Energy Efficiency Research and Analysis

Collaborative Efficiency conducts research and writes publications for the National Rural Electric Cooperative Association's (NRECA) Cooperative Research Network. The audience for these publications: NRECA's 900 member electric cooperatives that serve over 42 million electric meters across the United States.

Collaborative Efficiency is a part of the team behind these publications. Co-op staff from around the country contribute best practice ideas and review each report. The National Rural Electric Cooperative Association staff direct our efforts and transform the Word® documents we produce into beautiful publications.

Publications

How the Non-Energy Benefits of Energy Efficiency Can Help Co-ops (September 2013)

Implementing energy efficiency in residential or commercial buildings can create a host of other impacts beyond reducing energy use and expenditures. Some impacts can be negative, especially when energy efficiency measures are implemented improperly, but others can be very positive for both co-ops and their members. The non-energy benefits (NEBs) of energy efficiency fall into this positive category. Understanding these can help co-ops make better decisions about energy efficiency programs and implement them in a way that increases the benefits to their members.

A Commercial and Industrial Opportunity for Co-ops: Energy Management and Energy Teams (January 2014)

All business enterprises, including electric cooperatives, recognize the importance of their largest customers. Commercial and industrial (C&I) businesses and public agencies buy a large share of a cooperative's electricity and provide a large share of a co-op's sales revenue. These large customers are also critical to the community because of the jobs they provide. Co-ops assign account executives to serve large customers, but is there more they could do? This report explains how utilities are beginning to work with their largest customers on energy management and explores an important tactic of energy management, which is the formation of energy teams.

A Consumer's Guide to an Energy Efficient New Home (February 2014)

Becoming the owner of a newly-constructed home is an exciting process and can be a major life milestone. Whether you are building a custom home or buying a spec home, you will be making dozens of important decisions before moving in—from picking kitchen countertops to selecting a home financing package. This Consumer Guide will explain the benefits of an energy efficient home, provide tools to help you make smart energy decisions throughout the building or buying process, and connect you to additional information resources.

The Current State of Home Energy Monitoring Devices and Applications (February 2014)

Home energy use often goes unnoticed because it is a largely intangible good. It isn't until the monthly electric bill arrives that home occupants get concrete feedback about their energy use. But, because of the delay between energy use and billing, occupants often can't accurately account for how specific behaviors contribute

to their overall energy consumption. This is akin to shopping at a grocery store where customers cannot see the prices of goods and are billed just one time per month in aggregate. In-home energy monitors and applications that provide real-time, or near real-time, feedback about energy use are a promising solution to this problem. This paper provides background on the development of home energy monitoring, the current status of the technology, and insights into where this quickly moving industry is going.

Guide to Implementing a Trade Ally Program (March 2014)

A community of tradespeople in your service area—likely consisting of contractors, building science professionals, and equipment distributors—serves members of your cooperative facing energy-related problems. From a drafty home to a noisy furnace to high electric bills at a commercial warehouse—home and business owners turn to tradespeople to help assess and fix these problems. Drawing on best practices from residential and commercial trade ally programs in operation around the country, this paper is a guide for electric cooperatives that would like to establish their own trade ally programs. It explains the benefits of a trade ally program— and what resources are needed to launch and manage it. From program planning to pro- gram evaluation, step-by-step program design recommendations are provided. Concerns that are specific to electric cooperatives are also addressed—including strategies for how to overcome the challenges of establishing a trade ally program in sparsely populated rural areas.

Co-ops Can Improve the Energy Performance of New Homes (April 2014)

An electric co-op's influence during the new home design process, whether through education, technical assistance, and/or financial incentives, can reduce the energy consumption of new significantly. This article presents information to assist co-ops in planning how to help members make these important decisions about energy efficiency during construction of new homes.

Leading by Example with a LEED Commercial Building (April 2014)

While many electric cooperatives promote building energy efficiency and conservation to their members through marketing initiatives and incentives—some cooperatives are walking the talk by achieving Leadership in Energy and Environmental Design (LEED) green building status for their own buildings. These co-ops are not alone. Constructing high performance LEED commercial buildings is now a top sustainability goal for many private and public organizations. Achieving LEED status is perceived as a market differentiation tool leading to increased financial performance by 60 percent of corporate leaders (McGraw, 2012). This paper explains how your electric cooperative can achieve LEED certification for commercial buildings. It describes what LEED is—including the development of the certification system, the benefits of a LEED building, criteria a commercial building must meet to achieve different LEED certification levels, administrative requirements, and costs. Examples of how NRECA electric cooperatives—from Minnesota to Oregon to Texas—have approached green building projects and successfully achieved LEED are highlighted. Alternative green building certification options are also included.

Low-Cost Energy Use Monitoring (April 2014)

Peak load periods put stress on distribution systems and often require more costly energy resources to meet demand. Load monitoring and energy management devices can help smooth these peaks by providing information to users about the quantity, end uses, or cost of the energy they use. They are designed to educate and to instigate behavioral changes that result in lower energy use, especially during peak demand periods. Some of these devices can control energy systems in the house automatically. Several technological innovations are facilitating the rise in residential load monitoring solutions. This paper is a snapshot of a technology in

motion. It explains the logistics of getting energy use data into the home, analyzes the features of different low-cost load management devices, and reviews the devices currently available. Although largely focused on devices and services home occupants can purchase and use independently of their co-op, the paper also explores how co-ops might approach residential load monitoring and management devices as a solution to peak demand challenges.

How Are Third-Parties Impacting the Cooperative-Member Relationship? (June 2014)

Are co-op members beginning to turn to third-parties for energy-related information, services, and products? What can co-ops do to maintain strong customer relationships and continue to be seen as "trusted advisors" for their members? How can co-ops leverage the technological expertise of third-parties to better meet the needs of their members while they preserve the co-op image? This article explores these questions and provides a roadmap for co-ops to confidently approach the challenge of maintaining strong member relationships in an increasingly competitive and complex energy marketplace.

Behavior Energy Efficiency Programs: *Volume 1 – An Overview* (July 2014)

Building occupants can have a major impact on energy consumption. Identical buildings vary widely in energy consumption because of the way they are operated, suggesting a large potential for behavioral energy efficiency. This paper explains the market and regulatory changes that are prompting more energy providers to consider behavior programs, the potential benefits of these programs, and the taxonomy of behavior- based program types. This CRN TechSurveillance article, the first of a three-part series, provides analysis and guidance on behavioral efficiency. This CRN TechSurveillance article, the first of a three-part series, provides analysis and guidance on behavioral efficiency—including commentary from one of our NRECA Member Advisors, Sam DeLay of Tennessee Valley Authority. Volume Two describes real world applications of behavioral efficiency techniques, and Volume Three addresses program design, implementation, and evaluation best practices. The focus of this series is on the residential sector—which is the target market of a large portion of current behavior programs. Please note that while demand response is a component of behavioral efficiency—and is touched on in this report—this series does not provide a comprehensive analysis of how behavior-based program design approaches can be used for demand response applications

Behavior-Based Energy Efficiency Programs: *Volume 2 – Examples of Real World Behavioral Efficiency Programs* (August 2014)

This is the second of three TechSurveillance articles providing analysis and guidance on behavioral efficiency. The first volume of this series, Overview of Behavior-Based Energy Efficiency Programs, provides definitions of behavior change techniques and summarizes the benefits behavioral efficiency programs offer. Volume Two delves into real world examples of co-ops, utilities, and non-profit organizations currently operating behavioral efficiency programs. Program examples are intended to provide inspiration, best practices, and lessons learned related to the design, implementation, and management of behavioral efficiency programs. The next and final Volume in this three-part *TechSurveillance* series on Behavior Change Programs addresses how to design, implement, and manage a behavioral efficiency program. Methods for evaluating behavioral programs are discussed—as well as strategies for developing a partnership and selecting contractors or vendors to support your program.

Behavior-Based Energy Efficiency Programs: *Volume 3 – Designing Implementing, and Evaluating* (September 2014)

There is vast potential for behavioral energy efficiency because building occupants impact energy performance so significantly. For example, studies consistently find that energy use can differ by two to three times in identical homes, occupied by people with similar demographics—illuminating the influence occupant behavior has on overall home energy consumption (Froehlich, 2009). This paper, the third and final in this series of CRN *TechSurveillance* articles covering behavior change, describes how co-ops can capture behavioral energy efficiency. It provides a framework on how to design, manage, and implement residential behavior change programs. Although there is still much to learn about behavioral efficiency—the concepts presented on the following pages reflect the most advanced and accepted approaches in the energy efficiency industry. Guidance is offered regarding how to select and develop strategies for influencing behaviors, and how to estimate your budget and program cost-effectiveness. Methods for evaluating behavioral programs are discussed, as well as strategies for selecting contractors or vendors to support your program. The two preceding articles in this series provided analysis and guidance on behavioral efficiency (*Volume 1 – An Overview*); and described real world applications of behavioral efficiency techniques (*Volume 2 – Examples of Real World Behavioral Efficiency Programs*). The focus of this series is on the residential sector—which is the target market of a large portion of current behavior programs.

Building Automation Systems: *An Energy Management Solution for Commercial Buildings* (October 2014)

Managing energy consumption manually in commercial buildings is complex and often results in inconsistent building performance. Building automation systems (BASs) can simplify energy management and reduce facility energy use and costs by controlling the operation of energy-consuming equipment. BASs can also automate and centralize a building's demand response (DR) activities, allowing for greater participation in utility DR programs. This article will help co-ops—especially co-op key account executives— understand how commercial BASs work. It explains BAS functionality, costs, payback periods, and energy savings. The types of buildings that benefit most from a system, as well as building automation options for the small commercial sector, are also discussed. These insights aim to support co-ops as they help commercial members get the most out of their BASs. It should be noted that when approaching energy efficiency for any building, a sequential approach to building performance is considered industry best practice. First, shell improvements and weatherization should be considered, then lighting improvements and controls, followed by Heating, Ventilation and Air Conditioning (HVAC), and finally, BAS applications.

How Will Heat Pump Water Heaters Perform in Demand Response Programs? (November 2014)

The End-Use Energy Efficiency work group, part of NRECA's Business and Technology Strategies team, is focused on identifying the opportunities and challenges associated with electricity end-use and demand-side management strategies. *TechSurveillance* research relevant to this work group looks at the various aspects of energy efficiency technology, including market status, related policies and regulations, and business models. This article examines the technology behind and opportunity for heat pump water heaters within demand response programs.

Fleet Electrification 101 (November 2014)

The End-Use Energy Efficiency work group, part of NRECA's Business and Technology Strategies team, is focused on identifying the opportunities and challenges associated with electricity end-use and demand-side management strategies. *TechSurveillance* research relevant to this work group looks at the various aspects of energy efficiency technology, including market status, related policies and regulations, and business models. This article, the first of a two-part series, examines the evolving market of electric vehicles and application of this technology in utility fleets.

A Guide to Adopting Plug-in Electric Vehicles to Your Fleet (November 2014)

The End-Use Energy Efficiency work group, part of NRECA's Business and Technology Strategies team, is focused on identifying the opportunities and challenges associated with electricity end-use and demand-side management strategies. *TechSurveillance* research relevant to this work group looks at the various aspects of energy efficiency technology, including market status, related policies and regulations, and business models. This article, the second part of a two-part series, examines the use of electric vehicles for commercial fleets, and provides guidance on how to determine if this technology is right for our cooperative.

Publications in Process

- Demand Response Communication for Smart HVAC
- Electric Vehicles (3 papers)