Equitable Beneficial Electrification (EBE) for Rural Electric Cooperatives

ELECTRIFYING RESIDENTIAL SPACE AND WATER HEATING

CONTENTS

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>> BENEFICIAL ELECTRIFICATION EXECUTIVE SUMMARY

This report focuses on equitable beneficial electrification as a pathway for rural electric cooperatives to decarbonize their power grid. Particularly, this report examines how Midwest rural co-ops incentivize members to switch from fossil fuel–powered end-use equipment to electric end-use equipment. About 5 million homes in the rural Midwest—mostly served by co-ops—power their space-heating and water-heating equipment predominately with propane.

The lens in which the authors are viewing this research and information is based on the ReAMP Networks' Equitable Deep-Decarbonization Framework which states, "Include everyone, electrify everything, and decarbonize electricity."

To address equity, we examine some of the barriers that have led to historic inequity in distribution of energy efficiency program funds, evaluate equity of existing beneficial electrification and efficiency programs, and discuss opportunities to address equity in future program design and implementation.

Rural electric cooperatives have been energy innovators and leaders since their formation around eighty years ago. Today, about 900 co-ops nationwide provide power to 13 percent of all Americans and 56 percent of the US landmass. In the Midwest, 300 co-ops serve power to about 3.7 million members across 12 states.

As nonprofits owned by their members, co-ops are guided by seven cooperative principles, which are: voluntary and open membership; democratic member control; member economic participation; autonomy and independence; education, training and information; cooperation between cooperatives; and concern for community. Electric Cooperatives also have a commitment to serve their members by providing safe, low-cost, and reliable power. One way to better serve their members is for co-ops to offer incentives for beneficial electrification programs.

Beneficial electrification (aka Strategic Electrification) refers to switching fossil-fuel end-use equipment to electric equipment in a way that reduces overall carbon emissions, while providing benefits to the environment and to members. In buildings, this means replacing older and inefficient gas or propane-powered furnaces and water heaters with more efficient, electric space and water heat pump technology. It could also include incentives to electrify vehicles, for example, incentives to finance electric charging stations or electric school buses. Specifically, the report focuses on the replacement of fossil fuel–powered space and water heating with air-source heat pumps or water heaters in residential buildings.

In 2018, the National Rural Electric Cooperative Association (NRECA), an organization providing resources to all 900 co-ops, unanimously approved a resolution supporting beneficial electrification programs. This resolution indicates that the national association is putting all its resources behind beneficial electrification and that co-ops should start to consider such actions and programs as part of the services they provide to their membership. This report provides a landscape view of current residential energy efficiency, energy equipment programs, and space- and water-heating beneficial electrification programs run by Midwest co-ops for their members.

The report reviews beneficial electrification reports published on this emerging topic. The report also analyzes hundreds of Midwest electric cooperative websites to identify electric space- and water-heating conversion programs and assess whether these programs could be deemed "beneficial electrification."

Unlike older fossil fuel–powered end-use devices, newer electric equipment provides multiple benefits creating a winning proposition for the member, the utility, and the environment. For the co-op member, new equipment achieve energy and monetary savings as new generation air-source heat pumps and electric water heat pumps are two-to-three times more efficient than their fossil fuel–powered counterparts. Cold climate air-source heat pumps (ccHP) technology has advanced greatly in the last five years to the point where ccHP can efficiently heat buildings as outdoor temperatures approach 0 F.

Unlike older fossil fuel–powered end-use devices, newer electric equipment provides multiple benefits creating a winning proposition for the member, the utility, and the environment.

Co-ops also benefit as these devices offer a multitude of grid management attributes including load shifting and load shedding capabilities. These actions flatten the load curve and make it more predictable. All these attributes provide reductions in energy usage during high-demand times, meaning savings for utilities through lower demand charges. Additionally, co-ops experience increased load and revenue by incorporating newly converted electrical equipment into their grids.

The environment also wins with lower carbon emissions as (mostly) propane-powered devices are replaced by residential electric space- and water-heating equipment. With more renewable energy on the grid, this same equipment can contribute to even lower carbon emissions.

Combing through hundreds of co-ops websites and performing a dozen surveys and interviews, our research found that about 88 percent of all Midwest co-ops offer some type of energy upgrade and/or loan program for their members to improve their energy efficiency and/or replace their heating and water equipment. Co-op energy efficiency upgrade programs can serve a dual purpose: first, they can help a member weatherize their home, which saves money; and second, these programs can be building blocks for a beneficial electrification program. A non-insulated home can negate the savings from a new electric heat pump/and or water heater. Some of these co-op energy upgrade programs are offered in partnership with their larger power providers, especially for specific-conversion rebates for water heaters and heat pumps.

Financing programs are a step beyond energy upgrade rebate programs and provide increased access to capital for co-ops to reduce carbon emissions. Our research identified 51 co-ops across the Midwest (17 percent) that offer some type of financing program for energy efficiency or conversion, including on-bill financing programs. While financing programs are more complex than rebate programs—as they include energy auditors, repayment processes, and follow ups—these programs leverage more capital and energy upgrade actions from members than rebates alone.

Financing energy upgrades is not new for co-ops. Starting in the 1980s, Energy Resource Conservation (ERC) loan programs allowed co-op members to retrofit their homes and save energy. About 20 Midwest co-ops still run ERC loan programs, including Butler Rural Electric Cooperative (Ohio), which has an on-bill financing program. Participants can repay these loans on the utility bill (on-bill financing) or through a separate bill to the co-op.

Newer on-bill financing programs center equity in their core program elements by including no upfront costs, eliminating the use of credit scores to screen potential participants, offer very low interest rates to keep costs down, and have longer-term payback schedule to ensure a net positive cash-flow from the improvements. Beneficial electrification programs can ease the sticker shock of pricey, but very efficient, new-generation cold climate air-source heat pumps and heat pump water heaters. With on-bill financing the participating member can repay over-time the cost of converting to electric end-use equipment and can leverage the savings accrued.

One goal of the research was to determine if any Midwest co-ops offered a full beneficial electrification program, but the website review found none. This report defines a fully beneficial electrification program as one that includes the following elements: 1) incentives and/or financing to cost-effectively convert fossil fuel-powered equipment to electric equipment; 2) a central program goal of reducing net carbon emissions; 3) a verification process to check that the replacement has indeed occurred; and 4) energy audits to calculate estimated energy and monetary savings resulting from the switch-out.

The research did find, however, 19 programs offered by co-ops that fall short of this report definition of a beneficial electrification program. Of these, 16 programs provide conversion incentives for members to switch from fossil fuel—-powered residential water heaters to electric/heat pump water heaters. An additional three programs help co-op members replace their fossil fuel-powered furnaces with more efficient air-source heat pumps. Each of these programs are managed by large cooperative power providers. While none of the programs have all the elements of a fully developed beneficial electrification program, they do offer incentives that form building blocks for a complete beneficial electrification program.

Nationwide, more co-ops are running more-inclusive on-bill financing programs for their members to save energy and switch to electric end-use devices. Midwest Electric Cooperative (Kansas), Ouachita Electric Cooperative (Arkansas), Roanoke Electric (North Carolina), South Carolina Electric Cooperatives, and Orcas Power and Light Co-op (Washington) are among a group of co-ops leading with beneficial electrification financing and equitable programs.

>> PURPOSE OF THE REPORT

This report was produced by an action team made up of members of the RE-AMP network. By thinking systemically and acting collaboratively as peers, funders and advocates, we have been working diligently over the last decade toward our shared goal. The RE-AMP Network consists of over 130 nonprofits and foundations working across eight Midwestern states on climate change and energy policy with the goal to equitably eliminate greenhouse gas emissions in the Midwest by 2050. One of the pathways to reach zero-emission goals and achieve deep de-carbonization is to electrify all buildings in the Midwest. This includes residential buildings served by electric cooperatives in rural areas.

At the 2018 annual meeting, the National Rural Electric Cooperative Association (NRECA), the national organization providing resources to 900 rural electric co-operatives, and all its members, approved unanimously a resolution supporting beneficial electrification actions/and or programs for everyone. This indicates the national association is willing to put resources behind beneficial electrification programs, and that co-ops need to consider such actions as part of their services to members.

When an individual co-op wants to develop a program for its members, the co-op looks to the national organization and to its peers for support and for successful examples. NRECA is already shifting resources to fulfill the beneficial electrification resolution by supporting the creation of the Beneficial Electrification League. This report attempts to provide examples of successful beneficial electrification programs run by fellow Midwest co-op peers, and highlight co-ops that have included equity considerations in program design. In the absence of truly "beneficial electrification" examples, the report identifies programs that, at minimum, offer incentives for members to switch from propane-powered space- and water-heating equipment to electric equipment.

The RE-AMP Network consists of over 130 nonprofits and foundations working across eight Midwestern states on climate change and energy policy with the goal to equitably eliminate greenhouse gas emissions in the Midwest by 2050.

This report also seeks to provide a landscape view of current residential energy efficiency, energy equipment programs, and space- and water-heating beneficial electrification programs run by Midwest co-ops for their members. Overall, the report focuses on the replacement of fossil fuel–powered space- and water-heating with electric air-source heat pumps or water heaters in residential buildings. In particular, it focuses on propane as the target fuel in the conversion process, given the high dependency on propane in the rural Midwest for both space and water heating.

Many rural community members are disproportionately impacted by high energy burdens and by the effects of climate change.[1] This report seeks to understand the barriers that exist for access to programs that should equitably benefit all members so that carbon emissions can be reduced. Thus, our research questions revolve around how current energy upgrade programs run by Midwest co-ops are addressing equity in program development and implementation as well as how future programs can better address equity.

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1 Ross, Lauren, Drehobl, Ariel, Stickles, Brian. "The High Cost of Energy in Rural America: Households Energy Burdens and Opportunities for Energy Efficiency". American Council for an Energy Efficiency Economy (ACEEE). July 2018. https://aceee.org/sites/default/files/publications/researchreports/u1806.pdf

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>> INTRODUCTION

Rural electric cooperatives (co-ops)—member-owned nonprofits serving rural areas in the Midwest—find themselves at a crossroads in energy delivery and in meeting demands for members. Historically, energy demand has increased hand-in-hand with an expanding economy. However, for the last decade, co-ops (and other utilities) have experienced a flat or decreased energy demand, even with a growing economy, in a process known as decoupling.[2] Successful energy efficiency and demand response programs have reduced energy demand, while coal plant closures have decreased carbon intensity on the grid. Following this route, co-ops have turned to a small and often forgotten device in member's homes: the water heater. An electric water heater holds latent thermal power heat, in the form of water. If it is grid-connected, it can help the co-op with controlling loads on a daily basis by pre-heating before or after a peak demand event.

Nationally, there are almost 900 rural electric cooperatives serving about 43 million people rural areas. Across the Midwest,[3] nearly 300 electric co-ops provide power and services to about 3.7 million members, meaning, on average, Midwest co-ops serve 12,333 members.

Co-ops are set up as nonprofit cooperatives with a mission to serve their members rather than to make profit for shareholders. Co-ops commit to seven cooperative principles, among them are democratic member control, concern for community, and cooperative values of equity, equality, solidarity, and social responsibility.[4] Historically, most investments in residential energy efficiency have gone to middle- and upper-income households. Programs for higher-income households have a lower average cost per kWh saved than those for lower-income households, partially due to the need to invest in health and safety upgrades to make low-income households ready to accept efficiency upgrades.[5,6] While low-income efficiency may be more expensive, it "offers real and viable opportunities to realize multiple social, economic, and health co-benefits—that is, energy efficiency can result in health and economic improvements for families, as well as community revitalization."[7]

Energy efficiency programs that ensure access for low-income member-owners can demonstrate electric co-ops' commitment to their cooperative principles and values, increase member satisfaction, and enhance how the co-op is perceived in the community.

Energy efficiency programs that ensure access for low-income member-owners can demonstrate electric co-ops' commitment to their cooperative principles and values, increase member satisfaction, and enhance how the co-op is perceived in the community. The programs provide monetary benefits as well, by reducing peak power demand and the lowering members' energy burden. In addition to increasing the

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2 Business Council for Sustainable Energy. "2019 Sustainable Energy in America Factbook". 2019. https://www.bcse.org/factbook/

3 Midwest is defined in this report as: Iowa, Illinois, Indiana, Kansas, Michigan, Minnesota, Nebraska, North Dakota, Missouri, Ohio, South Dakota, and Wisconsin.

4 International Co-operative Alliance. "Cooperative identity, values & principles." Accessed January 8, 2019: https://www.ica.coop/en/cooperatives/cooperative-identity

5 Michigan University study in 2017 found "on average utilities invested 3 times less on Low-Income (electric) programs per capita, and near equitable levels for Low-Income gas programs." From: Stacey, Ben & Tony Reames. 2017. "Social Equity in State Energy Policy: Indicators for Michigan's Energy Efficiency Programs." University of Michigan: Urban Energy Justice Lab. https://justurbanenergy.files.wordpress.com/2017/12/equity-in-energy-efficiency-investment-and-savings-report-2017.pdf

6 "Table 3. Savings-Weighted Average Total Cost of Saved Electricity by Sector" shows total cost of Low-Income energy savings at $0.142/kWh, which is more than four times the average residential cost of energy savings at $0.033/kWh with data from 2009-2013. From: Martinez, Cecilia. 2017. "Environmental Justice and the Clean Power Plan: The Case of Energy Efficiency." 41, Wm. & Mary Envtl. L. & Pol'y Rev. 605, http://scholarship.law.wm.edu/wmelpr/vol41/iss3/4

7 Ibid, pg 630.

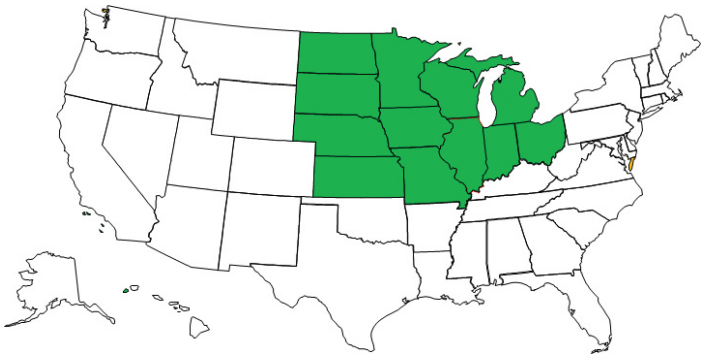
financial sustainability of co-op member-owners, reducing energy burden can lead to decreased administrative costs associated with chronically late bill payers.

To reverse the reduction in electricity sales, co-ops have looked to their communities and members for options. Some electric cooperatives are leading the way in a new business model that is not focused on increasing electricity sales. Ouachita Electric Cooperative's CEO Mark Cayce: "It seems counterproductive; why would any utility supplier want to sell energy at a lower price and decrease their profit? 'Well,' says Cayce, 'We're in the business of serving our members, not selling electricity.'"[8]

>> EQUITABLE BENEFICIAL ELECTRIFICATION METHODOLOGY

For this report we researched and analyzed how co-ops provide beneficial electrification programs to their members. The objective of this research is three-fold. First, uncover beneficial electrification actions nationwide—with emphasis on Midwest co-ops. Second, research how equity is addressed in program development and implementation. Third, develop case studies of beneficial electrification programs, so that other co-ops can learn from, and develop similar programs for their members. To understand how and in what capacity co-ops provide these beneficial electrification programs, we performed research in three phases.

MIDWESTERN STATES—AS DEFINED IN THIS REPORT



First, we researched all 300 Midwest co-ops to identify the type of energy efficiency and end-use equipment replacement programs being offered. To do this, we analyzed the co-ops' websites, since they provide a window on how co-ops interact with their members. The research was based on three criteria: 1) does the co-op provide additional incentives specifically to replace fossil fuel–powered space- and water-heating equipment with electric equipment; 2) does the co-op offer a program to finance these conversions with no upfront costs; and 3) does the co-op provide rebates for electric heat pumps and water heaters and energy efficiency retrofits in their homes.

Second, in a database we tabulated the identified information across the criteria for all Midwest co-ops. Then, we filtered down the list to those co-ops which: 1) provide financing for energy efficiency measures and heat pump replacement (including replacing a fossil fuel–powered furnace); and 2) offer an additional incentive, or larger energy upgrade rebate to replace a fossil fuel–powered device with an electric one (e.g., electric water heat pump or space heating equipment).

With the resulting list of Midwest co-ops, we sent out a survey requesting additional information to develop case studies, seeking to extract additional qualitative and quantitative data on the programs. We followed up with questions about why the co-ops chose to develop the programs, how they worked with local and regional partners, and how they interact with low-income customers and communities of color. This last question, which addresses equity, is important as it helps identify programs that increase access to historically underserved communities. We used the information to write case studies of equitable beneficial electrification programs, which can be shared and replicated by co-ops nationwide, and especially in the Midwest.

We also analyzed all the basic elements of an energy efficiency and beneficial electrification program, including such topics as how many co-ops (by state) offer energy audits to their members and how many provide fuel-switching rebates or bonuses.

To complement the Midwest case studies, we also conducted nationwide research looking at co-ops with innovative programs (e.g., energy efficiency finance), which might include (equitable) beneficial electrification programs. We asked our partners to provide leads to co-ops with innovative programs and then contacted the co-ops, requesting additional information, either by telephone interview or by survey.

8 Hayle, Clarisse. 2018. "Revitalizing Ouachita: How One Electric Co-op is Moving Forward." Appalachian Voices: Front Porch Blog. http://appvoices.org/2018/11/15/revitalizing-ouachita-how-one-electric-co-op-is-moving-forward/

>> BENEFICIAL ELECTRIFICATION: A WINNING PROPOSITION, PROVIDING MULTIPLE BENEFITS

Beneficial electrification refers to the reduction of carbon emissions by electrifying end-uses powered by fossil fuels (e.g., propane, fuel oil, or natural gas) while providing benefits to the environment and to customers through energy and monetary savings. In buildings, this means replacing older and inefficient natural gas– or propane-powered equipment with more efficient electric equipment, such as air-source heat pumps and/or heat pump water heaters. While this report focuses on residential buildings, beneficial electrification also applies to the industrial and transportation sectors.

An electrification conversion program is beneficial when it provides savings for the customer, enables load management capabilities for the utility, and creates environmental benefits by reducing carbon emissions. Programs must achieve at least one of these pillars without adversely affecting the others to be considered beneficial electrification.[9] This report adds a fourth consideration: equity of access to electrification conversion programs, especially in the electrification of space- and water-heating equipment in the residential building sector.

Beneficial electrification looks at the entire energy system as a whole, including the transportation system generation, direct-use emissions (e.g., gas to homes), and propane use, especially concentrated in rural areas.

Energy efficiency programs that ensure access for low-income member-owners can demonstrate electric co-ops' commitment to their cooperative principles and values, increase member satisfaction, and enhance how the co-op is perceived in the community.

Propane is the main fuel choice for heating homes in rural areas, given the high cost of building natural gas infrastructure in low-density areas. Because rural electric cooperatives are the primary utilities providing power to rural areas in the Midwest—and nationwide—they need to be involved in creating these types of programs for members. Switching from propane fuel–powered devices to electric equipment reduces carbon emissions and fits into the decarbonization process in the Midwest. Rural electric cooperatives involvement in beneficial electrification and conversion programs would help the Midwest power grid to decarbonize.

According to the 2015 EIA Residential Energy Consumer Survey (RECS),[10] about 5.6 million homes in the Midwest are located in rural areas, or 21 percent. Approximately 2.3 million households use propane fuel–powered equipment for their space heating or water heating needs. All 5.6 million rely on electric power for other home energy usages, such as lighting. With 300 co-ops in the Midwest serving about 3.7 million households, nearly two-thirds of Midwest rural homes are powered by co-ops. About 1.5 million homes in rural areas use propane as their main source of space heating; while propane is secondary for 400,000 homes. For water-heating, about 1 million homes use propane fuel–powered equipment.

Across the twelve Midwest states, in both rural and urban areas, 2,486 trillion BTUs is used annually to power and heat homes. Most of this consumption (61 percent) is natural gas concentrated in urban areas. About 107 trillion BTUs, or 4 percent, is propane usage (the rest is electricity usage). In the rural Midwest, about 18 percent of all energy used by the 5.6 million rural homes is propane, or 94 trillion BTUs, the rest is electricity and some natural gas. This means that 95% of all propane usage in the Midwest, is concentrated in rural homes.

About 92 trillion BTUs of propane is used annually by Midwest rural households. However, those homes that use propane as their main fuel for space- and water-heating (1.5 million homes), use an average of 60 million BTUs, and spend $1,019 in fuel annually on-site.

Achieving deep decarbonization of the Midwest economy implies working on all sectors of the economy at the same time. According to a 2018 Rocky Mountain Institute report,[11] moving the entire power sector to renewable energy gets us one-third of the way to total decar-

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9 Billimoria, Sherri, Mike Henchen, Leia Guccione, and Leah Louis-Prescott. The Economics of Electrifying Buildings: How Electric Space and Water Heating Supports Decarbonization of Residential Buildings. Rocky Mountain Institute, 2018. https://rmi.org/wp-content/uploads/2018/06/RMI_Economics_of_Electrifying_Buildings_2018.pdf

10 https://www.eia.gov/consumption/residential/reports/2015/methodology/

11 Ibid.

bonization in the US. Fully electrifying the transportation sector means another one-third. Building sector electrification provides another 10 percent of the de-carbonization pie, while the rest is achieved through electrification of industrial and agricultural sectors.

UTILITIES CAN SEE GAINS IN PERFORMANCE WITH BENEFICIAL ELECTRIFICATION

Electrification of end uses opens the door for a host of multi-service abilities, especially on the demand side of the power grid. Air-source heat pumps and electric water heaters offer demand and grid flexibility options.[12] Newer generation space- and water-heating equipment enable grid management attributes (valuable economic options for utilities) such as load shifting and load shedding. By turning water heaters and heat pumps on-and-off during peak demand times, load shedding is realized,[13] implying a reduction in energy usage during high demand times. Energy load can be shifted to non-peak demand times as well. Load shifting implies both postponing an action (e.g., heating a water heater tank at night rather than at peak times) or preheating or precooling ahead of peak periods. Load shifting can be incentivized by implementing a time-of-use (TOU) rate design, where energy prices are higher at peak times.[14] These processes flatten the daily utility load curve, especially at peak demand times, which means lower energy usage and demand charges for the utility. This is true for distribution co-ops needing to buy power supply from their power producer, or generation and transmission cooperatives (G&Ts). Any reduction in energy demand at demand peaks results in clear utility savings.

Additionally, with electrical end-use equipment added to their systems (which before was outside their grid), utilities will see increased load and revenue. Additional load means increased revenue for utilities, especially co-ops, which have been experiencing a flat or low growth for the past decade. Beneficial electrification creates new utility investment opportunities.

CUSTOMERS SEE SAVINGS WITH BENEFICIAL ELECTRIFICATION

New electric technologies, particularly in heating and cooling of residential buildings, are more efficient than their propane fuel-powered counterparts. These technologies reduce overall energy costs and save money for the member. High efficiency propane-powered furnaces have a 94 percent efficiency rating and are approaching their efficiency limit; whereas cold climate heat pumps, with a 300 percent on-site efficiency (even when accounting for electricity losses) have greater potential for efficiency gains as the technology advances. This means that staying with propane-powered furnaces is a losing proposition, in the long-term.

The same is true for Energy Star-rated propane water heaters, which are 67 percent efficient, while their electric counterparts are 200 percent efficient on-site. As a result, "for every unit of power used, the electric heat pump produces two or three times that amount by taking heat out of ambient air. Using these systems cuts energy use and associated emissions of the system by a factor of two or three."[15]

Due to their greater efficiency ratios, electric air-source heat pumps can adequately heat a space with one-quarter of the operation and maintenance costs (O&M) of a comparable fossil fuel–powered device. Lower O&M costs translate into lower energy usage and

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12 Farnsworth, D., Shipley, J. Lazar, J. and Seidman, N. (2018, June). Beneficial electrification: Ensuring electrification in the public interest. Montpelier, VT: Regulatory Assistance Project. https://www.raponline.org/wp-content/uploads/2018/06/6-19-2018-RAP-BE-Principles2.pdf

13 Billimoria, Sherri, Mike Henchen, Leia Guccione, and Leah Louis-Prescott. The Economics of Electrifying Buildings: How Electric Space and Water Heating Supports Decarbonization of Residential Buildings. Rocky Mountain Institute, 2018. https://rmi.org/wp-content/uploads/2018/06/RMI_Economics_of_Electrifying_Buildings_2018.pdf

14 Ibid.

15 Dennis, Keith. "Environmentally Beneficial Electrification: Electricity as an End-Use Option," The Electricity Journal, Volume 28, Issue 9, July 2015. https://www.sciencedirect.com/science/article/pii/S104061901500202X

monetary savings for the member.[16] These savings help members reduce their energy bills and their energy burden.

In contrast to their propane fuel–powered counterparts, an air-source heat pump incorporates grid-management attributes. Coupled with a smart thermostat, an air-source heat pump can pre-cool and post-cool a space before or after a peak demand period. This process of shifting energy demand from peak (expensive) times of the day to valley (cheaper) energy times can provide significant savings for members. These additional monetary savings for members can add up over time, reducing electric bills and energy burdens.

Installing new electric space heating in an inefficient energy house can negate the heat pump's energy efficiency benefits. To that end, houses in colder climates need to combine a new electric heat pump with building envelope measures, such as attic and wall insulation as well as air and duct sealing. Coupling weatherization measures with a new air-source heat pump and water heater can unlock deeper energy and monetary savings for the homeowner or renter.[17]

Electrifying home space- and water-heating equipment can also provide a hedge against propane seasonal price fluctuations and availability, especially in winter, resulting in additional energy and monetary savings. Switching from a propane fuel-powered furnace to a heat pump with a propane-fuel backup can reduce propane usage by half. Decreased propane usage eliminates the need for mid-winter refills for the average co-op member with a 500 gallon propane tank. This is a winning proposition for the member as the mid-winter refills are more expensive than in the summer (even twice as much).

Besides energy benefits, converting to electric equipment provides tangible health benefits for the customer. Electric end-uses reduce the need for venting combustion gases and eliminate carbon monoxide sources in the home.

A beneficial electrification action increases convenience as all the energy costs (e.g., propane, electricity and oil/diesel) after a conversion are charged on a single electric bill—from the rural electric cooperative—rather than several. For example, consider a co-op member who decides to replace a propane-fueled water heater with an electric heat pump water heater. Instead of paying $30 per month for the propane-usage bill and another $50 for electricity, the co-op member just pays a single $60 electricity bill to the co-op (assuming money-savings from switching to a more efficient device).[18]

ELECTRIFICATION REDUCES TODAY'S AND TOMORROW'S CARBON EMISSIONS

Traditionally, carbon emissions in the power sector and the transportation sector have been handled separately by state policies and energy efficiency programs. Beneficial electrification is an entirely new approach that looks at energy consumption as a whole, integrating both building and transportation sectors. In common energy efficiency programs, the target is to reduce power (e.g., kWhs) through building retrofits measures.[19]

Beneficial electrification programs and actions can help meet state or local government's greenhouse gas (GHG) mandates and goals. Nationally, the fuel mix of co-ops is 68% fossil fuel, 15% nuclear, and 17% renewable. Switching from fossil fuel–powered residential equipment to electric equipment reduces carbon emissions and helps to decarbonize rural electric cooperatives' power grid. If the new equipment is at least as efficient as that replaced, fossil fuel consumption can be reduced by over 30 percent. Actual reductions will vary for each case, but electrification should lead to lower emissions now and greater reductions as the electric grid becomes cleaner.

A NREL report found that as we move to a cleaner grid, strategic electrification of the heating and transportation sectors could re-

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16 Shipley, J., Lazar, J., Farnsworth, D., and Kadoch, C. (2018, November). Beneficial electrification of space heating. Montpelier, VT: Regulatory Assistance Project. https://www.raponline.org/wp-content/uploads/2018/11/rap-shipley-lazar-farnsworth-kadoch-beneficial-electrification-space-heating-2018-november.pdf

17 Billimoria, Sherri, Mike Henchen, Leia Guccione, and Leah Louis-Prescott. The Economics of Electrifying Buildings: How Electric Space and Water Heating Supports Decarbonization of Residential Buildings. Rocky Mountain Institute, 2018. https://rmi.org/wp-content/uploads/2018/06/RMI_Economics_of_Electrifying_Buildings_2018.pdf

18 Farnsworth, D., Lazar, J., and Shipley, J. (2019, January). Beneficial electrification of water heating. Montpelier, VT: Regulatory Assistance Project. https://www.raponline.org/wp-content/uploads/2019/01/rap-farnsworth-lazar-shipley-beneficial-electrification-water-heating-2019-january-final.pdf

19 Dennis, Keith, Ken Colburn, and Jim Lazar. "Environmentally Beneficial Electrification: The Dawn of 'Emissions Efficiency'," The Electricity Journal, Volume 29, Issue 6, July 2016. https://www.raponline.org/knowledge-center/environmentally-beneficial-electrification-dawn-emissions-efficiency/

duce greenhouse gas emissions by more than 70 percent compared to 2015 levels.[20] Throughout the lifetime of the equipment (e.g., electric heat pump water heaters and/or air-source heat pumps), which is 15 years on average, the grid is projected to get increasingly greener, as more renewable energy sources are added. As a result, the same electric heat pump or water heater installed today can produce lower emissions in ten years—with a higher penetration of renewables on the grid—than now.[21]

EQUITY

The monetary savings from adopting more efficient electric technologies is especially valuable to economically distressed families. When electrification is combined with energy efficiency measures, benefits and savings increase. For a beneficial electrification program to be equitable, it must address those member households least able to afford upgrades or those that represent historically marginalized groups.

Co-ops are likely already aware of the disproportionate amount of income that many rural households spend on energy. This "energy burden" median for rural households is estimated to be 4.4%, versus the national median of 3.3%. The median energy burden for rural low-income households is even greater, at 9%, with even greater burdens often experienced by non-whites, renters, and the elderly.[22] Perhaps the most visible sign of a significant energy burden is when a household chronically struggles to pay the energy bill.

For a beneficial electrification program to be equitable, it must address those member households least able to afford upgrades or those that represent historically marginalized groups.

Factors that impact a household's energy burden includes efficiency of the house structure, the type and cost of heating fuel, and persistent low household income.[23] These factors represent opportunities for co-ops to address when designing an equitable beneficial program. By recognizing the historically disproportionate distribution of energy efficiency program funds, co-ops can instead work to identify those member households most likely to benefit from EE and electrical upgrades. A rigorous geographic and community needs assessment, paired with surveys and focus groups, may be important to understanding which member-owners would most benefit from the program. In turn, a successful program may result in lower energy costs for all co-op members, keeping more dollars within the community while encouraging local job development in the energy efficiency, HVAC, and renewable energy fields.

Demonstrating a commitment to equity starts with the program design process—providing meaningful opportunities for member-owners to help develop any energy efficiency policy from the beginning. This is a great opportunity for electric co-ops to increase member engagement and work with member-owners to develop programs that will best serve member-owners, especially those historically underserved by energy efficiency programs, and to think creatively about how to overcome challenges including limited funding for health and safety upgrades. For example, are there opportunities to partner with health care providers, social workers, community action agencies, or other community groups to increase funds for health and safety upgrades?

More specifically, meaningful engagement provides opportunities for members to feel listened to and for their ideas to inform the final program design. There could be opportunities for a member-owner advisory committee to be a part of the team developing or redesigning a program and to provide ongoing opportunities for meaningful engagement. A best practice for committees or advisory groups should be transparency—clear communication channels between member-owners and the committee and a clear role for the committee in the program design process.

The seventh principle of Environmental Justice from the 1991 First National People of Color Environmental Leadership Summit

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20 Mai, Trieu, Paige Jadun, Jeffrey Logan, Colin McMillan, Matteo Muratori, Daniel Steinberg, Laura Vimmerstedt, Ryan Jones, Benjamin Haley, and Brent Nelson. 2018. Electrification Futures Study: Scenarios of Electric Technology Adoption and Power Consumption for the United States. Golden, CO: National Renewable Energy Laboratory. NREL. https://www.nrel.gov/docs/fy18osti/70485.pdf

21 Billimoria, Sherri, Mike Henchen, Leia Guccione, and Leah Louis-Prescott. The Economics of Electrifying Buildings: How Electric Space and Water Heating Supports Decarbonization of Residential Buildings. Rocky Mountain Institute, 2018. https://rmi.org/wp-content/uploads/2018/06/RMI_Economics_of_Electrifying_Buildings_2018.pdf

22 Lauren Ross, Ariel Drehobl and Brian Stickles. The High Cost of energy in Rural America: Household Energy Burdens and Opportunities for Energy Efficiency. American Council for an Energy Efficient Economy, 2018. https://aceee.org/research-report/u1806

23 Ibid.

reads: "Environmental Justice demands the right to participate as equal partners at every level of decision-making, including needs assessment, planning, implementation, enforcement and evaluation."[24] In 2008 in Massachusetts, a Green Communities Act passed to promote energy efficiency in the state including utility mandates for weatherization rebates. "However, low-income communities, immigrant households, and people of color were vastly underutilizing these rebates, making the Act less accessible and equitable than it was intended to be."[25] The Green Justice Coalition, made up of 40 environmental, community and other organizations worked to get the state to incorporate equity provisions to address the inequity in the implementation of the Green Communities Act. These equity provisions included: up-front financing for energy upgrades, community-driven outreach, local high-road jobs, and meaningful participation in the process.[26] This example shows how it is possible to revise and improve policies and programs to increase access after initial implementation. The person or committee leading the redesign needs to have a commitment to equity by including diverse communities in the planning and redesign. However, to ensure outcomes that meet community needs and increase access to energy efficiency and beneficial electrification, communities need to be engaged in the program design.

>> BENEFICIAL ELECTRIFICATION: THE BUILDING TECHNOLOGIES AVAILABLE

Water and space heaters for buildings are prime targets for beneficial electrification. These untapped markets for utilities can offer a boost in revenues and load as well as help utilities to mitigate peak loads.

The efficiency of electric-powered appliances has increased dramatically in recent years. Improvements in heat pump technology means these appliances can heat space and water at efficiencies between 200 and 300 percent, compared to 67 percent for a typical Energy Star gas water heater.[27]

ELECTRIC WATER HEATERS

Residential heat pump water heaters can be valuable grid management tools. In the nighttime, when there is excess load on the system due to renewable power generation, utilities can use this additional energy to heat residential water heaters. The potential savings are huge—one estimate[28] put the value at grid enabled water heaters at $200 per customer, per year. In total, grid-enabled water heaters could balance 500 MW of load across the United States. Already, 250 rural electric cooperatives in 34 states are using their customers' electric water heaters to reduce peak demand by 500 MW.[29] Such synergies will become increasingly necessary with greater renewable power penetration.

AIR SOURCE HEAT PUMPS

Cold climate air-source heat pumps (ccHP) can perform better in colder temperatures than traditional heat pumps. Heat pumps can be ducted or ductless. Ducted heat pumps use a forced air-ventilation duct systems to move air from the central outside unit to the indoor unit(s). Ductless systems instead use a refrigerant line to connect the outside ventilation unit with the indoors air-handling unit(s). Because ductless heat pumps do not need to use additional power to forced-air through the ducts, they are 15-25 percent more energy efficient than ducted heat pumps.[30]

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24 First National People of Color Environmental Leadership Summit. 1991. "Principles of Environmental Justice." EJnet.org: http://www.ejnet.org/ej/principles.html

25 Franklin, Marcus, Katherine Taylor, Lorah Steichen, Swetha Saseedhar, and Elizabeth Kennedy. 2017. Just Energy Toolkit. NAACP, pg 201. https://naacp.org/wp-content/uploads/2014/03/Just-Energy-Policies-and-Practices-ACTION-Toolkit_NAACP.pdf

26 Boyd, Soledad & Jeremy Shenk. 2009. "A Green Justice Breakthrough in Massachusetts" Community Labor United Senior Organizers http://www.forworkingfamilies.org/article/green-justice-breakthrough-massachusetts

27 Dennis, Keith, Ken Colburn, and Jim Lazar. "Environmentally Beneficial Electrification: The Dawn of 'Emissions Efficiency'," The Electricity Journal, Volume 29, Issue 6, July 2016. https://www.raponline.org/knowledge-center/environmentally-beneficial-electrification-dawn-emissions-efficiency/

28 Hledik, Ryan, Chang, Judy, Lueken, Roger. "The Hidden Battery. Opportunities in Electric Water Heating". The Brattle Group. (Prepared for NRECA, NRDC, and PLMA). January 2016. http://www.electric.coop/wp-content/uploads/2016/07/The-Hidden-Battery-01-25-2016.pdf

29 Ibid.

30 Center for Energy and Environment and American Council for an Energy-Efficient Economy. (November, 2017). Cold Climate Air Source Heat Pump. Prepared for: Minnesota Department of Commerce, Division of Energy Resources.

Until recently, standard heat pumps could not effectively heat a space in subfreezing temperatures. At 40 degrees F, members had to switch to back-up heat, typically an inefficient strip resistance electric heater or a fossil fuel-powered furnace.

With new generation ccHPs, propane is not completely eliminated, especially in climates with temperatures that dip below zero degrees F (e.g., Minnesota, Wisconsin, and North Dakota). A switch to a dual-fuel heat pump system (that uses propane as a backup fuel) can cut propane usage in half. The Center for Energy and the Environment reports that in a dual-fuel heat pump system, propane only comes on as a back-up fuel for Minnesotan residential buildings for about 20 percent of the heating needs. This halves propane usage, as ccHP's can perform efficiently in temperatures ranges between 40 degrees and 5 degrees F, instead of 100 percent with older heat pumps.[31] For those co-ops in milder climates (e.g., Indiana, Ohio, and Kansas), ccHPs can turn on for only about 5-10 percent of the heating needs. This means that the ccHP component is turned on for longer periods during winter times, compared to a traditional heat pump and propane furnace set up.

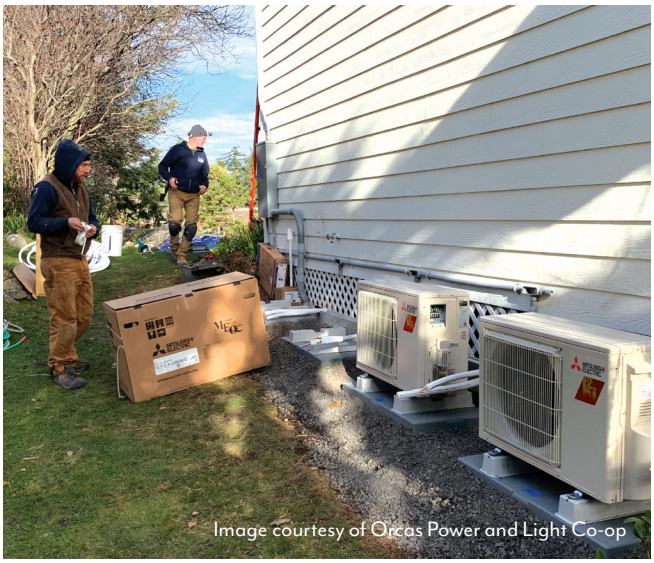
Image courtesy of Orcas Power and Light Co-op

A decreased reliance on propane for heat means that an average Midwest household can withstand the winter without the need to refill a 500 gallon propane tank. Avoiding a mid-winter refill has large monetary savings for customers, as propane prices tend to double in winter, in respect to summer prices.[32] This represents an equity consideration as low-to-medium income co-op members save money with heat pumps, while still keeping warm in cold winter conditions.

New generation heat pumps are slightly more expensive upfront than their fossil fuel-powered counterparts, but when looking at total lifecycle costs, the energy savings generated from the two-to-three times greater efficiency typically provides a pretty short payback period. When combined with grid-management attributes, such as shifting to valley times, heat pumps provide monetary and energy savings for the customer. Over the average 15+ year lifetime, the annualized accrued savings outweigh the initial costs of purchasing and installing it, creating lifetime equipment net-savings, while the member enjoys all the benefits of a more conformable home.

Installing a heat pump can also have benefits in the summer, as many households in the Upper Midwest lack air conditioners. With hotter summers, investing in an air-source heat pump can have dual benefits, in both the heating and the cooling seasons.

>> MOVING MEMBERS TOWARDS BENEFICIAL ELECTRIFICATION PRACTICES AND PROGRAMS

The research focused on all 300 Midwest co-ops by identifying the type of energy efficiency and end-use equipment replacement programs being offered. To do this, we analyzed the co-ops' websites, since they provide a public window on how co-ops interact with their members. Our research and analysis focuses on three strategies that co-ops currently use to incentivize members to switch from fossil-powered equipment to electric equipment: 1) offering an energy upgrade rebate program; 2) financing for energy efficiency measures and heat pump replacement (including replacing a fossil-powered furnace); and 3) offering an additional incentive (e.g., bonus rebate) or large amount energy upgrade rebate to replace a fossil-powered device with an electric one, such as a heat-pump water heater or space heating equipment.

At the 2018 annual meeting, the National Rural Electric Cooperative Association (NRECA), the national organization providing resources to 900 co-ops, and all its members approved unanimously a beneficial electrification resolution. This indicates that the national association is putting its resources behind beneficial electrification programs, and that co-ops need to consider such actions

31 Ibid.

32 Ibid.

as part of the services to their members. A co-op looking to develop a beneficial electrification program would turn to successful programs run by fellow co-op peers for lessons learned. This report attempts to provide successful examples of programs run by fellow Midwest co-op peers deemed as "beneficial electrification". This also include programs that offer specific incentives for members to switch from propane-powered space- and water-heating equipment to electric equipment.

ENERGY UPGRADE REBATE PROGRAMS

Our research shows that 88 percent of all Midwest co-ops offer some type of rebate or loan program for energy upgrades either on their own or in conjunction with their power provider.

Most co-op energy upgrade programs are designed to be simple, while providing a value to the member and to the utility. Rebate programs fit squarely in that reasoning. The member provides evidence (e.g., contractor's invoice or retail ticket) proving that the member has indeed purchased the equipment with a rebate. The co-op then cuts a check to the member for the rebate amount. No energy audits or follow up are involved. Rebates can be considered a step above from providing energy efficiency tip, and a step below a comprehensive financing program for conversions. Rebates are limited to members who are aware of the rebate program and have the time and capital to invest in the upgrade; therefore, rebates are likely to disproportionately go to middle and upper income members as we have seen historically with energy efficiency funds.[33, 34]

Only 34 co-ops in the Midwest (out of 300 total) offer no rebates or financing programs for their members according to their websites. Nine South Dakota co-ops (out 27) provide no upgrade programs, while six Missouri co-ops (out of 42) offer no upgrade programs. Nebraska, Kansas, and North Dakota also have a few co-ops in each state where no upgrade programs are stated on their websites. On the flip side, all rural electric cooperatives in Ohio (40), Indiana (35), and Michigan (8) offered programs for energy upgrades.

Looking more closely at co-ops that do offer energy rebate and loan programs, a great diversity of offerings can be seen. Heavily rebated water heater programs are prevalent across the Midwest and nationwide. Co-ops buy Marathon, Westinghouse, or AO Smith water heaters in bulk, offering them to members at half-price or about $500 (retail value of $1,000). When co-ops add radio-controls or grid-connect to these electric water heaters, co-ops can control these devices, providing load management capabilities creating additional savings. Federated Electric Cooperative in Minnesota (case study in Appendix A) is one of these co-ops.

Co-ops can incentivize members to switch to more efficient forms of energy by offering rebates for air-source heat pumps and ground-source heat pumps. As newer electric heat and water heating models are two to three times more efficient than older equipment, rebates provide members with energy and monetary savings. New generation space- and water-heating equipment include grid-management capabilities, which can provide savings to both the member and the co-op. Thus, rebates represent efficient electrification, as they are not intended to provide incentives for fuel conversion. Rather, rebates help members move from old electric equipment to newer, efficient electric equipment.

Rebate upgrade programs can also allow members to switch from inefficient electric-strip resistance heating systems (common in rural communities) to more efficient electric heat pumps. This provides savings for the member, and even for the co-op, as strip resistance can use unnecessary energy to heat a space; energy that can be at a premium during demand peaks. The change-out likely generates peak savings for the utility.

Midwest co-ops tend to align their rebate programs with those offered by their power providers or generation and transmission co-ops (G&T's) to save on program costs. (G&T's are large generation entities encompassing multiple local distribution co-ops, which also own the G&T's). Participating in group rebate programs provides multiple benefits, especially for smaller co-ops with limited resources. Pooling labor, capital resources, and sharing a common marketing program brand helps sell the program, while keeping the value for members. And, this strengthens the relationship between the distribution co-op and their G&T. Rebates are often set up

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33 Michigan University study in 2017 found "on average utilities invested 3 times less on Low-Income (electric) programs per capita, and near equitable levels for Low-Income gas programs." From: Stacey, Ben & Tony Reames. 2017. "Social Equity in State Energy Policy: Indicators for Michigan's Energy Efficiency Programs." University of Michigan: Urban Energy Justice Lab. https://justurbanenergy.files.wordpress.com/2017/12/equity-in-energy-efficiency-investment-and-savings-report-2017.pdf

34 Table 3. Savings-Weighted Average Total Cost of Saved Electricity by Sector" shows total cost of Low-Income energy savings at $0.142/kWh, which is more than four times the average residential cost of energy savings at $0.033/kWh with data from 2009-2013. From: Martinez, Cecilia. 2017. "Environmental Justice and the Clean Power Plan: The Case of Energy Efficiency." 41, Wm. & Mary Envtl. L. & Pol'y Rev. 605, http://scholarship.law.wm.edu/wmelpr/vol41/iss3/4

as a refund you receive after you have paid for an upgrade and the service is completed, which limits accessibility. Instead, if rebates could be offered as an immediate discount before a purchase that would lower initial upgrade costs and could help increase access.

MORE THAN REBATES: ENERGY LOAN PROGRAMS

Financing energy efficiency measures through energy loan programs, allowing members to save money and energy on their utility bills, is a viable alternative for Midwest co-ops. Loan programs are more complex than rebate programs. Some co-ops will find it challenging to manage the extra labor and capital resources needed to design and implement a successful loan program that provides valuable service to their members. However, there are third-party companies and nonprofit organizations that can provide program management services, reducing the burden on the co-op. More complex programs, however, can deliver better value to members, larger monetary and energy savings and increased member satisfaction.

Well-designed loan programs can create deeper energy and monetary savings than simple rebates. When rebates are integrated into loan programs, affordability is increased. Advantages to energy loan programs include: 1) lack of upfront costs, which expands offerings to more members (and thus equity); 2) availability to include multiple energy upgrade measures instead of just one; and 3) ability to recoup the investment realized—through repayments—to pay for program administration costs. Loan programs require additional resources in comparison to rebate programs including: increased capital to fund the retrofits, certified auditors to assess homes' conditions (before approving a loan), and ongoing loan servicing needs.

A total of 51 Midwest co-ops (17 percent) offer some kind of loan program to their members. Minnesota (10), South Dakota (9) and North Dakota (8) are the states with the largest amount of co-ops running a loan program for energy efficiency or electric equipment conversion. (Minnesota is a case apart which will be discussed on page 26 in the beneficial electrification programs section). North and South Dakota are indeed surprises from the research as their co-ops tend to be smaller. Indiana is the only state with no co-op providing an energy loan program, although Indiana co-ops do offer specific incentives for fuel conversion to electric heat pumps water heaters and air-source heat pumps (detailed on page 25).

The following table highlights the four types of energy loan programs offered to members by Midwest co-ops, identified in this report. Single-measure loan programs refer to programs that only finance one residential measure, such as an electric equipment (e.g., air-source heat pumps) or insulation. Multi-measure loan programs finance an array of energy efficiency measures and electric equipment, including switching to a more efficient electric air-source heat pump.

Traditional financing means those loan programs where the repayment for the energy upgrade is provided by the member to a third-party financing institution (e.g., National Cooperative Bank), or to the co-op through a separate bill. On-bill financing refers to those programs, where the repayment to finance the cost of energy efficiency measures and the upgrade of residential space- and water-heating equipment, is made through the participant's monthly co-op electric bill.

TABLE 1: HIGHLIGHTED TYPES OF ENERGY LOAN PROGRAMS RUN BY MIDWEST CO-OPS

CO-OP PROGRAMS	TRADITIONAL FINANCING	ON-BILL FINANCING
Single-Measure	• *Heat loan programs:* FEM Electric and Central Electric (ND) provide up to $10,000 for 7 years at 5% interest to help members switch to all electric heat homes. • *EnergyWise loan program:* Nebraska Public Power District (NPPD) provides a low-interest loan program to finance heat pumps, in conjunction with the state energy office, Dollar and Energy Loan Program. All 25 distributed rural electric/NPPD members can pass-on this offer to their individual members.	• *Bluestem Electric Cooperative* (KS) operates the Comfort Plus program, a meter-attached on-bill financing program, which helps members finance insulation and air-sealing upgrades in their homes with no upfront cost, and low-interest rates.
Multi-Measure	• *National Cooperative Bank (NCB)*: provides energy loans for Eastern Illininois Electric and Adams Electric (IL) members for air-source heat pumps and energy efficiency measures. • *Energy Resource Conservation* (ERC) loan program: Stern Cooperative Electric (MN) and Access Energy Cooperative (IA). • *Center for Energy and Environment (CEE) loan program*: CEE, a Minneapolis-based nonprofit provides no-interest loans to individual members served by several Minnesota co-ops, including Dakota Electric and Connexus Electric, to finance air-source heat pumps and heat pump water heaters.	• *Energy Resource Conservation (ERC) loan programs*: Illinois Electric Cooperative, Dakota Valley Electric Cooperative, Guthrie Electric Cooperative (IA), and Butler Rural Electric Cooperative (OH). • *P.K.M. Electric Cooperative (MN) and Thumb Electric (MI)* offer programs to their respective members, for energy efficiency and electric equipment, where repayments are added to the member's monthly electric bill

Energy Resource Conservation (ERC) loan programs are a popular offering among Midwest co-ops to help their members fund energy efficiency measures and potentially convert to electric heating. ERC loans were offered to co-ops through a U.S. Department of Agriculture (USDA) capital deferment program starting in the early 1980s. About 20 co-ops still offer them, with eight of those in North Dakota. The repayment on these loans can be either on the utility bill (on-bill financing) or through a separate bill. Because the loan programs finance energy upgrades, including heat pumps and water heaters, it is conceivable for a co-op member to use a loan to convert their propane furnace or water heater to a more efficient air-source heat pump or water heater. Through these loan

programs members are saving money, energy, and reducing carbon emissions. Since 1982, Butler Rural Electric Cooperative has been running a successful ERC loan program, using on-bill financing as the repayment mechanism (See Appendix A for the case study).

Unfortunately, all ERC loan programs are de-facto running as revolving loan funds, as the ERC program, administered by the Rural Utility Service within USDA, is defunct. RUS does have a new program called the Rural Energy Savings Program (RESP), which provides no-interest loans to rural electric cooperatives to re-lend to their members for energy efficiency measures, and beneficial electrification programs. RESP has $100 million available through September 2019 for loans. RESP became law in the 2014 Farm Bill and was reauthorized in 2018, through 2023, with appropriations for 2020, so the program is not going out anytime soon. Under RESP on-bill financing programs are an eligible re-lending mechanism to members, and thus RESP can capitalize on-bill financing programs.

ON-BILL FINANCING PROGRAMS

On-bill financing programs is where the repayment for an energy upgrade is made through the member's monthly utility bill over time with no up-front costs. Financing energy efficiency measures, to deliver energy savings and comfort to the member, is the most common application for on-bill financing programs. Traditional on-bill financing programs screen participants based on credit scores and tie the repayment to the individual, meaning that the loan must be paid off if that individual leaves the property. This greatly restricts who can participate in the program. Most, if not all, ERC loan programs using the on-bill financing mechanism assign the loan to the participating member.

In contrast with traditional financing programs, inclusive on-bill tariff programs center equity in their design core by removing access barriers to financing. This newer model, which has emerged over the past 10 years, ties the financing or investment to the meter. This allows for transferability of the payment obligation to the next occupant or renter, which limits risk to the renter and helps to extend the loan repayment period. Inclusive tariff programs also approve applicants through on-time utility bill payment history, instead of credit scores. These features expand the pool of potential program participants, increasing equity, without increasing risk to the utility.

To keep repayments affordable for all participants, these programs focus on cost-effective energy upgrades (e.g., insulation, air sealing, LED light bulbs, a new air-source heat pump, and duct-sealing). These measures are more likely to generate enough energy savings for loan payments to be offset by the reduced energy costs (on an annualized basis). Eliminating upfront costs, and incorporating building envelope upgrades to the program, as well as water efficiency, make these programs more equitable.

These design program elements allows more co-op members to benefit from clean energy, including renters, economically vulnerable families, and those on fixed-income. Reducing household energy burdens—or the amount of the family budget dedicated to energy on a monthly (or annual basis)—through energy efficiency actions, is a trademark of these programs.

Nationwide, more co-ops are running energy-saving on-bill financing programs that are designed to be inclusive for as many members as possible. These leading co-ops include Midwest Electric Cooperative (Kansas), Ouachita Electric Cooperative (Arkansas), Roanoke Electric (North Carolina), and a group of South Carolina electric co-ops. But none are of these programs explicitly sought to switch members off of fossil fuel. In April 2019, Orcas Power and Light (Washington) became the first on-bill program in the country to explicitly focus on beneficial electrification projects. (See Appendix A for case studies).

BENEFICIAL ELECTRIFICATION PROGRAMS

An electrification conversion program is beneficial when it: provides savings for the customer; enables load management capabilities for the utility; and creates environmental benefits by reducing carbon emissions. All three pillars of beneficial electrification need to be achieved at the same time and not in a trade-off situation.

Beneficial electrification programs needs to include the following:

A. incentives and/or financing to cost-effectively convert fossil fuel-powered equipment to electric equipment;

B. a central program goal of reducing net carbon emissions;

C. energy audits to calculate estimated energy and monetary savings resulting from the switch-out; and

D. a verification process to check that the replacement has indeed taken place by the participant and evaluate the savings overtime.

Because of these elements, many electric reduced heat rate-only programs offered by Midwest co-ops cannot entirely be called beneficial electrification programs. If a member—with an electric residential space- and water-heating equipment—signs-up for these program, then the member receives a reduced electric rate, which generates monetary savings. However, these programs are for co-op members that already have electric equipment at home; and thus, these programs are not intended for fuel conversions (from propane-powered to electric equipment).

Members could opt to switch to an electric space- and/or water-heating equipment (e.g., air-source heat pumps) in order to receive the benefits of the reduced electric heat rate, but that is not the core purpose of the program. Offering grid-connected electric water heaters provides benefits to both the member and the utility. However, neither the member receives a rebate for the conversion (if one happens), nor the utility tracks that a propane-powered to electric switch-out has occurred, so it could not be deemed a full beneficial electric program. Nonetheless, these programs provide a good base for a complete beneficial electrification program.

Similarly, not every energy loan or rebate program can be considered a beneficial electrification program. While these loan programs provide energy audits and verification of equipment replacement, they are mostly energy efficiency loan programs. Most loan programs offer no statement on reducing fossil fuel usage. Most programs appear to finance new heat pumps and energy efficiency conservation measures, but it is not clear how many of these programs finance fossil-to-electric equipment conversions.

A majority of programs reviewed specify that loans are for installing electric heating systems or energy efficiency retrofits, and are not intended for fuel conversions (from propane-powered to electric equipment), as they do not provide a specific-conversion rebate. Some programs, however, like one offered by an Iowa co-op, do provide a more favorable statement: "replacements and modifications, which reduce oil or gas consumption."

The research did not find any fully beneficial electrification programs offered by a Midwest co-op for residential uses. The research did identify, however, 16 electric water heaters/water heat pumps conversion rebate programs, as well as three air-source heat pumps fuel conversion specific rebate programs. These programs fall short of the report's definition of beneficial electrification programs as they only meet some of the definitions elements. Mainly that these programs only provide energy rebates to incentivize the conversation from gas or propane residential equipment to electric equipment. Specifically, these programs do not center fuel conversion as a program goal to reduce carbon emission, and do not include a process to verify that the change can taken place. Also, these programs do not track the energy and emissions before-and-after the changeout. To become fully beneficial electrification programs would have to include these elements mentioned into their programs.

The 16 co-op programs identified deemed as near-full beneficial electrification programs are electric water heater/heat pump conversion programs that offer rebates for replacing a fossil fuel-powered water heater. About half of these programs are run by Minnesota co-ops. Three Midwest generation and transmission (G&T) cooperatives, which combined provide power to more than 50 distributed co-ops across four Midwest states, offer incentives for individual members to switch from residential propane-powered space heating equipment to electric air-source heat pumps.

TABLE 2. MIDWEST CO-OPS OFFERING WATER HEATER CONVERSION INCENTIVES

Table 2 lists all 16 Midwest rural electric cooperatives offering electric water heating/heat pump water heater conversion incentives.

RURAL ELECTRIC COOPERATIVE	STATE	ELECTRIC WATER HEATING CONVERSION INCENTIVES/REBATES
Central Wisconsin Electric Cooperative	WI	Free 52- and 80-gallon water heaters are available for conversion from gas
Oakdale Electric Cooperative	WI	$300 rebate for electric water heater if converted from gas
Oconto Electric Cooperative	WI	$100 bonus rebate for converting from fossil fuel-powered water heater to any Marathon electric water heater on top of the $150 rebate for 50- and 85–gallon water heaters
Agralite Electric Cooperative	MN	$300 rebate for installing a 105-gallon electric water heater to replace a fossil fuel water heater.
Meeker Co-op Light & Power Assn	MN	Up to a $800 credit/rebate for a qualified 80-gallon or larger electric water heater
Minnesota Valley Co-op L&P Assn	MN	$150 rebate for converting from a fossil fuel-powered water heater to an 85-gallon electric water heater; $200 rebate for a 105-gallon or more
North Itasca Electric Cooperative	MN	$600 rebate for converting from fossil fuel-powered water heater to electric storage water heating
Red Lake Electric Cooperative	MN	$250 bonus rebate for water heater conversion from natural gas or propane to an electric one, on top of $350 rebate (100-gallon or more); $300 rebate (56-99 gallon); and a $150 rebate (50-gallon or less)
Roseau Electric Co-op	MN	$250 additional rebate for conversion from existing natural gas or propane to electric water heater on top of a $200 rebate for a 100-gallon or more
Steele-Waseca Cooperative Electric	MN	A free 115-gallon storage water heater for signing up for load control program
Wild Rice Electric Cooperative	MN	$250 additional rebate for conversion from existing natural gas or propane to an electric water heater on top of a $200 rebate for a 100-gallon or greater electric water heater for a total $450 rebate
Chariton Valley Electric Cooperative	IA	$200 rebate for, Electric to Electric Replacement, and Gas to Electric Replacement
Farmers Electric Cooperative—Kalona	IA	$400 rebate for propane conversion to air-source heat pump; $400 for propane conversion to electric water heater
Moreau-Grand Electric	SD	$200 when replacing an existing gas or oil water heater with a new electric water heater (40-gallons or more)
Cass County Electric Co-op	ND	$250 additional rebate for conversion from natural gas or propane to electric water heater on top of $200 rebate
Nodak Electric Co-op	ND	$250 additional rebate for conversion from natural gas or propane to electric water heater on top of $200 rebate (100-gallon or more)

TABLE 3. MIDWEST GENERATION & TRANSMISSION CO-OPS PROVIDING HEAT PUMP CONVERSION INCENTIVES

The table below lists the three regional power cooperatives offering incentives for air-source heat pumps conversion, and the program they provide to their member local distributed co-ops.

RURAL ELECTRIC COOPERATIVE	STATE	ELECTRIC HEAT PUMP CONVERSION INCENTIVES/REBATES
Wabash Valley Electric Power Cooperative	IN, MO, IL	Power Moves Program is available for all 23 co-ops served by Wabash Valley and includes rebates to replace an old and inefficient furnace (propane or fuel oil) with a more efficient air-source heat pump (ducted or mini-splits). Up to $750 in rebates is available
Hoosier Energy	IL	Five of the 10 co-ops served by Hoosier offer rebates incentives (up to $750) for replacing a fossil fuel system with an air-source heat pump
Great River Energy	MN	GREs EnergyWise centralized marketplace include air-source heat pump and electric water heater/heat pump rebates as well as for grid-connect water heating

Minnesota's 43 electric distribution co-ops are an example apart in Midwest co-ops due to the policy environment. Enacted in 2007, The Next Generation Energy Act of 2007 (NGEA) established energy efficiency goals for all utilities in Minnesota including co-ops. Through the conservation and improvement program (CIP), co-ops are mandated to reduce retail energy consumption by 1.5 percent annually. To reach these goals, co-ops provide an array of energy conservation rebates. Great River Energy (GRE), the energy provider to 28 co-cops, manages the EnergyWise program, a centralized marketplace where GRE member co-ops can shop and select the best rebates to offer to their individual members. Lake Region Electric offers large rebates for air-source heat pumps and electric water heaters—which could include switching from fossil-powered equipment—in conjunction with GRE (See Appendix A for case study).

Great River Energy's co-ops have jointly offered grid-connected water heating programs for more than two decades—through the Minnesota CIP program. Electric water heaters are large latent energy storage devices with great potential to provide monetary and energy savings for members through grid-management capabilities. When combined, and grid-connected, these devices collectively provide large demand savings through load shifting. These savings can be passed along to members through rebates or freebies, such as free water heaters. While these programs do not integrate all the elements of a full beneficial electrification program, but they help members electrify residential buildings. Furthermore, GRE is a leader in creating innovative programs that add value for their member and these programs do provide the building blocks for a full beneficial electrification program.

Our research and analysis found no full beneficial electrification program offered by a Midwest co-op. However, a Washington co-op is offering a beneficial electrification program to their members using on-bill tariff as the mechanism to finance the conversions (See Appendix A for case study).

>> CONCLUSION

At the 2018 annual meeting, the National Rural Electric Cooperative Association (NRECA), the national organization providing resources to 900 co-ops, and all its members approved unanimously a beneficial electrification resolution. This indicates that the national association is putting its resources behind beneficial electrification programs, and that co-ops need to consider such actions as part of the services to their members. A co-op looking to develop a beneficial electrification program would turn to successful programs run by fellow co-op peers for lessons learned.

The NRECA beneficial electrification resolution is also a great opportunity to drive these type of programs and to point co-ops to resources available. This report attempted to provide successful examples of programs run by fellow Midwest co-op peers deemed

as "beneficial electrification, or at least of programs that offer incentives for members to switch from propane-powered space- and water-heating equipment to electric equipment.

While this report did not identify a fully-complete beneficial electrification program run by a Midwest co-op, it did find almost two dozen programs that provide rebate incentives for members to switch from propane-powered space- and water-heating equipment to electric equipment. This report also uncovers more than two dozen additional energy loan programs operated by Midwest co-ops. These programs could serve as building blocks, for a co-op running them, towards a fully complete beneficial electrification program.

Fully-complete beneficial electrification programs can be a great strategy for Midwest co-ops to achieve deep decarbonization in the Midwest. This can be realized by incentivizing members to switch residential electric space- and water-heating equipment to electric equipment. As the new electric equipment (e.g., cold climate heat pumps and/or electric heat pump water heater) are two-to-three times for energy efficient than their fossil-fuel powered counterparts, member save money, energy, and reduce carbon emissions.

Developing a inclusive on-bill financing program to make fully complete and equitable beneficial electrification programs is key for Midwest co-ops, even if they are offering a loan program. Financing with no upfront costs, can capture these savings and allow the member to pay for these very efficient electric equipment. However, not every financing program is valid, a equitable on-bill financing program is the best way.

A well-designed equitable on-bill financing program provides a good way for members to pay for such an upgrade over time using a portion of the generated savings, through the member's monthly utility bill. The financing or investment by the co-op needs to be assigned to the meter—allowing for the transferability of the charge to the next occupant or renter—expanding accessibility and increasing equity. These programs also need to screen participants using on-time utility bill payment history—rather than credit scores—and use cost-effective measures often with no up-front costs. Combined with a strong quality assurance process, meaning energy audits and verification pre-and-post work, an inclusive on-bill financing program can generate enough energy savings so that the loan payments are offset by the reduced energy costs (on an annualized basis).

Obviously, the program needs to allow member participants to replace residential fossil-fuel powered space- and water-heating equipment with electric equipment using the investment. Insulation, air-sealing, weatherization measures, as well as other building envelope measures would also have to be included to avoid negating the savings generated by the new electric equipment.

To make these programs more affordable to members, it is important to offer them with low-interest financing. This is possible through the Rural Energy Savings Program (RESP). The Rural Utility Service, housed at the Dept. of Agriculture, provides zero-interest loans to co-ops to finance beneficial electrification programs, as well, as energy efficiency measures. RESP has $100 million available through September 2019 for loans, and has been authorized by Congress through 2023. Therefore, there is low-cost capital available for these inclusive on-bill financing program available through USDA.

Electric co-ops should be aware of historic inequity in the distribution of energy efficiency program funds, thus the creation of equitable beneficial electrification programs is an opportunity for co-ops to embody their commitment to cooperative principles and values and right past wrongs. Designing equitable programs starts with engagement of member-owners and community groups to ensure increased access to efficiency and beneficial electrification, especially for members with high energy burdens. Up-front financing is an important program consideration along with: meaningful member engagement to develop, implement, and evaluate the program; creation of good local jobs; community-driven outreach; and funding for health and safety upgrades. Equitable beneficial electrification program will increase access to electrification, save money for members, reduce carbon emissions, and help co-ops decarbonize their power grid.

>> APPENDIX A: CASE STUDIES

OUACHITA ELECTRIC COOPERATIVE, AR

Ouachita Electric Cooperative (OEC) is based in Camden, Arkansas, and serves over 7,000 members. OEC was named the 2017 Smart Electric Power Alliance (SEPA) Electric Cooperative Utility of the Year for the cooperative's work to construct a 12-megawatt solar array in East Camden. This project had many side-benefits to the membership and the Cooperative itself. While there were initial challenges to the project—especially due to the unique power contract arrangement presented to the G&T (OEC's Generation and Transmission wholesale energy provider)—they eventually allowed one of OEC's largest loads (and largest local employers) to construct a larger solar system than they needed for their own use (not typically allowed) in order to reduce the overall demand fees to the Cooperative. This not only saved OEC lots of money in demand charges, it added lots of solar energy to the local energy mix, and kept the large employer in the area. They are now looking to expand the solar array as the company is expanding and creating more local jobs, primarily due to the willingness of OEC and their G&T to provide local clean energy while reducing costs for the whole system.

After almost 2 decades of consistent decline in membership and load, CEO Mark Cayce recognized the need for some dramatic shifts in "business as usual" if the co-op was going to survive. This has lead the co-op to undertake many 'out of the box' projects and pilots programs.

One of OEC's most successful programs for their members has been their HELP PAYS® program. Compared to OEC's HELP energy efficiency loan program, the HELP PAYS® tariffed on-bill program saw participation triple, included renters, doubled the average investment and tripled the total amount of efficiency upgrades. It is an on bill program that uses the savings from energy efficiency improvements to pay for the upgrades.[35] They include HVAC, insulation, duct sealing, weatherization, lighting, NEST thermostats, and in 2019 they will be adding home solar. They start by sending out certified auditors at members request to perform a comprehensive energy audit to determine what improvements are necessary, and which ones will be the most cost effective. Auditors then make recommendations and the homeowners &/or renters determine what work gets done and which improvements are to be made. 80% of the estimated savings will be recovered on the electric bill until the investment is recovered by the cooperative. The member receives the other 20% during payback and 100% after payback is achieved. There is no charge for the audit and no credit check required. The improvements are financed for up to 10 years at only 0.5%, making this program very accessible to all members, regardless of income, age, credit worthiness, or home ownership status. The only criteria for loan approval is that you are a member of the cooperative.

Interestingly, the CEO noted that one of the most difficult issues around implementing their HELP PAYS® Program was getting the board and employees to accept that lowering members bills is in the best long-term interest of the cooperative.

ROANOKE ELECTRIC COOPERATIVE

Roanoke Electric Cooperative is based in Aulander, NC and serves about 14,000 members. They have been offering their members various financing options for energy efficiency improvements for over a decade, but recognized that most of their members were not able to participate or qualify for these programs due to credit worthiness or other hurdles. Recognizing their program shortfalls, Roanoke committed to broadening the types of energy efficiency improvements available (fuel-switching, home and office weatherization, solar energy) as well as removing the barriers to participation such as age, income, credit score, or home ownership status. Subsequently, their Upgrade to $ave—Energy Efficiency Program has become invaluable to their members, providing increased safety, affordability and comfort as well as reducing energy waste system wide, reducing demand charges for the co-op, and creating more sustainable local jobs.

Roanoke Electric uses a tariffed, on-bill financing program to offer members an opportunity to make voluntary investments in energy efficiency with no upfront payment and no new debt. This program is directly responsive to members' interest in lower energy costs, and Roanoke is committed to financing investments in energy efficiency as part of its long-term plan to diversify the nature of value- added energy services it provided to members. This financing option is made available from the Rural Energy Savings Program (RESP) administered by USDA Rural Development.

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35 Ouachita Electric Cooperative. "Opening Opportunities with Inclusive Financing for Energy Efficiency: Report on the first year of the HELP PAYS® Program at Ouachita Electric." OEC, June 2017. https://www.oecc.com/pdfs/HELP_PAYS_Report_2016-Ouachita_Electric_20170612V1.pdf

Many of the Low to Moderate Income members at Roanoke Electric who have participated in the Upgrade to $ave Energy Efficiency Program have experienced a 25%+ reduction in their energy bills, resulting in the reduction or elimination for the need to participate in the various bill-assistance programs such as LIHEAP.

Roanoke Electric Cooperative also created Roanoke SolarShare—a Community Solar Project with the goal of providing energy assistance to economically disadvantaged member-owners. The Project attempts to serve, assist, and educate eligible co-op member-owners in energy conservation, lower energy costs, and solar energy.

Each eligible and approved participant in the Roanoke SolarShare project shall receive a predetermined investment share in the Community Solar Garden. As a result, the member-owner will receive future billing credits to their account for the life of an assigned purchased power agreement associated with the Community Solar Garden. Members can also purchase shares of the solar garden outright, or finance them through the Upgrade to $ave program. Members can also have a solar system installed on their own home or business, financed with the on-bill tariff mechanism, but these systems may require some up front costs in order to bring the payback time-frame down to the 10 year mark required by the RESP program participation guidelines.

Roanoke Electric Cooperative strongly feels that these programs have improved the satisfaction levels of their member-owners with the co-op, and that members feel that Roanoke Electric is even more committed to and engaged in improving their members' quality of life as well as their financial stability than before these programs were introduced.

GREEN MOUNTAIN POWER (VT)

Green Mountain Power is the only Investor-Owned-Utility included in these case studies, and we wanted to include them because of their very bold and progressive "triple bottom line" economic basis for how they choose to act as providers of an essential service to their community. As the first and only Certified B-Corp designated Utility in the United States, they have set very high standards and are redefining success in business. By meeting rigorous performance, accountability, and transparency standards, they are using the power of business to alleviate poverty, address climate changes, and build strong local communities while providing a great place to work.

From their website: "GMP is committed to our community and the environment, as we transform into Vermont's Energy Company of the Future to provide our customers with energy efficient products and services to help them save money by using less energy. Our mission is to embrace a new energy system that can improve lives, reduce costs, and be produced in a more environmentally and economically sustainable way. We are actively pursuing moving away from the traditional grid, to one that is more resilient and reliable, and that uses a series of microgrids through renewable generation and innovative energy storage."

GMP's 'eHome' and 'eBiz' initiatives take an 'All-In' approach to reducing the energy burden for families, and energy costs for businesses. This on-bill project financing mechanism allows for very deep weatherization improvements to be made, as well as the addition of solar panels and batteries for energy storage, with the payback timeline long enough to typically be 'cash-flow-positive' for the utility consumer from the start.

GMP is also willing and able to finance Tesla Powerwalls for customers, which enables GMP to collectively aggregate all of the Powerwalls on their system when needed for grid-stabilization, especially during peak demand times, and the customers can utilize the Powerwall during outage situations. GMP considers this a Win for the utility, and a Win for the customer.

See GMP's CEO Mary Powell present on their 'Utility of the Future' model at the 2017 Michigan Clean Energy Conference hosted by the Groundwork Center for Resilient Communities: https://www.youtube.com/watch?v=rRrDiFMcwQI&t=1361s

CHERRYLAND ELECTRIC COOPERATIVE (MI)

Cherryland Electric Cooperative (CEC) is based in the Northwest region of Michigan's lower peninsula and serves 35,000 members. While Cherryland has been a leader in many ways, like building the state's first Community Solar Project in 2013, one of it's most unique pilot projects is a program where 50 of their low-income members receive a 'solar-credit' on their monthly electric bill from the production of 4 solar panels that are part of their 1MW community solar project. Here are some of the program highlights and details:

- CEC partnered with the State of Michigan's Energy Office to split the cost of purchasing 4 solar panels for each of the 50 members in the pilot (200 panels total), with the monthly output of the panels showing up as a credit on each member's electric bill.

- Members that were selected must have already gone through Michigan's low-income Community Action Agency weatherization program, which makes energy efficiency improvements after a comprehensive energy audit.

A couple key takeaways from this pilot program:

- Finding 50 homes in CEC's territory that had already been weatherized was more challenging than anticipated, primarily due to a not easily searchable database on the Community Action Agency side.
- Upon the realization that there is a far greater need for weatherization services for their low to moderate income members than can be handled by the Community Action Agency or other similar local organizations (which also do not typically allow or pay for electrification fuel-switching upgrades for HVAC equipment), the coop decided to research what forming an in-house weatherization department might look like. They are currently working through and researching some options, including whether the best option would be a separate nonprofit subsidiary, another in-house department, or providing additional support to existing businesses or agencies that are already involved in this work—helping build their capacity.
- CEC is also exploring creation of a revolving endowment fund starting with the memberships' Capital Credit allocations, which would be used for deep energy retrofits, weatherization, and home safety improvements.
- As found in many low to moderate income homes, the building may need considerable work and improvements beyond energy efficiency and weatherization projects. There are often many other issues caused by years without maintenance, causing water leaks, plumbing issues, structural damage, and ventilation and indoor air quality issues. CEC hopes to address these issues in conjunction with the weatherization and electrification improvements.

FEDERATED RURAL ELECTRIC COOPERATIVE (MINNESOTA)

Federated Rural Electric Cooperative, a co-op serving about 4,500 members in southern Minnesota, receives power from several generation and transmission cooperatives including Great River Energy (GRE), Basin Power Cooperative, and Western Area Power Administration (WAPA). GRE and Basin are heavily coal-powered (about 60 percent vs. a national average for electric co-ops of 41% coal)—with some wind energy and hydropower from the Western Area Power Administration (WAPA).

Born out of the need to sell more power when a power plant had excess capacity, Federated's space- and water-heating programs have become mainstay for members. Meanwhile, the co-op sees the programs as a win-win; members save money on their bills and Federated saves money by reducing demand charges through peak demand. Starting in 1980, the co-op began promoting dual heat pumps—both electric and propane powered—to reduce propane consumption and therefore carbon emissions. Co-op members receive a discount rate of 1.4 cents per kWh for Dual Heat with a free meter socket, with the member paying for the installation. Recently, the Dual Heat program has not been as popular because the credit incentive has dropped over the years and natural gas/propane prices are lower.

The water heater program is the most popular program for Federated members as it is a one-stop shop to receive a half-priced water heater. Since 1983, the co-op has added radio controls to water heaters, providing demand charger savings to the co-op through load management capabilities. Presently, the co-op has about 5,000 radio controls serving 6,700 members. Federated Co-op, like many co-ops nationwide, buys Westinghouse and Marathon water heaters ($1,000 retail price) in bulk offering them to members for $540, and members receive monthly credits on the bill up to $5.50. With this great offer, Federated has seen members switch from natural gas-powered water heaters to electric ones as they are tired of replacing their natural gas water heater every few years.

Federated co-op started offering Energy Star appliance rebates to comply with the Minnesota CIP law passed in 2003. CIP mandates all Minnesota utilities, including electric co-op to reduce energy usage by 1.5 percent annually of retail sales. Since then, the co-op has added a smart thermostat rebate ($25) and air-source and ground source heat pump rebates. Because Federated serves rural southern Minnesota (cold climate region 6) propane furnaces are common for space heating, with electric resistance heat as the go-to backup system. Converting electric resistance to newer and more efficient cold-climate air-source heat pumps, can reduce energy usage—thus complying with Minnesota CIP law—and allowing the co-ops to control peaks.

In 2018 Federated provided 21 air source heat pump (ASHP) rebates totaling $24,500. They had 1 ground source heat pump rebate totaling $2,100 and four ductless heat pumps totaling $2,000. After a successful seasonal promotion, 2019 ASHP rebates are $1,000 for 14-16 SEER and $1,500 for 17 SEER or higher, instead of the former rate of $600 for an ASHP.

Federated offers additional load management programs including the Cycled Air program, which provides members a $100 sign up credit and $6 monthly credit on the June, July and August electric bills for being able to cycle off a member's AC for 15 minutes on the hottest days. The standby genset program provides a lower electric rate to members with standby generators.

LAKE REGION ELECTRIC COOPERATIVE (MINNESOTA)

Lake Region Electric Cooperative is a distribution co-op headquartered in Pelican Rapids in rural northern Minnesota, serving 30,000 members. The co-op is one of 28 co-ops receiving power from Great River Energy (GRE), a generation and transmission (G&T) cooperative. GRE's generation mix is coal-heavy (about 60 percent), with wind and hydro providing 20 percent, and the rest by natural gas.

The co-op is very active in creating programs that take advantage of new technologies for their members to save money and to source greater amounts of renewable energy.

To that effect, Lake Region recently developed for their members two solar arrays, called Community Solar I and GoWest Solar. Community Solar I, a 60 kW farm built adjacent to Lake Region's headquarters, uses an innovative "pay over time" option with no fees or interest. Through this option members can lease a solar panel for $40 a month for 36 months, instead of having to pay $1,400 upfront for the solar panel.

For members looking to save money on their electric bills through energy upgrades, Lake Region provides two options: extensive rebates or loan financing. Through the EnergyWise marketplace—Great River Energy's rebate program—Lake Region offers a wide array of incentives for its members to save on energy, including rebates for heat pumps, and water heaters.

Lake Region has a creatively designed LED program, called "easy-pay", where members pay no money down for the LED bulbs and repay on their monthly utility bill—a sort of on-bill financing program—over a 36 months period and receive a $3 bill credit. LEDs are purchased in bulk by the co-op through Service Concepts, which does fulfillment. The co-op also applies the easy-pay model to Electrical Thermal Storage (ETS) water heaters (with a reduced electrical rates at 4.4 c/kWh), and to air-source heat pumps with an ETS furnace, with a 48-month repayment period.

Cold climate heat pumps are included in Lake Region's conversion rebate program. Cold climate air-source heat pumps can perform better in colder temperatures than traditional heat pumps. While, these heat pumps lose efficiency as outdoor temperatures dip below 0F, they can still provide an efficiency rating of 1.4 at—13F. At that point, the heat pump can switch to a dual fuel system with a propane input. This is a viable alternative for colder climate areas, especially those in climate zone 7, where Lake Region Cooperative provides service.

Due to low electric demand growth, Lake Region provides extensive incentives for members to switch from propane-powered space-heating to electric equipment (e.g., heat pumps). This is a method to increase load demand which otherwise sits outside of Lake Region's grid. Lake Region provides a double match of EnergyWise marketplace rebates for heat pumps, meaning SEER 16+ air-source heat pump rebates are $2,000 per unit, instead of $630. Ductless heat pump rebates have also increased to $75 from $50 per head. Thanks to this promotion, heat pump rebate demand has doubled, in respect to previous years, from 68 to 160 (as of December 2018). A survey by Lake Region –focused on heat pump usage and understanding—revealed that contractors (on their own) are promoting the co-op's rebates in their air-source heat pump advertising.

The co-op also offers home energy audits to members that would like to check their homes' energy efficiency. A certified energy auditor completes a thorough inspection including blow door test, infrared camera scan, and a report identifying recommendations and potential savings.

For financing options, Lake Region offers a service from the National Cooperative Bank, which is a National Rural Utilities Cooperative Financing Corporation (NRUCFC) program. Members can finance geothermal heat pump installations, energy storage, residential solar, community solar, EV chargers, and energy efficiency measures, such as insulation and weatherization. Through the unsecured loan option, members can finance up to $30,000 over 8 years at a fixed rate, while the secured loan option (a UCC-1 is filed) members can loan up to $100,000 for 8 years repayment period at a fixed rate.

BUTLER RURAL ELECTRIC COOPERATIVE ENERGY EFFICIENT IMPROVEMENT LOAN PROGRAM

Butler Rural Electric Cooperative ("Butler Electric") has been running, since 1982, a successful on-bill financing program, the Energy Efficiency Improvement Loan Program. The program's objective is to promote its energy efficiency offerings, primarily heat pumps

and geothermal pumps. Located in southwest Ohio, Butler Electric serves a highly educated population as it serves rural areas north of Cincinnati and around the University of Miami (Ohio). In fact, Butler Electric has worked with the University of Miami to develop the on-bill financing program and continues the relationship through the funding of a scholarship with the Institute for Environment and Sustainability at the University of Miami.

Butler Electric's on-bill financing program started as a financial option for its members interested in installing geothermal heat pumps and HVAC systems, which were becoming popular thanks to the co-op's generous rebates. Loans issued under the program cover the project's full cost for energy efficiency improvements. A 3.5 percent interest rate is applied to all loans and the maximum amount a member can borrow is $25,000. The length and type of the loan depends on the amount borrowed, but the minimum term of any loan is twelve months. A typical loan issued by Butler Electric through the on-bill loan program is around $15,000 and has a repayment schedule of up to twelve years. These larger loans are due to the more costly geothermal heat pumps installations.

Historically, most loans issued under the on-bill program have been for heat pumps, and geothermal pump systems installations, as well as HVAC tune-ups. With no up-front payments for the energy upgrades, and with the ability to pay-back the loans via the co-op's monthly electric bill, the on-bill program has made financing geothermal pumps easier and more affordable. While weatherization-only loans have not been as popular as heat pump loans for the Butler Electric members, whole-house envelope projects have been included as part of the loans issued for energy improvements.

Initially funded through a U.S. Department of Agriculture Rural Utility Service (RUS) Energy Resource Conservation (ERC) loan program, the Butler Electric on-bill program has transformed over time into a self-financing program. ERC is a predecessor to Rural Energy Savings Program (RESP), where RUS provided loan deferments to participating co-ops program at 2 percent interest rate. Co-ops could then add 300 basis points, as they re-loan it to members, to pay for program administration costs. In effect, co-ops provided loans to members for energy efficiency measures up to $5,000, at 5 percent interest, and for a five year repayment period.

Presently, loan capital for the program originates from a revolving loan fund created through the payments and interests from the initial program participants. This fund also acts as a backstop in case of potential loan defaults. As of October 2018, the program has had only one default out of 541 loans issued since inception. Since 1982, Butler Electric has loaned out $8.1 million at an average loan size of $15,000.

The near absence of loan defaults in the Butler Electric's on-bill program is explained by the co-op's strict underwriting participation requirements. For program eligibility the co-op uses a hybrid method that includes both credit scores and income requirements. The participant needs to have: 1) a debt-to-income ratio under 40 percent; 2) a solid credit score & credit history; 3) an established equity in the home as the program is only for homeowners; 4) a bill payment history (electric and other) with Butler Electric; and 5) a job tenure and history.

Butler Electric's on-bill program is run entirely in-house, from processing the loans to the loan origination fund. The co-op markets the programs through in-office brochures and materials, social media (facebook, website, email blasts) as well as bill inserts and a monthly magazine, Ohio Cooperative Living. Local contractors are knowledgeable about the program and actively refer clients to it as an option to pay for the energy upgrades. Once the member is approved for the program, contractors run the energy audits, and install the elected energy measures by the co-op member. For loan security Butler Electric issues a second mortgage filing on the home with the energy upgrades, and a UCC-1 filing through the State of Ohio.

WABASH VALLEY POWER COOPERATIVE CASE STUDY

Wabash Valley Power Cooperative, a power provider for 23 rural electric cooperative spread across three Midwest states (Indiana, Illinois and Missouri) offers the Power Moves rebate program. Power moves is a package of energy rebates including energy efficiency measures (e.g., lighting, insulation and home energy assessments) electric water heaters and heating and cooling equipment (HVAC). This includes replacing an old and inefficient furnace (propane or fuel oil) with a more efficient air-source heat pump (ducted or mini-splits), or ground source heat pumps. As new generation heat pumps are three times more efficiency than propane furnaces, this creates savings for the customer and reduces carbon emissions.

Similarly to other generation and transmission (G&Ts) cooperatives nationwide, the Power Moves programs provides a suite of residential HVAC rebates to co-ops, which in turn can offer to their co-op members. Participating in group rebate programs provides multiple benefits, especially for smaller co-ops with limited resources particularly on designing and operating rebate programs. Benefits include pooling man-hours, capital resources, and sharing a common marketing program brand that helps sell the program,

while keeping the value for members. Programs like this that provide value to local distribution co-ops also strengthen the relationship with their G&T.

Participating co-ops can also offer their own energy efficiency and HVAC incentives on top of the Power Moves incentives doubling the money savings. Marshall County REMC members can replace their gas water heater with a 40 gallon or larger standard water heater and receive a $100 bill credit. Kosciosko REMC members are eligible for additional rebates. Members switching from a gas-powered water heater to an electric can receive a $125 bill credit, while those that opt to install a new air-source heat pumps can see a $150 bill credit after completing the application and submitting an invoice to the co-op.

Wabash Valley Power recently re-introduced the dual-fuel heat pump rebate—discontinued for the last two years—to take advantage of the new technical attributes. Power Moves offers a $500 per unit rebates for those members replacing a propane furnace. Dual-fuel heat pumps can cut propane usage in half, by adding a new electric heat pump to the system, and leaving the propane as a fuel backup. However, if the propane furnace is old and inefficient, then by installing a new air handler, the system can adequately heat a space in cold outside conditions (below 20 F), while keeping the house comfortable. In this situation, the electric heat pump can also act as an AC system in the summertime; many co-op members have not had AC systems, so new heat pumps with AC units add energy load to the co-op. As less propane is needed to heat the same space, an average co-op member with a 500 gallon propane tank can avoid the winter refilling, which is twice as costly as in summer. This also provides a hedge against a rise in propane and natural gas prices. Thereby, energy costs and emissions are optimized for the member.

ORCAS POWER AND LIGHT COOPERATIVE

Orcas Power and Light Cooperative (OPALCO), a co-op serving the San Juan Islands in the northwest part of Washington, offers the Switch It Up! On-Bill Tariff program to their members. Launched in April, the program finances the replacement of propane-powered residential and commercial equipment with electric, efficient equipment, and electric vehicle (EV) charging stations. This beneficial electrification program is part of OPALCO's utility-wide initiative

Switch it Up! is capitalized through a $6 million zero-interest loan from the U.S. Dept. of Agriculture through the Rural Energy Savings Program (RESP). RESP is a relatively new federal resource that allows rural electric utilities to finance a wide variety of behind-the-meter energy efficiency and clean energy projects, including beneficial electrification. This conversion process increases load for OPALCO—which would otherwise sit outside of its power grid—and provides a member value, by reducing energy, increasing comfort in their homes, and decreasing overall carbon emissions.

Set up as a member opt-in tariff on-bill program, no loans are issued; instead, participants repay the upgrades and conversions through an energy conservation charge rider tariff. The repayment charge is attached to the participant's electric meter, allowing for the conservation charge to transfer to the next owner or renter. Program eligibility is based on the participant's on-time utility bill payment history, rather than credit scores. Combined these design elements expand access for financing energy efficiency and beneficial electrification programs to more co-op members.

Switch It Up finances the installation of mini-split heat pumps and electric water heat pumps—previously heated by propane—and electric vehicle charging stations. OPALCO members can borrow up to $18,000 for these three projects, in a combined way at 2 percent. Electric ductless heat pumps can be financed for up to $15,000 and 10 years, while electric water heat pumps can be repaid up to $2,500 over 5 years. Building envelope improvement measures will be added at a later date. For EV charging stations, $3,000 is available for a 3 year repayment period. The program finances both the Level 2 charging station, for homes and businesses, and the electrical rewiring needed to plugin the station, which can cost up to $3,000. Financing EV charging stations for businesses (e.g., restaurants, groceries, and local shops) can drive economic development, while reducing carbon emissions.

Launched in April 2018 and with the goal of converting 100 heat pumps annually for 10 years, the Switch It Up program converted all of the HVAC systems in a hotel. Through investing $105,000, which is to be repaid by the co-op monthly bill, the hotel switched all of the propane radiant heat with seventeen electric ductless heat pumps.

Moving from fossil-powered end-use devices—both in buildings and for transportation—helps OPALCO members save money and reduce emissions.

TABLE 4. SUMMARY TABLE OF CASE STUDIES

ELECTRIC CO-OP	BENEFICIAL ELECTRIFICATION MEASURES	LOANS AND ON-BILL FINANCING	REBATE PROGRAMS	EQUITY MEASURES	RENEWABLE ENERGY PROGRAMS
Orcas Power and Light Cooperative Eastsound, WA	HVAC upgrades, EV charging stations	On-bill tariff program for financing conversion of fossil-powered equipment to electric equipment		Repayment charge is assigned to the electric meter, no credit checks, transferable to the next occupant or renter	Community solar
Ouachita Electric Cooperative Camden, AR	HVAC upgrades	PAYS on-bill tariff program[36] for HVAC upgrades, energy efficiency measures, rooftop and community solar		PAYS program includes: no credit check, free energy audit, and guaranteed savings for cost-effective upgrades	Community and rooftop solar
Cherryland Electric Cooperative Grawn, MI	HVAC and refrigerator upgrades	Low-interest loans for EE upgrades, including HVAC, refrigerators, insulation and weatherization		Loans attached to the meter, not customer, and payments must be less than the energy saved; pilot project of 50 low-income members to receive solar credit on their electric bill	Community solar
Federated Rural Electric Assoc. Jackson, MN	Dual heat pumps program; electric water heater program (radio-controlled); ASHP incentives		Air source and ground source heat pump rebates; smart thermostat rebate	Water heaters offered to members at roughly half the retail price, and monthly credits up to $5.50; $100 sign-up credit and $6 monthly credit for cycled air program (June - Aug)	

36 For more on the Pay As You Save® (PAYS®) program visit: http://www.cleanenergyworks.org/pays-for-ee/

TABLE 4. SUMMARY TABLE OF CASE STUDIES (CONTINUED)

ELECTRIC CO-OP	BENEFICIAL ELECTRIFICATION MEASURES	LOANS AND ON-BILL FINANCING	REBATE PROGRAMS	EQUITY MEASURES	RENEWABLE ENERGY PROGRAMS
Lake Region Electric Cooperative Pelican Rapids, MN	Incentives for heat pumps and water heaters	On-bill financing program for LED bulbs, ETS water heaters and ASHP's (48 month repayment period); 'pay over time' option for solar, with no fees or interest; unsecured loan option of up to $30K for geothermal, energy storage, solar, EV chargers and EE measures.	ASHP and electric water heater rebates		Community Solar
Butler Rural Electric Cooperative Oxford, OH	Incentives for heat pumps	On-bill financing program for heat pumps, geothermal pumps and EE measures, for up to $25K at 3.5% interest	Rebates on heat pumps and geothermal pumps		
Roanoke Electric Cooperative Aulander, NC	HVAC, Weatherization and Solar	Upgrade To $ave on-bill tariff	Solar, heat pumps, weatherization	Upgrade to $ave is a PAYS program that includes: no credit check, free energy audit, very low interest tariffed repayment, and guaranteed savings for cost-effective upgrades, Solar Share Program	Community and roof top solar