four finalists, the winning story depicted a young couple navigating different needs and expectations as they bought a new home. The home featured several new technologies and applications that both managed energy and were environmentally friendly. The utility served as a pro-active partner to the couple, assisting them with their decision-making, even providing an "energy concierge."

Professor Rajsingh found it interesting that the students all rooted their visions of future customer experience in social contexts, which humanized the relationship between customers and utilities. "Transparency and social responsibility were key themes that were woven into all the Vision 2020 presentations," he noted.

The results of the competition pointed to a future where young adults expect their utilities to engage with customers and support a mix of consumer technologies, devices and interactions on the customer's terms. "The student's Vision 2020 married major trends in customer service and communications with advancements in energy management and technologies into one seamless experience," stated DEFG CEO Jamie Wimberly. "In other words, for the millennial generation, the future customer experience represents the digitization of the utility customer experience. Ultimately, that is a very different relationship between the customer and the utility from today."

EFFICIENCY FOR INDUSTRY

Energy efficiency programs for industrial and other large customers call for a different approach than residential programs. Businesses may need to train or hire staff to deal with specialized equipment or operations.

See UTILITY EFFICIENCY PROGRAMS, page 8

TECHNOLOGY SPOTLIGHT:

NEW LIGHTING TECHNOLOGIES MAY MAKE CANOPY RETROFIT A WINNER

Exterior lighting attracts customers to retail locations, enhances safety conditions and improves the perception of safety in spaces where pedestrian and vehicle traffic mix, such as convenience stores with gas pumps. TSsidebar1

Gas station canopy lighting operates for long hours in all weather conditions to light the fuel pumping area. Metal halide (MH) lighting has long dominated this application, but LED and induction lighting offer an alternative. These products save energy, reduce maintenance, provide higher-quality light and offer more control options. The biggest unknown is if the technologies can deliver the promised long lamp life in real-world conditions. High-quality fixtures are the key to achieving that longevity.

What is induction lighting?

Induction lamps, or electrode-less fluorescent lamps, are powered by an electromagnetic field induced by a generator. Lamps may last up to 100,000 hours, but their generators may not.

Induction lamps are usually large, making them appropriate for area lighting. The technology has a longer real-world track record than LEDs.

BETTER, NOT MORE, LIGHTING

While energy codes reduce power allowances and regulate light pollution, businesses still want to look brighter than their neighbors to attract more customers. New technologies can provide more light with less energy, and a good retrofit can put the right amount of light where you need it without producing excess light.

Some utility programs promote canopy lighting retrofits with incentives and the promise of energy savings. LEDs can often deliver more useful light for less than half the energy MH lamps use, but there are no standard rules about how many LEDs are needed to replace MHs.

According to the Illuminating Engineering SocietyRedirecting to a non-government site (IES), measured and perceived light levels are not directly related. An articleRedirecting to a non-government site by the National Lighting Product Information Program explains that the perceived brightness of a space is affected by the average light level, contrast and distribution, and amount of light produced. For example, a recent retrofit projectRedirecting to a non-government site replaced 56 320-watt MH fixtures with 30 142-watt LED luminaires, reducing energy use by 80 percent.

DIFFERENT LUMINAIRES, DIFFERENT NEEDS

A recent survey of canopy retrofits found very high light levels under canopies but not enough area lighting beyond the structures. This high contrast can impair vision. People also feel safer when they can see and respond to what is going on beyond their immediate space.

Many gas pump islands exceed the light level recommendations for these retail spaces in the horizontal plane (see sidebar), while vertical light levels are often much lower. These levels should be the same because vertical light is needed to make people and objects more visible. TSsidebar2

A qualified lighting designer can maximize lighting effectiveness and energy savings by using different types of luminaires on different parts of a property. The IES classifies luminaires according to the amount of light that they distribute upward. Full-cutoff fixtures direct all their light down, while semi-cutoff fixtures emit some light sideways. Non-cutoff fixtures may be omnidirectional and contribute to light pollution. Using a variety of luminaires in different locations ensures that there is enough light to meet customers' needs and it does not create glare or other safety issues.

REALISTIC ENERGY SAVINGS EXPECTATIONS

Understanding how much of the total energy bill canopy lighting represents helps in managing savings expectations. Exterior lighting at convenience stores can consume 20 percent of the total energy useRedirecting to a non-government site. Convenience stores and truck stops have many other significant

See TECHNOLOGY SPOTLIGHT, page 6

energy loads, such as refrigeration and heating and cooling. If those systems are upgraded at the same time, or if electricity rates change, energy savings from a lighting retrofit may be obscured.

Many facilities still rely on manual controls, even though photocells and timer controls are available. MH is most efficient when left on for at least 10 hours; in contrast, LEDs and induction lamps can be switched frequently without affecting their lamp life or light quality. Bi-level operation—lamps that come up to full power when customers arrive and drop to a lower light level when customers leave—might offer additional savings at less busy stations.

Horizontal light – Light measured in the horizontal plane when holding a light meter horizontally below the lights and measuring the light that falls on the pavement.

Vertical light – Light measured in the vertical plane when a light meter is held vertically in the lighted area, indicating how much light is falling on people and objects that are perpendicular to the pavement.

MORE SAVINGS FROM MAINTENANCE?

MH lamps have a relatively short lifespan (10,000 to 20,000 hours) compared to LED and induction lamps (50,000 to 100,000-plus hours), and experience much higher depreciation of lighting quality over time. To compensate for these drawbacks and to avoid frequent expensive replacements, facilities using MH lamps often over-light. LEDs and induction lamps, with their long lamp life and more durable quality, can reduce the need for maintenance and over-lighting. Maintenance savings may accumulate faster than energy savings, improving the payback in spite of high first costs.

As LED performance improves and costs decline, this technology has become competitive in many markets, especially when factoring in total cost of ownership rather than energy savings alone. Induction lighting may also be worth considering.

Call Western's Energy Experts hotline, 800-769-3756, for more guidance on customer lighting projects.

DATES CHANGE FOR SPRING TRIBAL RENEWABLE ENERGY WEBINARS

The Tribal Renewable Energy Webinar Series has rescheduled two upcoming webinars. Renewable Energy Project Framework: The Five Step Process previously planned for March 26, will now air on April 2. The April 30 webinar, Identifying Project Potential and Options, is being moved to April 26. Both events will take place at 11 a.m. MDT.

Early birds who have already registered for these two webinars do not need to register again. Those who were unable to attend on the original dates now have a second chance. The April 2 webinar will introduce participants to the key steps that lead to success in energy project development. The first two steps will be covered in depth during the April 26 webinar.

Following the live events, recordings and presentations are posted in the Renewables Program webinar library. Visitors can review the material at their convenience, but need to download the GoTo Meeting codec to access the recordings.

ask the energy experts

DISTRICT HEATING SYSTEM FEASIBILITY DEPENDS ON MANY FACTORS

QUESTION:

Are there examples of district heating systems providing heat to new housing developments? A local developer of large luxury homes is incorporating conservation and renewable technologies, and wants to investigate district heat using ground-coupled heat pumps or biomass-fueled boilers.

ANSWER:

District heating projects involve many variables, such as the cost of energy, the installed cost of the system, possible revenue from each part of the system, maintenance costs and more. Local climate and regulations, access to funds and available renewable resources must be considered as well when evaluating the feasibility of an individual project. Finally, each proposed system should be planned and designed as a long-term investment. That being said, the technology is a highly efficient means of delivering heat, and a new development offers the best-case payback for installing a district heating system.

HEAT, ELECTRICITY

Where houses are close together and a source of otherwise wasted energy is available, combined heat and power (CHP) systems can provide cost-effective heat to large numbers of customers. In lower-density areas, installing and maintaining piping—especially underground systems—is often prohibitively expensive.

Your development may be a good candidate for a CHP system. These systems use a turbine or diesel engine to generate electricity for on-site use and for sale to the local electrical utility. Most of the waste heat from the process is captured for use by a district heating system to heat homes and domestic hot water. Several college campuses around the country have installed CHP district heating systems. The International District Energy AssociationRedirecting to a non-government site has case studies of some of these projects.

Biofuels such as wood, agricultural waste, garbage, or nearly anything else that will burn are a potential low-cost source of energy for CHP district heating systems. The feasibility of using any fuel depends on several factors – cost (including transportation), volume of fuel available, heating and electrical loads, construction and operating cost of the facility, and the value of the electricity produced.

DIRECT GEOTHERMAL

If you have a source of geothermal hot water available, it can be used in a non-CHP district heating system. Boise, Idaho, boasts the first commercially successful geothermal district heating system in the United States, installed in 1897. The system provides 4,000 gallons per minute of geothermal water at 179 degrees Fahrenheit to city businesses and residences. Other locations, mostly in the West, have installed similar district heating systems since then.

The Oregon Institute of Technology Geo-Heat CenterRedirecting to a non-government site (GHC) offers a brief overview of several existing direct-use district geothermal heat systems throughout the Western United States. The GHC website also contains a list of consultants experienced in all phases of implementing geothermal heating systems, as well as other valuable resources for planners and designers considering this technology.

You also expressed an interest in using geo-exchange (geo-x) heat pumps to supply heat for a district heating system. In a district heating application—regardless of how large or small the system—the greater efficiency of heat pump technology might offset the high first cost of system installation. Normally, district heating systems are considered an option when the developer has access to a renewable heating resource, such as hot springs or other geothermal resources. However, the feasibility of adding geo-x heat pumps to each home and business to heat water should be carefully evaluated.

The benefits of integrating technologies and incorporating innovative design into your system depend on your overall goals for the housing development, financial and otherwise. It would be worthwhile to compare the cost of different options: building a district heating system, installing individual geo-x heat pumps with a desuperheater (heat exchange unit for water heating) or integrating the two technologies. You may be surprised at which option is most cost-effective.

See ENERGY EXPERTS, page 8

Energy Experts *from page 7*

ADDITIONAL INFORMATION RESOURCES

A search of the Energy Solutions DatabaseRedirecting to a non-government site yields several resources on the topic of biofuels. The DOE Office of Energy Efficiency and Renewable Energy has a comprehensive Biomass website.

Here are some more case studies you might find useful:

- *Maryvale Terrace: geothermal residential district space heating and cooling*
  U.S. Small Business Administration. Green Government Opportunities for Small Businesses.
- *Selected cost considerations for geothermal district heating in existing single-family residential areas*
  U.S. Small Business Administration. Green Government Opportunities for Small Businesses.
- *Case Study: Vancouver's District Heating Program*
  Seattle New Building Energy Efficiency Policy Analysis by EDAW, Inc.
- District Heating Idaho
  Governor's Office of Energy Resources
- North Springfield Sustainable Energy Project
  State of Vermont Public Service Board
- Serving a Dense Residential Complex with a Pellet BoilerRedirecting to a non-government siteBiomass Energy Resource Center
- *Heat pumps – A key technology in future district heating and district cooling systems*
  Stene, Jørn; IEA Heat Pump Centre Newsletter. Vol. 30, No. 2. 2012. p. 21.

Utility efficiency programs *from page 4*

A report from Southwest Energy Efficiency ProjectRedirecting to a non-government site (SWEEP) indicates that utilities can achieve significant, measurable savings by providing large customers with funding to build in-house energy management expertise.

SWEEP studied three strategic energy management (SEM) programs, as these programs are called, and reported its findings in Utility Strategic Energy Management Programs. SEM programs implemented by Bonneville Power Administration, Energy Trust of Oregon and Puget Sound Energy achieved energy savings of 15 to 25 percent of the agencies' total savings for all commercial and industrial efficiency programs. The programs also showed that savings from operations and maintenance (O&M) improvements can be measured in a rigorous way, and that SEM can be very cost effective.

SWEEP recommends that utilities with an interest in SEM programs start by launching an energy manager co-funding program. This strategy helps many large customers to see energy management in a more comprehensive way and begin to develop the staff resources needed to implement energy-efficiency improvements.

The next step might be to create a pilot program to train a group of customers in the SEM principles and develop a way to measure savings. Offering a utility program to help industrial customers find, implement and measure savings from O&M improvements will put businesses on the SEM path.