Business & Technology Report

February 2021

Case Studies in Beneficial Electrification

Electric Cooperatives Develop Programs to Build Consumer Value and Meet Climate Change Goals

NRECA

America's Electric Cooperatives

Business & Technology Report
February 2021

Case Studies in Beneficial Electrification

Electric Cooperatives Develop Programs to Build Consumer Value and Meet Climate Change Goals

Prepared By:

Eric P. Cody
Cody Energy Group
codyenergygroup@gmail.com

NRECA Subject Expert:

Keith Dennis, PE
Vice President – Consumer Member Engagement
Business and Technology Strategies
Keith.Dennis@nreca.coop
703-907-5787

NRECA
America's Electric Cooperatives

Table of Contents

Overview

Beneficial electrification, the systematic conversion of energy end-uses from fossil fuels to electricity, is gaining traction within the utility industry. This movement seeks to improve the environmental footprint of the electric sector, energy system efficiency and productivity by encouraging consumers and businesses to invest in high-efficiency, electric-end-use equipment, systems and processes. Some electric cooperatives have recently announced that more than 50 percent of their generation supplies will come from renewable resources, most notably solar and wind, within the next few years. This underscores the fact that conversion to electricity is now cost-effective and part of the solution to carbon dioxide mitigation in the future. Converting carefully selected end-uses of energy to electricity and upgrading existing electric equipment to higher efficiency units can save consumer-members money and reduce net carbon emissions.

This development is not without its challenges, however. Beneficial electrification will involve fundamental and possibly sweeping changes in the way the electric utilities operate. It will impact the core business of providing power to consumers in significant ways, from the busbar of the power generating resources to the consumer's side of the electric meter. How it plays out will be influenced by choices made in homes and businesses, in statehouses, regulatory commission hearing rooms and the U.S. Capitol. For these reasons, beneficial electrification calls for a measured approach with diligence, attention to details and practiced implementation of new programs, heeding lessons learned from the real experiences of electric cooperatives and other utilities. Data collection and trend analysis are equally important.

Consumer expectations will be at the heart of beneficial electrification. It will be up to electric cooperatives to ensure that their consumer-members' desires are understood and that what ultimately emerges creates lasting consumer value. An industry transformation is underway and electric cooperatives are leading the way forward. This white paper contains case studies describing some of cooperatives' early experiences and summarizes what we might learn from them.

Powered by Electricity—Electric Forklift and Electrode Boilers. Photos Courtesy of:
North Carolina Electric Membership Corporation (left) and Precision Boiler / Diageo plc (right)

Introduction and Background

Sea change? Seismic shift? Watershed moment? Any of these, or all of them, might be used to describe the transition underway in the utility industry toward something called "beneficial electrification." Beneficial electrification is the application of electricity to end-use equipment and systems where doing so satisfies at least one of the following conditions, without adversely affecting the others:

- Saves consumers money over time.
- Benefits the environment and reduces greenhouse gas emissions.
- Improves product quality or consumer quality of life.
- Fosters a more robust and resilient grid.

The transition is conditioned by new regulatory policies, rate tariffs, program incentives and consumer education. Regardless of what we call it, beneficial electrification is likely to become a strategic area of emphasis for electric utilities of all types as efforts to address climate change ramp up.

Beneficial electrification within the electric cooperative community is being driven by several key factors and enabling technologies including:

- Lower costs as renewable energy resources reach price parity with more traditional generation types.
- A shift away from fossil-fueled electricity generation coinciding with the addition of low to zero-emissions energy resources to the power supply mix.
- Consumer preferences that increasingly favor electricity when it is sourced from clean, renewable resources.
- The likelihood of significant federal and state infrastructure investments in electric vehicle (EV) charging networks and other electrification programs.
- Increasingly widespread access to detailed, electricity demand data through advanced metering infrastructures (AMI) being deployed by electric cooperatives.
- Expanding access to high-speed communications as more and more electric cooperatives extend broadband networks into underserved rural areas.

The combined effect of these factors is to fundamentally alter electric utilities' planning and decision-making processes. The utility perspective is changing, along with that of energy policy makers, regulators and, not least of all, consumers.

Many electric cooperatives have already launched programs to realize the potential value of beneficial electrification for their consumer-members. This report summarizes the experiences of six electric cooperatives across the United States that have developed beneficial electrification programs. Taken together, their programs directly or indirectly involve more than 100 electric distribution cooperatives and public power districts serving a population of over five million people in ten states from coast to coast (see Figure 1). Their combined service areas span several hundred thousand square miles. Insights

from these electric cooperatives' bellwether experiences in this emerging business area are relevant to the entire electric industry. These case study cooperatives are helping to chart a roadmap to the future.

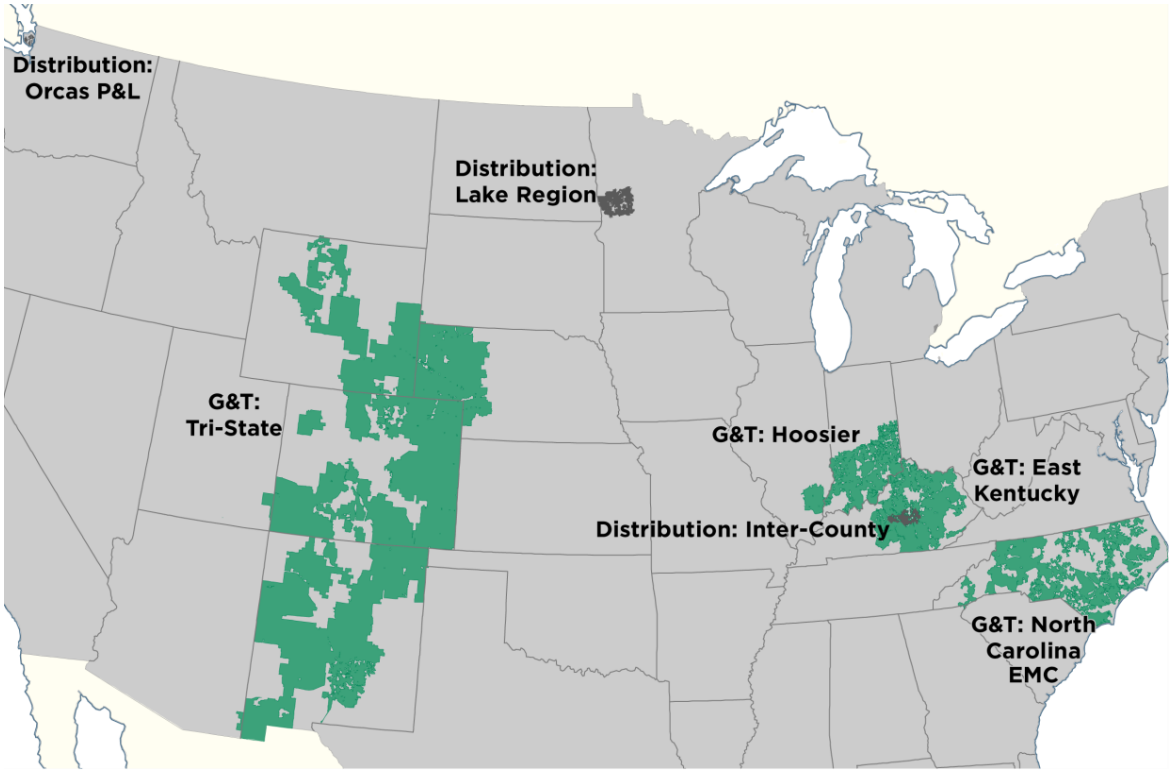

Figure 1: Operating locations of the case study cooperatives.

Bellwether Experiences — Electric Cooperatives Light the Way

Real experience is the best teacher. Six, high-level case studies of electric cooperatives have been developed and serve as the centerpiece of this report. They offer a means for understanding key issues, challenges and opportunities that may be associated with beneficial electrification. Three of these focus on the programs of generation and transmission (G&T) cooperatives that supply power and transmission services to distribution cooperatives and other entities. Two feature electric distribution cooperatives. One case features both a G&T and a member distribution co-op. All are actively engaged in the early stages of beneficial electrification. The featured cooperatives and their operating locations are as follows:

- East Kentucky Power Cooperative (EKPC, a G&T) and its member distribution cooperative Inter-County Energy Cooperative (both operating in Kentucky).
- Hoosier Energy Rural Electric Cooperative (Hoosier Energy, a G&T with member distribution cooperatives in Indiana and Illinois).
- Lake Region Electric Cooperative (LREC, a distribution cooperative operating in Minnesota).

- Orcas Power and Light Cooperative (OPALCO, a distribution cooperative operating on islands off the coast of Washington).

- North Carolina Electric Membership Corporation (NCEMC, a G&T with member distribution cooperatives throughout North Carolina).

- Tri-State G&T Corporation (Tri-State, a G&T with member distribution cooperatives and pubic power districts in Colorado, Wyoming, New Mexico and Nebraska).

This body of electric cooperative experience represents a meaningful test bed for understanding beneficial electrification and its impacts on consumer households and businesses for the purposes of policy development and program planning. In effect, the collective experiences of these cooperatives can be viewed as a nationwide demonstration project.[1] While not a statistically designed sample, the six cases can be characterized as being reasonably representative within the universe of electric cooperatives for the following reasons:

- **Nationwide coverage** – the case studies cover parts of ten states and provide a geographic cross-section of America, as indicated in Figure 1. The experiences they collectively represent are large-scale, encompassing more than five million people, 10,000 miles of transmission lines and combined system peak electric demands approaching 12,000 megawatts (MW).

- **Low-density, rural areas** – Areas served by the case study co-ops cut slices across rural America, where population densities are low, open highways stretch for hundreds of miles and the share of low-income households is disproportionately high. All of these characteristics are essential for understanding the economic, social and policy impacts of beneficial electrification in homes, businesses, industries and the transportation sector.

- **Cleaner power supplies at competitive cost** – These electric cooperatives are tapping into power supplies that come increasingly from renewable, zero-emissions sources that have become cost-competitive with traditional generation types. This removes a key impediment to greater reliance on electricity in homes and businesses—increased use of electricity will not produce increased emissions. It will reduce them.

- **Diverse set of programs** - A diversity of beneficial electrification programs with widely varying purposes and approaches is represented in these case studies.

- **Utility leadership** – NRECA and these participating member systems have taken a lead role in exploring the potential value inherent in beneficial electrification and promoting well-informed decisions and investments by members and the utility industry at large. This provides members with a high degree of technical and policy support, both of which are critical when a complex industry transition is underway. Furthermore, individual electric cooperatives and statewide

[1] This is in some ways parallel to the nationwide Smart Grid Demonstration and Solar Utility Network Deployment Acceleration (SUNDA) projects undertaken by NRECA to understand other fundamental shifts being enabled by technology.

electric cooperative associations have taken an active role in establishing state-level chapters of the Beneficial Electrification League (BEL).[2]

Key Insights from Electric Cooperatives' Early Experiences

Several recurrent themes appear throughout these case studies. Understanding these, and appreciating how they interact with one another, is important for policy development, program planning and consumer acceptance. The following is a summary of key insights that can be gleaned from these case studies:

- **Business and Consumer Relations**

  - Virtually all the featured electric cooperatives view beneficial electrification as a natural part of their role serving members, promoting economic development and building sustainable communities. They consider themselves to be the member's trusted energy partner and beneficial electrification to be a program that can be added to the portfolio of energy efficiency tools.

  - These cooperatives are keenly aware of the Environmental Sustainability Goals that have been adopted by some of their largest corporate accounts.[3] Beneficial electrification is seen by both the co-ops and their key corporate customers as a pathway to achieving some of these goals.

  - Countering misinformation about the performance or cost of changing end-use technologies has become a must for electric cooperatives showcasing beneficial electrification. Tri-State, for example, has installed several cold-climate heat pumps to refute contractor claims that "they don't work in this climate." The G&T has also rolled out a contractor training program.[4]

- **Rate Design and Revenue Stability**

  - The willingness of customers participating in some of the beneficial electrification programs profiled here to accept new rate structures is key to reducing financial risk to the cooperative and/or addressing the intermittent character of renewable energy resources such as wind and solar. The EKPC/Inter-County Energy Cooperative case study, for example, discusses a "green tariff" that was created specifically to enable large customers to purchase all or part of their energy from renewable sources under a long-term agreement.

  - While revenue growth does not appear to have been the primary driver behind any of the featured cooperatives' beneficial electrification programs, stagnant electric load growth in

[2] https://be-league.com/

[3] Environmental, Social, and Corporate Governance (ESG) refers to the three central factors in measuring the sustainability and societal impact of an investment in a company or business. (Source: Wikipedia)

[4] For another pilot program, see: https://www.cooperative.com/programs-services/bts/Documents/Reports/Report-Space-Heat-Pilot-Feb-2020.pdf

many of the low-density, rural areas served by cooperatives makes incremental revenues from expanded use of electricity helpful in maintaining financial stability and affordable electric rates.

- **Incentives and Financing**

  - Pilot programs are being used to test a variety of economic incentives for beneficial electrification. These include rebates, newly structured tariffs, bill credits and innovative financing.

  - The electric cooperatives featured here view their program expenditures for beneficial electrification as an investment for the future. The return on investment is related to load growth and, equally important, the improved energy efficiency that results. Some of the investments, such as those being made by LREC in Minnesota, are intended to improve the performance of the electric grid.

  - Rebates for member purchases of high-efficiency electric equipment and systems, including EV charging stations, are being offered to incentivize conversion to electricity where it makes sense. Some electric co-ops, such as OPALCO, also offer low-interest loans that can be paid back over time in the consumer-member's monthly electric bill (so-called "on-bill financing").

- **Organizational Restructuring**

  - Several of the co-ops featured in the case studies have reorganized to facilitate meeting their members' specific needs with electricity. In some cases, jobs have been restructured to reflect the expansion of existing energy efficiency programs to include electrification. For example, the lead for beneficial electrification at Hoosier Energy is the Manager of Energy Management Solutions, while at Tri-State there is a Beneficial Electrification Manager.

  - Beneficial electrification impacts both the power supplier and the distribution cooperative so it is not surprising to see new wholesale-retail arrangements forming around the concept. In North Carolina, NCEMC and its member cooperatives are working closely together to achieve sustainability goals recently announced through their shared *Brighter Future* initiative.

- **Program implementation**

  - Beneficial electrification is a new initiative in name only. Consumers' adoption of electricity for space heating, water heating, irrigation and other end-uses has been a staple in some regions and on the uptick in many parts of the country for the past decade. Hoosier Energy has seen a 13 percent increase in electric space heating in new homes throughout its member territories since 2008. Moreover, electric cooperatives have been promoting high-efficiency equipment such as heat pumps for a decade or more.

- These programs typically start small, involving a few customers. Consumer education is a prerequisite and the featured co-ops have created new web pages and print material for use in their conversations with consumer-members. Given the wide range of programs being offered—rebates, new tariffs, innovative financing, technical assistance—different implementation paths are adopted. Tri-State, for example, has hosted events that have given consumer-members the opportunity to test drive EVs.

- **Electricity supply and demand**

  - Several co-ops indicate that they expect renewable resources will comprise a majority share of their power supplies within the next five years. EKPC currently generates more green electricity than any other utility in Kentucky. Hoosier Energy anticipates the retirement of its 1,000 MW Merom generating station in 2023. LREC's power supplier, Great River Energy, has announced plans to close its 1,151 MW coal-fired generating station at Coal Creek in late 2022. Tri-State has announced that it will close all of its coal-fired power plants and mines in New Mexico and Colorado by 2030.

  - Beneficial electrification is helping electric co-ops to unlock new, more flexible load opportunities such as off-peak EV charging. These new loads enable more efficient use of generating resources, lower costs and reduced air emissions.

  - Some of the pilot programs are highly sophisticated in their designs, balancing supply and demand during the day to take fullest advantage of renewable resources whose output can be intermittent. LREC's grid-interactive electric thermal storage water heater pilot program is a good example.

- **End-use technologies**

  - Based on the extent to which our case study co-ops are supporting expanded use of EVs in their states, EV charging networks may turn out to be one of the most significant infrastructure investments in the next decade, perhaps second only to broadband communications networks. Some co-op managers refer to the accelerating adoption of EVs as a "game-changer" for the electric industry.

  - Depending on where they operate and what industrial sectors are prevalent, the case study co-ops are targeting different end-uses of energy for systematic conversion to electricity. North Carolina's pork and poultry farms and processing facilities have led NCEMC and its member co-ops to target agricultural equipment, electric irrigation pumps, forklifts and electric transport refrigeration units, as well as other end-uses. OPALCO, which is intent upon reducing its reliance on submarine cables to deliver power to its island service area, targets a wide range of consumer appliances and equipment—clothes washers and dryers, ductless heat pumps, Level 2 EV charging stations, high-efficiency electric heating systems, heat pump water heaters, among others.

  - Beneficial electrification is not limited to converting energy end-uses from fossil-fuels to clean electricity. Programs also include upgrades of certain existing electrical end-uses to

higher-efficiency. Moving from electric-resistance space heating to air-source heat pumps is a case in point.

  - Some of the end-use technologies being converted to electricity are specific to the customer's business. EKPC and Inter-County Energy, for example, have entered into a partnering arrangement with Diageo plc to source 100 percent renewable electricity for a new distillery. The company will use electrode boilers to eliminate direct greenhouse gas emissions from its new facility.

- **Industry leadership**

  - Ongoing research, networking exchanges with other electric cooperatives, pilot test programs and NRECA resources all contribute to raising electric cooperatives' level of understanding of issues and challenges so larger scale programs that may lie ahead can be implemented with confidence.

  - NRECA has taken a lead role in evaluating the issues, risks and opportunities inherent in beneficial electrification and has produced toolkits and sample materials for members for use by cooperatives and consumers (see links in final section of this white paper). NRECA launched the Beneficial Electrification League (BEL) in 2018 in partnership with the Natural Resources Defense Council.

  - Leading electric cooperatives around the country have followed NRECA's lead and formed state-level BEL chapters. Tri-State helped form the first state chapter of the Beneficial Electrification League in Colorado in 2019. A number of multi-stakeholder conferences have since followed—*Electrify Indiana! Electrify Iowa! Electrify Minnesota!* Electric cooperatives are networking to get the word out. Their message is: Electrify everywhere where it makes sense.

What Each Case Study Tells Us

The goal of these case studies is to examine real experiences to convey lessons learned to those who are planning to follow suit with beneficial electrification. As such, selection of the electric cooperatives to be featured was important. While many of the issues associated with beneficial electrification are present in all the case studies to some degree, each featured cooperative was chosen for its ability to illuminate one particular issue or set of issues. They can be highlighted as follows:

- EKPC/Inter-County Energy features a partnership with a global company headquartered in London to create a distillery using 100 percent renewably sourced electricity.

- Hoosier Energy describes a new organizational approach built around research and pilot testing of beneficial electrification concepts.

- LREC captures the experience of innovative rate changes coupled with an advanced load management concept.

- OPALCO reflects a wide-ranging, rebate incentive program combined with a tariff-based, on-bill financing approach.
- NCEMC explores the potential for agricultural innovation and sustainable technology applications.
- Tri-State illustrates how beneficial electrification can be integrated into a long-term Energy Resource Plan.

Electric cooperatives and other electric utilities considering the launch of new beneficial electrification programs will benefit by reviewing these cooperatives' experiences.

Case Study 1: Electric Cooperatives Work with Diageo to Create a Carbon-Neutral Distillery in Central Kentucky

Cooperative Profiles

East Kentucky Power Cooperative (EKPC) is a not-for-profit, member-owned cooperative providing wholesale electricity to 16 member distribution cooperatives serving 1.1 million residents at 545,000 homes, farms, businesses and industries across 87 Kentucky counties. EKPC provides power from coal-fired power plants, natural gas-fueled peaking units, purchased hydropower and renewable energy resources using more than 2,800 miles of transmission lines. EKPC generates more green power than any other utility in Kentucky. Collectively, EKPC and its member cooperatives are known as Kentucky's Touchstone Energy Cooperatives.

Inter-County Energy Cooperative (ICEC), one of EKPC's electric distribution members, is a not-for-profit, locally owned and member-driven cooperative that has been delivering electricity to over 26,000 members across six counties and parts of six more since 1937, as shown in Figure 1.1.

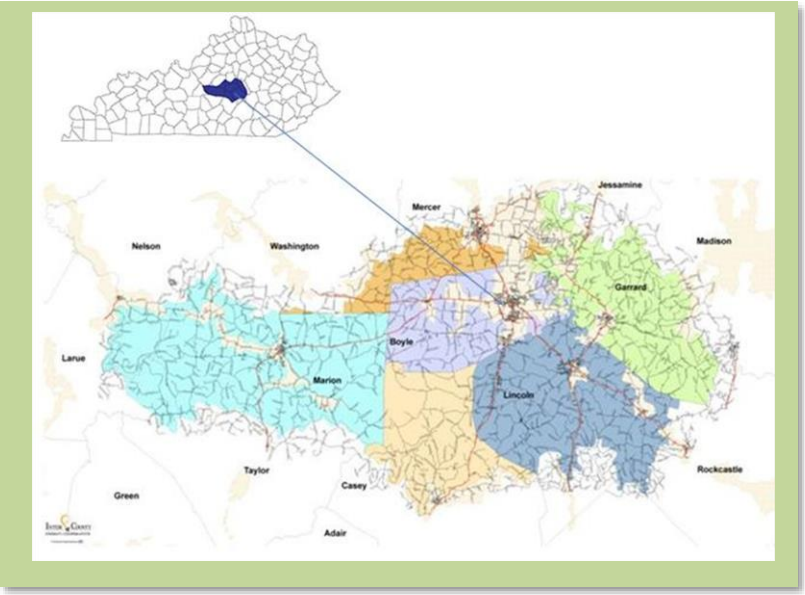

Figure 1.1:
Inter-County Energy Cooperative service territory.
Map courtesy of Inter-County Energy

Overview of the DIAGEO Project

Diageo is a global beverage leader whose brands include Bulleit Bourbon as well as a wide range of other spirits and beer. The company's net sales were £11,752 million (approximately $15.5 billion) in fiscal year 2020. Brands include Johnnie Walker, Crown Royal, J&B, Buchanan's and Windsor whiskies, Smirnoff, Cîroc and Ketel One vodkas, Captain Morgan, Baileys, Don Julio, Tanqueray and Guinness. In November 2020 the company announced a range of 25 bold and ambitious goals in its

Society 2030: Spirit of Progress plan, designed to make a positive impact on the world by 2030. This initiative builds on an already impressive record of achievements in the area of environmental sustainability, as highlighted in Figure 1.2. Not surprisingly, in late 2020 Diageo was recognized in the Dow Jones World Sustainability Index for the third straight year.

Figure 1.2: Diageo's Achievements in Environmental Sustainability, 2015-2020.
Image courtesy of Diageo

Diageo is building a new facility on 144 acres in Lebanon, Kentucky that includes a 72,000 square-foot distillery and dry house, along with twelve barrel warehouses. The distillery is expected to begin producing bourbon under the Bulleit brand there in 2021. Early in its planning process for the new facility Diageo initiated discussions with ICEC and EKPC to explore options for acquiring the power from purely renewable sources. ICEC's President and CEO Jerry Carter recalls Diageo's project manager asking whether the co-op could offer any renewable energy options. The parties exchanged information and ideas over a period of several months and built a cordial, working relationship. The discussions led to a breakthrough. The $130 million distillery will operate on 100 percent renewable electricity, helping to make this what is expected to be one of the largest carbon-neutral distilleries in North America. But there is more to the story. Diageo will also electrify its distilling process at the facility by using electrode boilers to eliminate direct greenhouse gas emissions. According to a Diageo spokesperson, "By using electrode boilers that employ 100 percent renewable electricity, the distillery will help us avoid more than 117,000 metric tonnes annually of direct and indirect carbon emissions – equivalent to taking more than 25,000 cars off the road for a year." Figure 1.3 provides an artist's rendering of the innovative boilers.[5]

[5] It should be noted that changing from the planned gas-fired boilers to the electrode boilers caused the site demand to increase enough that a new substation was required.

Figure 1.3: Rendering of electrode boilers to be installed at the Lebanon, Kentucky distillery. Courtesy of Precision Boiler and Diageo

How Does the Renewable Supply Arrangement Work?

Scott Drake, EKPC's Manager of Corporate and Technical Services, explains how Diageo's request for 100 percent renewable electricity supply is being met. "To contract for the necessary renewable supply resources, EKPC issued a Request for Proposals to supply the renewable energy. Although EKPC is the contracting party, Diageo participated directly in the bid review process, helping to select the resource type. EKPC will execute a power purchase agreement (PPA) to supply Diageo via ICEC, with the energy being specifically dedicated to the distillery." Under the arrangement, Diageo will also license solar panels from Cooperative Solar Farm One, an 8.5 megawatt (MW) solar farm operated by EKPC on behalf of its member cooperatives. The G&T will enter into PPAs for additional renewable energy resources as needed to operate the distillery at near 100 percent renewable energy resources. To achieve the goal of 100 percent renewable electricity, Diageo will purchase Renewable Energy Certificates (RECs) annually through EKPC if electricity consumption exceeds electricity contracted through PPAs.

The Green Tariff

The Diageo project represents a milestone in Kentucky cooperatives' efforts to create a process and provide tools that enable them to engage with large industrial and commercial end-use members intent upon achieving their corporate environmental sustainability goals. Because ICEC is rate-regulated by the Kentucky Public Service Commission (KPSC), the co-op entered into informal discussions with the KPSC, EKPC and Diageo to determine the best energy-supply mechanism for supporting the project without unfairly burdening other end-use members with costs. EKPC's vision was to create a 'green tariff' that provides all its member co-ops with the flexibility to respond to the needs of industrial members like Diageo. The green tariff that resulted enables large, end-use members with electricity demand greater than 1 MW to purchase through their local distribution cooperative (ICEC in this case) and EKPC part or all of their energy supply from renewable sources under a long-term Renewable Energy Purchase Agreement (see sidebar). The tariff is reflected in ICEC's tariff sheets as the Renewable Energy Program rate, with mirrored provisions in EKPC's wholesale rate. Under the rate, the member (Diageo here) receives credits for EKPC's avoided costs and certain other adjustments and is billed for the renewable energy supply per the agreement. According to EKPC's Drake, it is an

arrangement that meets the needs of both the industrial member and electric cooperatives involved while guaranteeing no cost-shifting to the rest of the co-op's end-use members.

Highlights of ICEC's Renewable Energy Purchase Agreement

- End-use members must purchase a minimum of 1 MW of installed renewable capacity.
- ICEC shall acquire the renewable power sold to the customer from EKPC.
- The customer may aggregate the energy consumption across multiple accounts anywhere within EKPC's service territory.
- The end-use member may choose the type(s) of renewable resources from which the energy shall be generated. Options include: solar, wind, hydropower, landfill methane gas and biogas.
- ICEC will receive a monthly credit on its wholesale power bill from EKPC reflecting avoided costs and other factors.
- The end-use member will receive a monthly credit on its retail power bill from ICEC reflecting the wholesale credit ICEC has received from EKPC.
- No impact on other rates or members.

Beneficial Electrification Programs Being Offered

ICEC's Carter emphasizes that beneficial conversion to electricity is not new for his cooperative. "We've been offering incentives for end-use members to switch to high efficiency, electric heat pumps since the nineteen eighties as an integral part of our energy efficiency program." He refers to his heat pump incentive program as the "original form of beneficial electrification." However, Carter says the near-term prospects for electric vehicles (EVs) continue to face an uphill climb, noting that "until charging stations are deployed on a widespread basis, range anxiety will remain an issue" among rural Kentucky consumers. He expects a big push ahead to build out the network of charging stations to address this. EKPC's Drake expects further growth in beneficial electrification programs as well. He observes that "the cost of renewables is becoming more competitive and the market is changing."

Reflections on the Experience

Carter views beneficial electrification, and developing the renewable energy arrangements to support it, as a "win, win, win" for the environment, the cooperative and, most of all, the end-use members. He sums it up, "What it all comes down to is our cooperative fulfilling its mandate by promoting economic development and building a sustainable community."

Case Study 2: Planning for Beneficial Electrification: Hoosier Energy Explores Consumer-Member Needs with Pilot Projects and Research

Cooperative Profile

Hoosier Energy Rural Electric Cooperative, Inc. (Hoosier Energy) is a generation and transmission cooperative (G&T) that provides wholesale power and transmission services to 18 member electric distribution co-ops in central and southern Indiana and southeastern Illinois. Hoosier Energy's energy supply portfolio includes coal, natural gas and renewable energy resources that deliver power through a nearly 1,700-mile transmission network. Total system peak demand is roughly 1,700 megawatts (MW). Collectively, this cooperative network operates and maintains more than 36,000 miles of distribution lines and provides electric service to nearly 300,000 meters, or about 686,000 people, across 59 Indiana and Illinois counties, as shown in Figure 2.1.

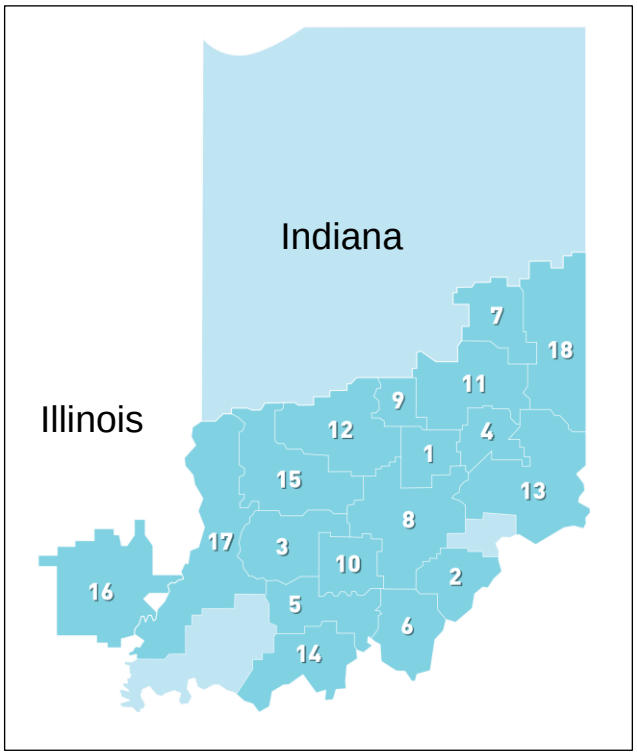

Figure 2.1: Hoosier Energy member cooperatives

1. Bartholomew County REMC
2. Clark County REMC
3. Daviess-Martin County REMC
4. Decatur County REMC
5. Dubois REC, Inc.
6. Harrison REMC
7. Henry County REMC
8. Jackson County REMC
9. Johnson County REMC
10. Orange County REMC
11. RushShelby Energy
12. South Central Indiana REMC
13. Southeastern Indiana REMC
14. Southern Indiana Power
15. Utilities District of Western Indiana REMC
16. Wayne-White Counties Electric Cooperative
17. WIN Energy REMC

Drivers of Hoosier Energy's Electrification Move

Electrification is not a new trend for Hoosier Energy. The G&T has been seeing increased interest in electric vehicles (EVs) and other emerging technologies for some time. Chief Technology Officer Bob Richhart predicts that emerging technologies will have far-ranging implications for the logistics, manufacturing and agribusiness industries and an even bigger impact on electric utilities themselves. In

Richhart's words, "Electric vehicles—from cars to semis—are becoming big disrupters. Combine that with technologies that promise large-scale, energy efficiencies for commercial operations and you have more than just game changers. You have a new electric utility model." To begin addressing the challenge, the G&T co-op in October 2019 teamed up with Indiana's other G&T cooperative Wabash Valley Power Alliance and the Beneficial Electrification League to sponsor *Electrify Indiana!*, a conference focused on beneficial electrification modes and technologies. The conference was attended by as many as 200 state and local leaders, representatives from member distribution co-ops and investor-owned utilities, the Indiana Utility Regulatory Commission (IURC) and other stakeholders.

Developments related to Hoosier Energy's power supply portfolio have also provided impetus for investigating the long-term value of beneficial electrification. The G&T's January 2020 *Long-Range Resource Plan* announced a significant shift in the co-op's generation mix going forward. The plan contemplates the retirement of the 1,000 MW coal-fired Merom generating station in 2023. Modeling of long-term resources in the plan projects that replacement resources will include a combination of natural gas, wind and solar resources both owned and PPAs. [6] With this fundamental shift, carbon emissions will decline materially and conversion of business and consumer end-uses from oil, natural gas and propane to electricity will produce a net beneficial effect on the environment.

Beneficial Electrification Trend

As noted above, the trend toward electrification is not new for consumer-members served by Hoosier Energy and its member co-ops. As Hoosier Energy's Integrated Resource Plan, which was submitted to the IURC in November 2020, indicates, electricity has been a favored energy source for some consumer end-use applications since 2009:

- An estimated 1,400 EVs or plug-in hybrid vehicles were owned in the combined service areas as of 2019.
- In the decades prior to 2008, 42 percent of new homes came with electric heat. Since then the share has risen to 55 percent.
- Use of electric heat pumps for air conditioning has increased from 12 percent in 2009 to 17 percent in 2019.

Planners at Hoosier Energy and its member co-ops are focused on managing this trend in ways that will realize the greatest possible benefits for consumer-members, their electric cooperatives and the environment. It is a carefully constructed approach, executed deliberately.

Organizing to Promote Beneficial Electrification

Since 2019's *Electrify Indiana!* Conference, Indiana electric cooperatives have organized for beneficial electrification on several levels. Hoosier Energy and its members formed a committee of distribution representatives to evaluate the cooperatives' role in bringing the benefits of emerging technologies to

[6] Power purchase agreement (PPA) is an arrangement for electricity supply from resources not owned by the utility.

their respective communities.[7] One aspect of the committee's work is looking into how beneficial electrification can be brought under the existing umbrella of energy efficiency programs. Blake Kleaving is leading this effort with the member cooperatives. He took over as Hoosier Energy's Manager of Energy Management Solutions in February 2020. The job used to carry the title of Marketing Manager.[8] Kleaving views networking with other electric cooperatives nationwide as a good way to identify best practices in beneficial electrification that can be applied in Indiana and Illinois. He leads the Hoosier Energy DSM Subcommittee whose mission is to collaborate with the member cooperatives to identify the changing needs and habits of their consumer-members. There is also an Emerging Technology Committee, headed by Doug Childs, CEO of the Utilities District of Western Indiana REMC, and Hoosier Energy's Richhart. Hoosier Energy and its members are leaning into the future and their organizational structure reflects this.

Program Development

Although Hoosier Energy and its member cooperatives are still in the early stages of launching full-scale, beneficial electrification programs, their carefully engineered approach relies on both research and direct experience. Ongoing research, networking exchanges with other electric cooperatives, use of NRECA resources and pilot test programs all contribute to raising the co-ops' level of understanding of issues and challenges so that larger scale programs that may lie ahead will be robust and low-risk. As Scott Bowers, Hoosier Energy's Vice President of Public Policy and Member Services says, "We are positioning ourselves to make smart investments and working shoulder-to-shoulder with our member cooperatives to ensure that there will be no surprises. The term I use to describe this process is 'constructive engagement.'"

Beneficial Electrification Programs Being Offered

Hoosier Energy and its member cooperatives currently offer consumer-members an array of beneficial electrification programs:

- EV charging pilot program (Residential Level 2 and Commercial Level 2 chargers).[9]
- FleetCarma EV charging locational pilot program to capture where EVs are being charged.[10]
- Electric lawn equipment incentive pilot program.
- Residential HVAC incentive pilot tied into existing energy efficiency programs.
- Horticultural new construction LED lighting research and incentive pilot program.

[7] "Leading a Clean Energy Transition in Indiana," Business Facilities Magazine, August 24, 2020. https://businessfacilities.com/2020/08/indiana-hoosier-energy-is-leading-a-clean-energy-transition/

[8] https://www.electric.coop/co-ops-staff-up-on-beneficial-electrification-to-meet-members-needs/

[9] https://chargehub.com/en/electric-car-charging-guide.html

[10] https://www.fleetcarma.com/smartcharge/

- Commercial, industrial and agricultural research into beneficial electrification.

A glimpse into two of these programs is provided below.

EV Charging Pilot

Hoosier Energy's team identified a strong need for EV charging stations in its member territories, both public and private, and this led to creation of the co-op's Cooperative Charge pilot program.

- Four EV charging solutions were evaluated using 10 criteria: differentiation; go-to-market; partners; investments; geographic reach; sales; portfolio; marketing; innovation; and staying power.[11] In the end, the team chose Enel X, which offers an established, smart EV charging system called JuiceBox, as shown in Figure 2.2.[12]
- Hoosier Energy has purchased 18 JuiceBox Pro commercial level 2 EV chargers, which allow for a quick charge and have two charging ports on each station, enabling simultaneous charging of multiple EVs.
- Hoosier Energy has also purchased 100 JuiceBox residential level 2 chargers. Each member co-op will receive five chargers and the remaining chargers will be available on a first-come, first-served basis. According to the co-op, these smart chargers will provide valuable information about patterns of use and the amount of energy consumed.

Figure 2.2:
Enel X's JuiceBox smart EV charging system.
Photo courtesy of Hoosier Energy

Agricultural and Horticultural Initiatives

Hoosier Energy's research into electrification opportunities in outdoor farming and indoor agriculture includes testing of LED technology as grow lights in southern Indiana greenhouses. Hemp is one of the state's agricultural growth markets. According to the Office of the Indiana State Chemist, Indiana licensed 130 hemp farmers in 2019, with roughly 5,300 acres of outdoor production and approximately 400,000 square feet of indoor production.[13] Should pilot projects show promising results, scaled-up programs would not only save farmers money, but would also spur economic development in key sectors of agriculture. The possibilities are almost limitless. Ten billion dollars' worth of agricultural

[11] https://www.hoosierenergy.com/energylines/charging-ahead/

[12] https://evcharging.enelx.com/products/juicebox

[13] https://hempindustrydaily.com/midwest-region-harvest-preview-indiana-hemp-farmers-focus-on-hemp-fiber/

products were sold in Indiana (2016 data) and Illinois led the country in total value of outbound agriculture shipments, with over $75 billion (2015 data).

Lessons Learned

Hoosier Energy's Bowers has a word of advice for his fellow electric cooperatives. "As far as beneficial electrification goes, electric cooperatives are the tip of the spear. We have to be nimble. We need to learn where our consumer-members' interests lie. We need to be smart, thoughtful and pragmatic. We may not get it right every time. That's why pilot programs are important. They tell us whether a program is likely to gain traction and how to maximize the beneficial impacts. Our approach at Hoosier Energy is to experiment and explore." Wise advice indeed.

Case Study 3: Beneficial Electrification, Innovative Rates and Renewables: Lake Region Electric Cooperative Manages Loads to Reduce Costs

Cooperative Profile

Lake Region Electric Cooperative (LREC) is a distribution co-op serving more than 28,000 member accounts across a 3,200 square-mile area in west central Minnesota (as shown in Figure 3.1). LREC operates and maintains 5,800 miles of distribution lines and receives its power from Great River Energy (GRE), a generation and transmission cooperative whose generation mix will be almost 95 percent carbon-free and very low cost by 2023. With its portfolio of innovative programs and pilot technology applications, LREC is a forward-looking utility and a bellwether among electric cooperatives.

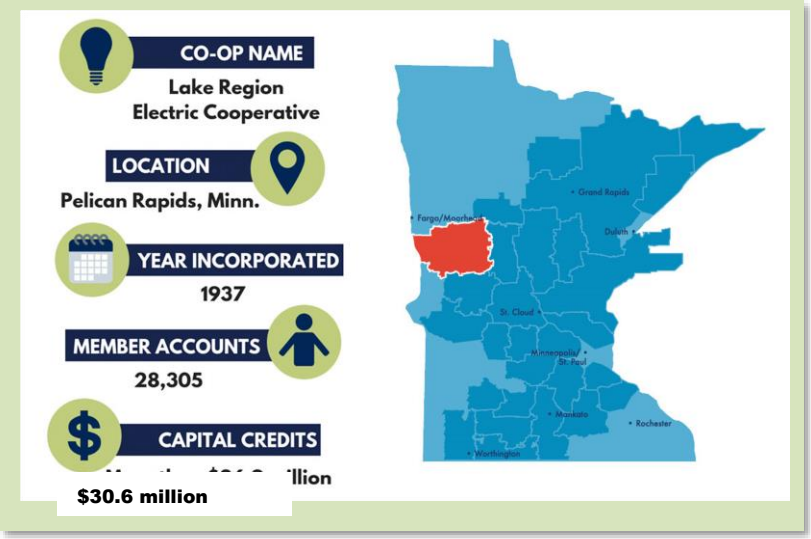

Figure 3.1: Overview of Lake Region Electric Cooperative.
Image courtesy of Great River Energy

Impetus for Beneficial Electrification

The drivers behind LREC's efforts toward greater electrification came from multiple sources. First and foremost, the co-op takes very seriously its responsibility to provide value to its members, many of whom have expressed strong and substantial support for electrification when it is backed up by renewable resources. This is an evolutionary situation. LREC has operated a Conservation Improvement Program (CIP) as required under Minnesota law since 2007.[14] CIP is a program that has successfully reduced the need for new power plants by limiting overall electricity usage and peak

[14] https://www.lrec.coop/your-co-op/news-events/news/modernizing-cip-promote-efficient-and-affordable-energy

demands in households and businesses with the help of rebates and other incentives that encourage conservation. Investments in high-efficiency appliances and machines have been among the measures promoted. However, the programs previously targeted reductions in electricity usage and often overlooked potential opportunities for greater efficiency and improved environmental performance where end-uses could be converted from fossil fuels to electricity, thereby increasing electric load. The current trend toward electric vehicles (EVs) is the most obvious example.

A major change in where LREC's power comes from has also pushed LREC toward greater electrification. In May of 2020, LREC's power supplier GRE announced plans to close its 1,151 megawatt (MW) coal-fired generating station at Coal Creek in late 2022, repower a smaller coal plant to run on natural gas and add 1,100 MW of wind generation capacity through power purchase agreements (PPAs) by late 2023. These are consequential changes. Coal Creek station is one of the largest power plants in the upper Midwest. When the transition is complete, GRE's power supply portfolio will be more than 95 percent carbon dioxide-free.[15] The transformation to a cleaner power supply mix gives LREC and other GRE members the opportunity to promote electrified end-use technologies that lower cost and benefit the environment.

Beneficial Electrification Programs

LREC currently offers several beneficial electrification programs:

- **ChargeWise EV program.** Members are eligible to receive an EV charger installation rebate if they agree to charge under one of two specially designed rates: an off-peak electric storage rate or a time-of-use rate, as illustrated in Figure 3.2. The program is currently limited to Level 2 in-home chargers. To add further value, GRE currently offers consumer-members participating in this program a free wind energy upgrade.

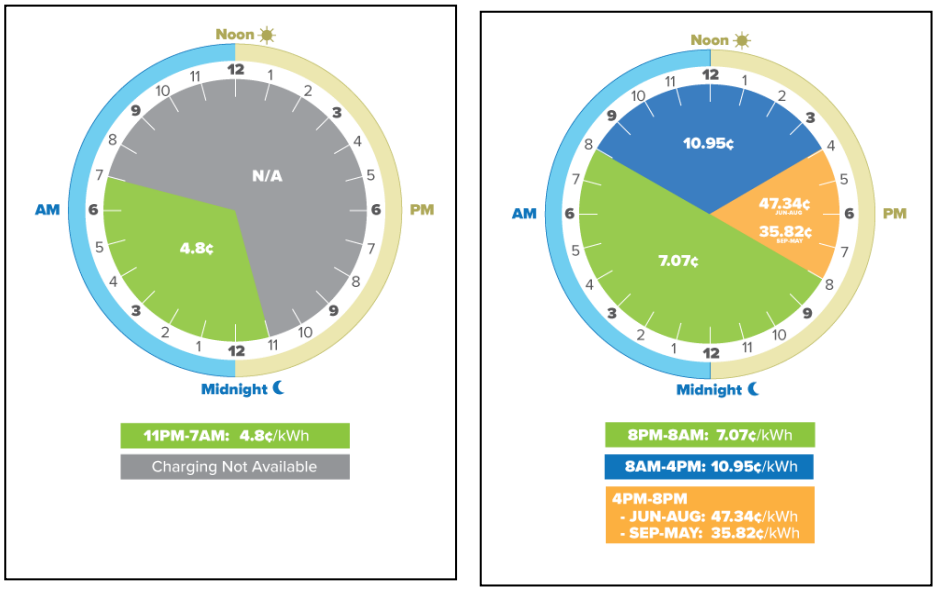

Figure 3.2:
LREC's off-peak EV charging rate (left) and time-of-use rate (right).

[15] https://www.electric.coop/great-river-energy-announces-transition-to-wind-market-power/

- **Grid-interactive ETS water heater pilot program.** One of the most promising technologies being tested by LREC involves what are called "grid-interactive electric thermal storage (ETS or GETS) water heaters."[16] ETS water heaters use off-peak energy and store the hot water for use during on-peak times of the day. The co-op launched a pilot program in 2019 to test the ability of ETS water heaters to optimize its utilization of renewable energy production from a local wind-solar hybrid project. According to Dan Husted, LREC's Vice President of Business Development, "We're building a wind-based renewable energy infrastructure so we need to encourage end-uses that can take advantage of intermittent power supply." The co-op's pilot program relies on the interconnection of a wind and solar hybrid project to a distribution feeder supplied by its rural Erhard substation. Dedicating a hybridized renewable supply source to a single feeder on which an innovative end-use technology is being tested is a novel and highly advanced approach.[17] The complexity associated with operating and evaluating such a pilot test is made clear by the 24-hour electricity supply vs. demand graphic in Figure 3.3.

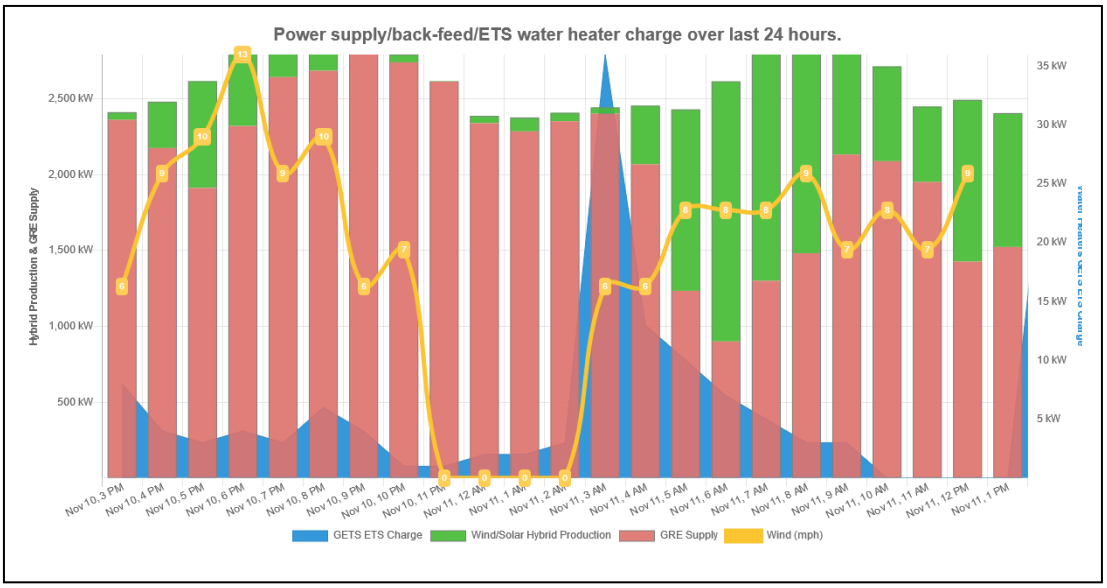

Figure 3.3: Twenty-four hours of supply and demand in the life of LREC's grid-interactive ETS water heater pilot program utilizing a wind and solar hybrid project.

- **Air-source heat pump (ASHP) promotion.** LREC offers residential energy efficiency rebates for installation of high-efficiency ASHP heating and cooling systems as well as water heaters. Rebates can be as high as $1,500. This program is offered throughout GRE member service territories.

[16] The pilot project relies on Grid–Interactive Electric Thermal Storage (GETS) storage water heaters from North Dakota-based Steffes.

[17] "Using Grid Interactive ETS Water Heaters to Optimize Local Utilization of Wind Solar Hybrid Production and Shape Load Curve (A Beneficial Electrification Pilot)," a fact sheet available from Lake Region Electric Cooperative.

- **On-bill financing of qualifying electric appliances and systems.** LREC offers its members *EASY-PAY* on-bill financing of any product the co-op sells, including high-efficiency water heaters, standby generators and high-efficiency heat pumps.[18]

Outlook for Beneficial Electrification

Husted sees beneficial electrification as a growth opportunity and focus for utility investment over the next five to ten years. "With rebates for converting equipment and processes to electricity, attractive rates and on-bill financing, why wouldn't our members take advantage of this?" He adds that in Minnesota there is broad support for beneficial electrification from the electric utility industry, state government and nongovernmental agencies. Most view a shift toward electricity as a natural fit with increasingly prevalent renewable energy resources. Nevertheless, he sees challenges ahead in the selection of, and investment in, the most appropriate and cost-effective demand-response technologies and the high-speed communications infrastructure necessary to support them, citing legacy communications systems still in place at many electric cooperatives. As Husted points out, continuing energy efficiency and demand management efforts are essential for electrification to be accomplished in a way that lowers members' costs.

Lessons Learned

LREC's multi-faceted approach to managing loads to take full advantage of GRE's rapidly greening power supply — relying on energy efficiency, beneficial electrification and innovative rate structures — is a highly advanced experiment. By focusing its pilot project on a site-specific, solar and wind hybrid generation resource and a single feeder on which advanced technologies (GETS water heaters) are being tested, the co-op has created a new utility supply and demand model on a test scale. A distributed energy resource is married to an advanced end-use technology, creating a new variant on the microgrid concept. With this model LREC is examining a future in which electricity supply resources are dynamic and intermittent and demand patterns must be trained to work with them. As such, this co-op's pilot project results should be of significant interest throughout the utility industry.

[18] https://energynews.us/2019/10/24/midwest/minnesota-co-ops-tap-on-bill-financing-to-help-shift-consumption-overnight/

Case Study 4: Beneficial Electrification and Sustainable Technology Solutions for North Carolina

Cooperative Profile

North Carolina's 26 electric distribution cooperatives collectively serve 2.5 million people at 1 million metering points across the state. This network of cooperatives serves consumer-members in 93 of the state's 100 counties, operating distribution grids that cover approximately 45 percent of the state (see Figure 4.1). The state's generation and transmission cooperative, North Carolina Electric Membership Corporation (NCEMC), supplies wholesale power to 25 co-ops in this network, meeting a total peak demand between 3,500 and 4,000 megawatts (MW).

Together, NCEMC and its member cooperatives are working towards two important sustainability goals, recently announced through their shared *Brighter Future* initiative:

- 50 percent reduction in carbon emissions from 2005 levels by 2030.
- Net-zero carbon emissions by 2050.

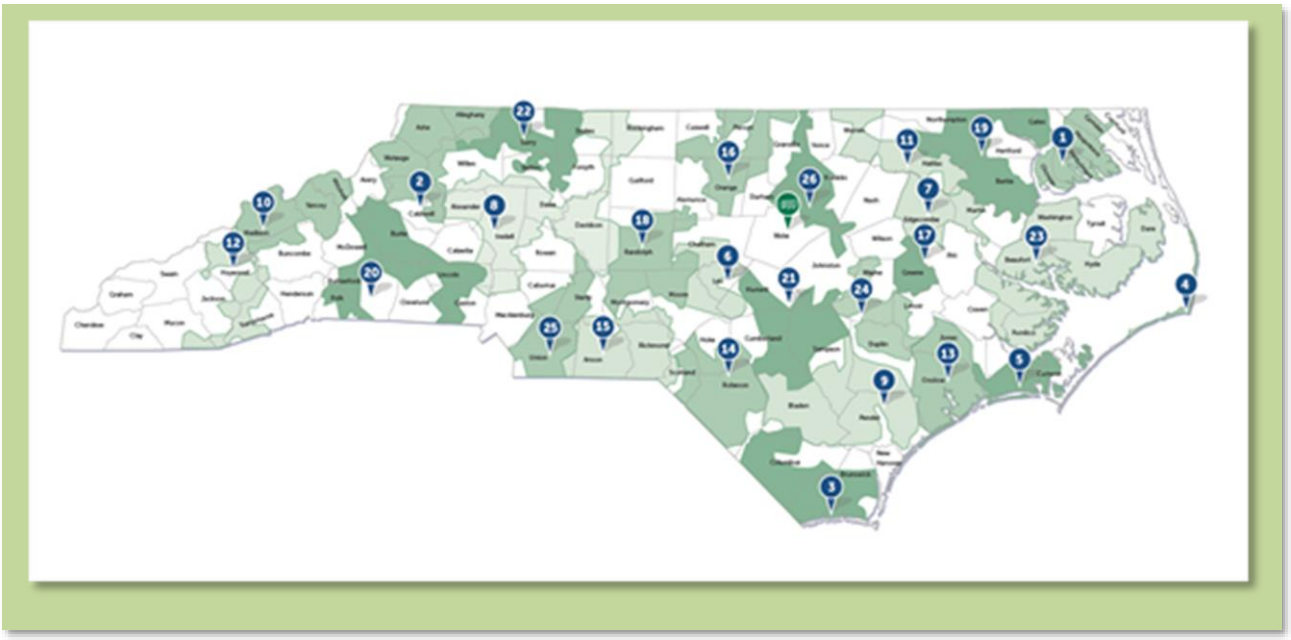

Figure 4.1: North Carolina's electric cooperatives

For further details, visit:
https://ncelectriccooperativesaction.com/aboutus/

Drivers of Electrification in North Carolina

According to Diane Huis, NCEMC's Senior Vice President of Innovation and Business Development, beneficial electrification is a key component of *Brighter Future*, which aims to achieve sustainability goals while upholding a commitment to reliable and affordable electricity. Specifically, beneficial electrification has the potential to:

- Reduce carbon emissions across all energy sectors
- Lower costs to consumers by increasing utilization of the grid.
- Provide choices for convenience and control to consumer-members, including commercial and industrial businesses with environmental sustainability goals.
- Support clean energy legislation.
- Create economic development opportunities for rural communities.

Huis notes that North Carolina's electric cooperatives see beneficial electrification as an economic development opportunity and have brought in an NRECA trainer to deliver key accounts training with beneficial electrification specifically in mind. The technologies NCEMC and its member cooperatives currently promote improve business productivity and reduce carbon emissions. Beneficial electrification beyond electric vehicles emerged as an area of interest for North Carolina's electric cooperative when the Electric Power Research Institute (EPRI) released its April, 2018 U.S. National Electrification Assessment.[19] Following that report, EPRI provided a North Carolina-specific Electrification Assessment, which revealed that significant electric load growth in the state could only occur through the electrification of transportation and industrial processes. The impact of electrifying these processes is made even greater because of NCEMC's existing, low-carbon portfolio, which comprises more than 50 percent emissions-free nuclear energy.

Program Development

NCEMC turned to the consulting firm ICF to build on EPRI's research to help develop beneficial electrification programs its members could implement.[20] The investigation relied on analysis of a large volume of data to determine where conversion to electricity makes most sense and what end-use technologies offer opportunities for improved productivity, better environmental performance and lower cost. Many questions were posed. Can ultraviolet light be used in place of chlorinated water in cleansing processes? Can infrared heating be used for agricultural harvest drying? Where should electric pumps be deployed to improve efficiency and lower costs for irrigation systems and swine lagoon pumping? The analysis is providing North Carolina co-op employees with a better understanding of potential

[19] https://www.epri.com/research/products/000000003002013582

[20] https://www.icf.com/insights/energy/implementing-beneficial-electrification-programs

electrification opportunities and is equipping them with tools and resources to engage members in a greater understanding of costs, savings and other benefits.

Beneficial Electrification Programs Offered

NCEMC and its network of member cooperatives offer an array of electrification programs:

- For residential consumer-members, programs focus mainly on electric vehicles (EVs) with educational materials to promote greater awareness and provision of EV charging infrastructure. The team built a website, www.ncdriveelectric.com, with a designated page for each member cooperative. It is target-marketed to cooperative consumer-members to help them understand the benefits of driving electric. Electric vehicle charging infrastructure includes a residential charging program and installation of destination chargers that include Level 2 and DC fast chargers.[21]

- For commercial and industrial (C&I) accounts, a program called "BEST Solutions" is offered, with BEST being short for Beneficial Electrification and Sustainable Technologies. Agriculture is North Carolina's top industry with many pork and poultry farms and processing facilities, so it became a natural focus for beneficial electrification. Programs are aimed at conversion of diesel-fueled end-uses such as irrigation to electricity, as well as electricity used in place of chemicals in certain food-industry processes. Equipment such as electric forklifts is also a focus.[22] Advanced Energy, a nonprofit energy firm in NC, was a key asset in program development.

Huis points out that BEST Solutions was created to meet the needs of C&I, agricultural, and other members facing pressures in the supply chain to be cost competitive, and to meet sustainability goals and mandates. She emphasizes that the program is structured to create an opportunity for distribution cooperatives to partner with their C&I members to meet these business goals, emphasizing the cooperative's role as trusted energy partner. "BEST will provide sustainable energy options through renewable power solutions and actionable information on converting from fossil fuel technologies to electric technologies," Huis says. "The program's integrated approach will bring key partners and vendors into the discussion, along with the common tools that will help us all drive greater value and innovation to C&I members."

Innovations with End-use Technology

North Carolina electric cooperatives provide online fact sheets to their member businesses that enable them to make more effective technology choices. These fact sheets highlight the cost, efficiency, flexibility, emissions, quietness, and safety benefits of converting from propane, diesel fuel or natural gas to electricity. Potential barriers to beneficial electrification are also identified. End-use technologies discussed in the fact sheets include the following:

[21] https://chargehub.com/en/electric-car-charging-guide.html

[22] https://www.ncelectriccooperatives.com/best-solutions/beneficial-electrification/

- **Electric forklifts** — while electric forklifts are slightly higher in upfront cost compared to propane-powered forklifts, annual fueling and maintenance costs are significantly lower, leading to better economic performance over the equipment's lifetime (see Figure 4.2).

Figure 4.2:
Electric forklift.
Photo courtesy of North Carolina Electric Cooperatives.

- **Electric irrigation pumps** — agricultural pumps are widely used for cultivating crops, raising livestock, improving land utilization and revegetating disturbed soils. As such they are a major energy consideration across North Carolina. Electric motor-driven pumps have been replacing diesel pumps over the past two decades due to their increased efficiency, lower operating costs and better reliability. The annual maintenance cost of a 75-horsepower electric pump is as much as 90 percent lower than its diesel counterpart. Table 4.1 illustrates a sample cost comparison.

Cost Comparison

	Electric Pump*	Diesel Pump
Rated Output (HP)	75	75
Operating Efficiency	94.5%	25%
Input Power (equivalent kW at rated output)	59.2	237
Hourly Operating Cost	$4.74 per hour (at $0.08 per kWh)	$13.74 per hour (at $3.00 per gallon)
Estimated Annual Run Hours	750	750
Estimated Annual Maintenance Cost	$25	$250

**Similar results for single-phase BELLE™ Written-Pole® or conventional three-phase electric motor. This table is an example only, with data adapted from Single Phase Power Solutions, LLC. For actual projects, official equipment quotes from relevant vendors must be obtained to determine payback.*

Table 4.1: Sample cost comparison - electric vs. diesel pump.
Courtesy of North Carolina Electric Cooperatives.

- **Electric transport refrigeration units (TRUs)** — TRUs are mobile refrigeration systems that preserve perishable goods during transport and storage. Products that require TRUs include meat and other foods, pharmaceuticals and cosmetics, plants and flowers and certain types of delicate furniture and equipment. A shift is underway from diesel internal combustion engines to hybrid diesel/electric refrigeration units which use electricity to power the unit when it is not in motion. Upfront costs are higher but are largely offset by fuel savings and lower maintenance costs, so the lifetime cost is lower.

Challenges to Continuing Success

Huis sees beneficial electrification as a program with a major positive impact over the next few years and a potentially historic opportunity over the longer term, likely to attract increasing levels of public and private investment. However, progress will be slow unless some barriers can be overcome. Current North Carolina law, for example, could be amended to streamline, and thus expedite, the process by which co-ops move from program conceptualization to implementation. Huis also sees some risk that beneficial electrification could be forced to happen too quickly. “A well-informed and balanced approach needs to be taken,” she says. “Our beneficial electrification team, including people from both NCEMC and our member cooperatives, is acutely aware that the devil’s in the details. We don’t want to promote new uses for electricity that will bump customers demand charges to the point that they are unhappy with their co-op or eliminate the cost savings from the new technology for the member. Rate restructuring has to go hand-in-hand with electrification for this to work as intended.” She notes that line extension policies may also need to be revisited as agricultural customers seek to electrify irrigation pumps.

Lessons Learned

With these electrification programs in place, North Carolina’s electric cooperatives are poised to help inform others in the electric utility industry about the opportunities and risks associated with beneficial electrification. They have learned that many factors play into electrification, including regulatory policies. Some of these factors are in fact prerequisites for successful programs, becoming barriers if they are not addressed proactively. Huis puts it well when she says “This is a marathon, not a sprint, and it takes a lot of training to get ready to race. Educating members now so that they are willing to look at new technologies when they are ready to replace equipment is really important.”

Case Study 5: Orcas Power & Light Cooperative Uses On-Bill Financing and Rebates to Facilitate Beneficial Electrification

Cooperative Profile

Orcas Power & Light Cooperative (OPALCO) is a member-owned, nonprofit cooperative that distributes electricity across 1,200 miles of electric lines to more than 11,000 homes and businesses located on twenty islands off the northwestern coast of Washington (see Figure 5.1). The co-op's power, which is delivered to its unusual service territory by submarine cables, comes mainly from hydro-electric plants operated by Bonneville Power Administration (BPA). BPA's fuel mix is 93 percent greenhouse-gas-free, making it ideal for the beneficial electrification of heating and transportation. However, many utilities in the Pacific Northwest appear intent upon exercising their rights to federal power resources such as BPA. With this in mind, OPALCO is transitioning toward a portfolio of appropriate renewable power that includes new local and regional sources. In the words of General Manager Foster Hildreth, "OPALCO's beneficial electrification program helps our members save money and reduce their carbon emissions."

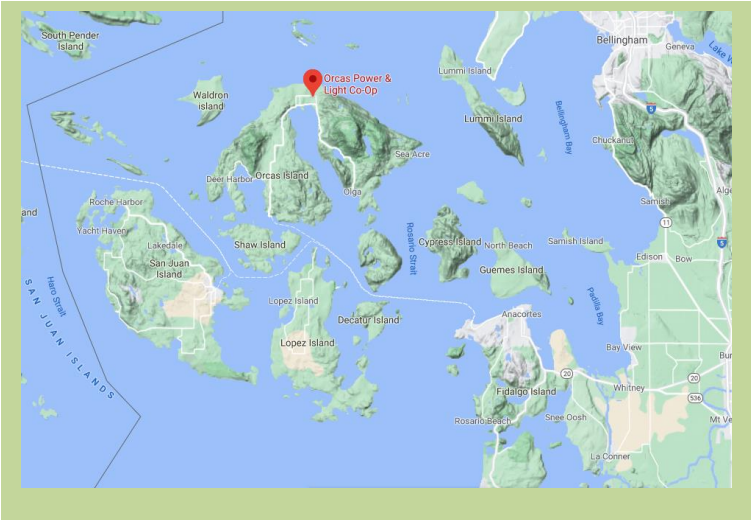

Figure 5.1: OPALCO service area, San Juan County, WA. Map from Google

Driving Factors

OPALCO's move toward promoting beneficial electrification as a strategy embodies several underlying factors and drivers:

- Saving cooperative members money by lowering their total energy budget, not just their electric bills. The co-op sees the 'low-hanging fruit' to be electrification of heating and transportation loads, which accounts for over 80 percent of a typical homes electric and fossil

fuel energy use (see Figure 5.2).[23] OPALCO encourages its members to save on their total energy bill by switching away from gasoline, propane and inefficient baseboard heating. OPALCO estimates that switching to a ductless heat pump can save a member $800 per year and switching to a clean and quiet electric vehicle can save up to $1,000 per year.

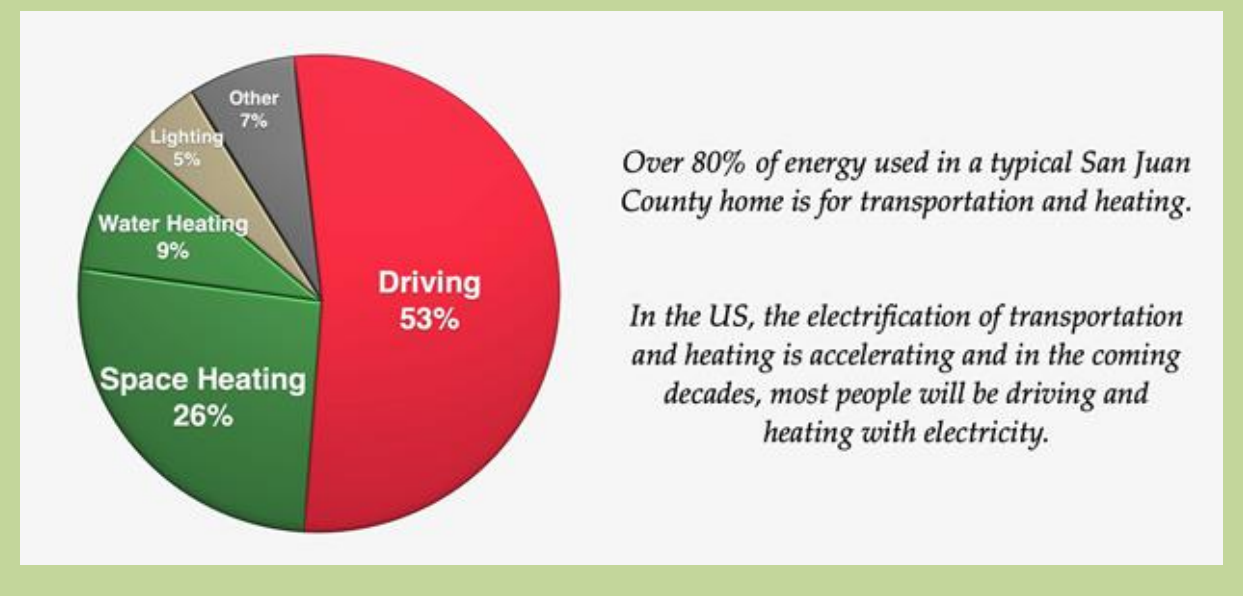

Figure 5.2: Average San Juan County Residential Primary Energy Use.
Image provided by OPALCO. Underlying data from Buildings Energy Data Book, US Department of Energy, US Department of Transportation and OPALCO.

- Taking further actions to reduce emissions into the atmosphere and de-carbonize the economy as carbon legislation in the region imposes new mandates and deadlines.
- Recognizing that the nationwide power grid is going through a transformative period of upgrading to accommodate renewable generation sources and dramatically reduce carbon-based fuels, with trillions of dollars needing to be invested.
- Understanding that renewable energy resources are approaching cost parity with conventional generation types, making electricity a more economical choice. In OPALCO's view, the more the co-op prepares its members for this transition, the better the remote, rural communities it serves will fare.

Financial reality is also at play here. Beneficial electrification enables slow-growth electric cooperatives such as OPALCO to maintain affordable rates by adding load that can be efficiently served. Hildreth succinctly summarizes, "Beneficial electrification is here to stay and our membership loves it. As we make the shift away from fossil fuels, our members depend on OPALCO to provide the tools and resources they need to get ready for a clean, sustainable and reliable energy future. We are being proactive."

[23] Detailed energy usage and economic information can be found at: https://www.opalco.com/wp-content/uploads/2017/07/Insights-Energy-Services-How-to-Reduce-Your-TOTAL-Energy-Bill.pdf

Beneficial Electrification Programs

OPALCO offers two primary programs to reward and encourage beneficial electrification by its members. The first, *Switch it Up!*, is an on-bill financing program funded by the Rural Energy Savings Program (RESP) of the U.S. Department of Agriculture (USDA) Rural Utilities Service (RUS).[24] RESP provides rural electric cooperatives and other rural utilities with zero-percent loans to launch or expand energy-efficiency financing programs for their members. The infusion of capital from RESP has enabled OPALCO to accelerate beneficial electrification, underwriting co-op members' investments. The second is a program self-funded by OPALCO that provides rebates for ductless heat pumps and electric vehicle (EV) chargers, among other appliances and equipment. Members who use RESP funding under *Switch it Up!* to install a ductless heat pump while converting to electricity can take advantage of both programs.

Figure 5.3 provides examples of some of the opportunities OPALCO provides its members.

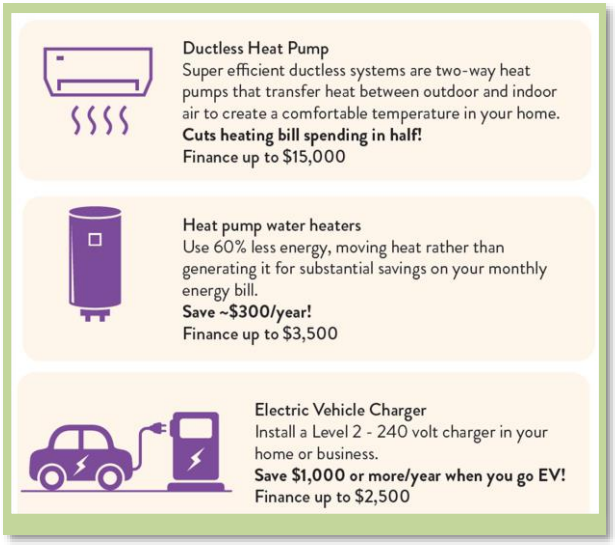

Figure 5.3: Beneficial electrification opportunities highlighted in OPALCO's *Switch it Up!* program marketing materials

Switch it Up! Program

This program offers OPALCO members on-bill financing at a 2 percent interest rate. Adding 2 percent to the zero percent capital provided by RESP enables the co-op to cover administrative costs and thereby avoid cross-subsidization by other ratepayers. The *Switch it Up!* program offers financing for ductless heat pumps, heat pump water heaters, EV chargers and, thanks to a recent change, fiber-to-the-home (FTTH) when paired with an energy-saving measure or device.[25] As of late 2020, the co-op had completed 145 beneficial electrification/energy efficiency projects with another 36 in the pipeline for a total investment of $1.3 million.

[24] The program is capitalized by a $5.8 million zero-interest loan from RESP. This initial capital was supplemented with a second RESP loan for $15 million in 2019. https://www.eesi.org/obf/case-study/OPALCO

[25] OPALCO subsidiary Rock Island Communications provides the FTTH high-speed Internet service.

Energy Efficiency Rebate Program

OPALCO's rebate program, mentioned earlier, covers a portfolio of energy efficient and end-device energy conversion opportunities, including a limited number of rebates for the following purchases (shown with rebate amounts):

- Advanced power strips ($25-40).
- ENERGY STAR-qualified clothes washing machines ($30).
- Ductless heat pumps ($800).
- Performance Tested Comfort Systems (PTCS) ducted heat pumps ($700-1600).
- Level 2 EV charging stations (up to $500).
- ENERGY STAR-qualified clothes dryers ($50).
- Fuel switching to electric heat.
- General electric efficiency measures.
- Heat pump water heaters ($300-600).
- Insulation and energy-efficient windows and doors.

The list illustrates the convergence between OPALCO's longstanding energy efficiency program (targeting reduced kilowatt-hours, kWh) and its more recent beneficial electrification program (targeting kWh additions with high electrical efficiency). Similar lists are likely to be seen on electric cooperative web pages across the country within a few years.

Potential Challenges Ahead

While Hildreth sees beneficial electrification as an historic opportunity, he also perceives a possible threat to its success coming from resource inadequacies in the Pacific Northwest. "As more coal plants are closed, our region needs flexible resources to firm up the intermittent resources — on days when the sun isn't shining or the wind stops blowing." He adds that battery technology has developed to the point where it can firm up such intermittent resources for hours, but not days. "As consumers move away from gasoline and carbon-based fuels in favor of electricity, our grid needs to have even more capacity and become even more reliable, not less. EVs alone could add 30 percent to load growth." He continues, "The cost – and timeline – to develop renewable resources and upgrade aging infrastructure – including major transmission lines – is a heavy lift. During the transition, blackouts and power supply issues could hurt confidence in electrification." He notes that an advanced metering infrastructure is a prerequisite for meeting both member expectations under this new utility business model, as well as for complying with some legislative mandates.

What is Unique About OPALCO's Experience?

OPALCO's Hildreth believes that his cooperative has done something unique in setting up a tariff-based solution instead of a loan program for its members to take advantage of efficiency-related electrification opportunities. He has given it a lot of thought, "Being a lender is different than being a utility. As a lender, you become subject to a number of bureaucratic regulations and laws such as Truth in Lending. Our tariff-based approach avoids this and each project is recorded with the deed so it goes with the house. Another reason our members are better off with no third-party lending institution involved. Financing rates would be higher under that model, perhaps as much as double the two percent we currently apply." Unique is indeed a fair descriptor for what OPALCO's program represents. This cooperative's approach, which closely integrates energy efficiency and end-use electrification measures, has kept electrification costs out of rates and overcome access to capital limitations through its use of RESP funding. It is a sensible approach that has already gained wide acceptance among OPALCO's members and one worth consideration by other electric cooperatives.

Case Study 6: Beneficial Electrification: Integral Part of Tri-State G&T Association's Responsible Energy Plan

Cooperative Profile

Tri-State Generation and Transmission Association (Tri-State) is one of the largest G&T cooperatives in the United States, with 42 utility distribution cooperative and public power district members and three non-members served by 5,665 miles of transmission lines in Colorado, New Mexico, Nebraska and Wyoming. Tri-State's utility members deliver the electricity to more than one million consumer-members in an area covering nearly 200,000 square miles as shown in Figure 6.1. Overall system peak demand topped 3,000 megawatts (MW) in 2019.

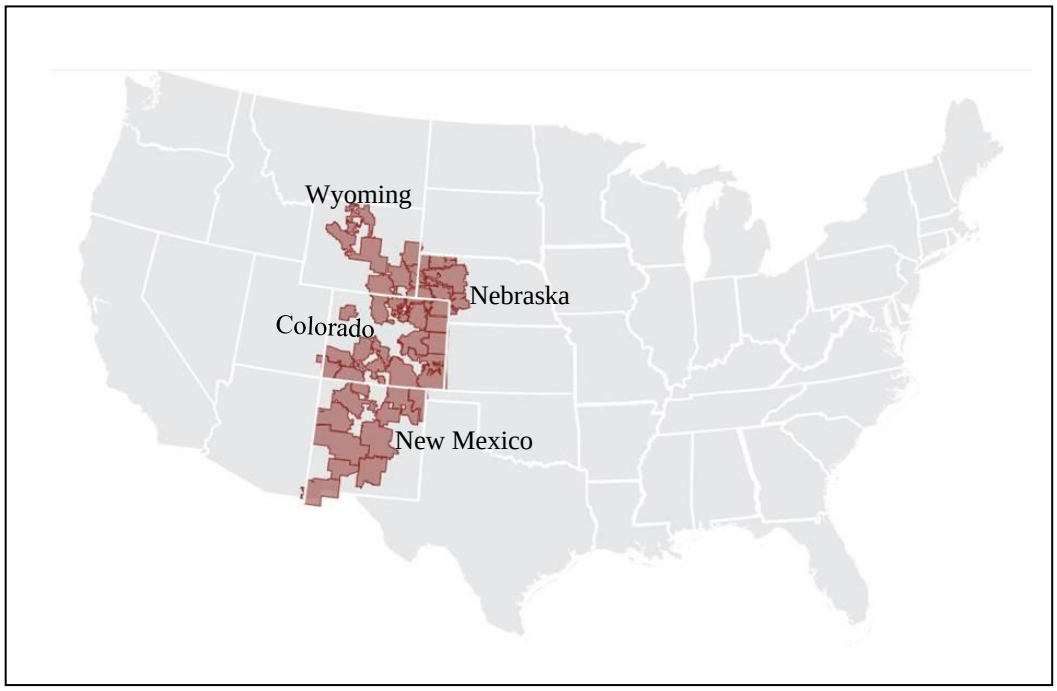

Figure 6.1: Areas served by Tri-State member cooperatives.
Map courtesy of Tri-State

Adoption of Beneficial Electrification by Tri-State

As Tri-State worked on developing its Responsible Energy Plan (REP) in 2019, it expanded its planned areas of emphasis to serve changing member needs. Tri-State had been pursuing energy efficiency programs with its member systems for many years and beneficial electrification seemed a natural extension. While each of the four states in which Tri-State members operate has different policy goals and regulatory frameworks, a strong signal was emanating from member systems. In July 2019, the G&T's member CEOs came to Tri-State with an idea—that electrification could help them realize

flexible load growth opportunities such as electric vehicle (EV) charging. The benefits would include more efficient use of generating resources, reduced costs and lower emissions. And with plans to phase out coal-burning generation in Colorado and New Mexico, electrification was seen as an opportunity to deliver the benefits of cleaner power to the consumer level. In fact, the G&T expects that by 2024 more than 50 percent of energy consumed by its members will have come from renewable energy resources. According to Matt Fitzgibbon, who moved into the newly created position of Beneficial Electrification Manager in 2019, Tri-State managers ultimately asked themselves, "Who are we here to serve?" The answer? "Our mission is to create value for our member systems." Beneficial electrification became an integral part of the 2020 REP, as shown in Figure 6.2.

Figure 6.2: Highlights of Tri-State's 2020 Responsible Energy Plan. Graphic courtesy of Tri-State.

Inclusion of beneficial electrification in Tri-State's REP in early 2020 was accompanied by a powerful statement of intent:

> *"Over the past year, we've set goals to reduce greenhouse gas emissions associated with wholesale electricity sales in Colorado by 80 percent by 2030, and to reduce wholesale rates to our members by at least 8 percent by the end of 2023. With our members, we've developed new options for member flexibility to support local renewable energy development and energy self-supply. And we're just getting started. We have a vision for the future in which the benefits of an economy-wide energy transition – from cleaner air to economic opportunity to a greener grid – are shared with everyone. Our plan will continue to evolve to make our vision a reality. We can achieve an energy transition that allows us to be responsible to our members, our communities, our employees and our environment."*[26]

[26] For more information, visit https://www.tristategt.org/responsible-energy-plan.

In October 2019, Tri-State joined the national Beneficial Electrification League (BEL), NRECA, Natural Resources Defense Council and others in establishing BEL's first state chapter, whose mission is to advance beneficial electrification in Colorado. Additional participants include the Colorado Energy Office, the Colorado Rural Electric Association and the Southwest Energy Efficiency Project. Beneficial electrification was off and running on Tri-State's home turf.

Beneficial Electrification Programs

EV charging incentives and support are at the heart of Tri-State's beneficial electrification initiatives. Nearly $2 million has been committed to extend the EV charging infrastructure throughout members' service areas with $45,000 allocated to each member system to promote EVs and EV solutions in rural areas. Moreover, the impact of beneficial electrification coupled with energy efficiency and demand-side management is being studied by BEL of Colorado. Member systems interested in promoting beneficial electrification can choose from Tri-State's suite of programs and set their own rebate levels to reflect local requirements. They can draw on the following beneficial electrification programs:

- Rebates to install EV charging stations, from Level 2 to fast-charging stations. Some member systems are setting up in-home charging programs.
- EV educational programs that inform consumer-members about EV performance benefits, driving range and recharging time, among other things. Some distribution systems offer an online savings calculator and walk-through of the process of selecting, purchasing and operating an EV.
- Incentives for purchases of outdoor electric power equipment such as lawn mowers, weed eaters, and pressure washers. Electric forklifts are also covered.
- Rebates for conversion from propane and natural gas heating systems to air-source or ground-source heat pumps and for conversion to air-source water heaters.

One challenge that Tri-State and its members face is countering misperceptions in the marketplace about the effectiveness of heat pumps in a cold climate. Fitzgibbon says that consumer-members provide feedback that contractors they have approached tell them "heat pumps don't work here." To disprove this, Tri-State has installed five cold-climate heat pumps as a test project. Going further, the G&T is rolling out a training program for contractors in the region and plans to offer a $250 per installation contractor incentive.

Fitzgibbon notes that promoting EVs can be fun. In one particularly popular program, Tri-State and its members hosted ride-and-drive events that allowed consumer-members to drive EV test cars and get the feel of the road, "boots-on-the-ground" experience as Fitzgibbon calls it.

Tri-State owns a pair of Tesla Model 3 EVs, a Model Y, a Chevrolet Bolt and a Chrysler Pacifica plug-in hybrid for drive-testing. Fitzgibbon says more than a thousand consumers have taken part so far.

Beneficial electrification in the words of Loren Howard,
CEO of Tri-State Member
San Luis Valley Rural Electric Cooperative (REC)

"In the last year or so, the term "beneficial electrification" has become an ever-increasing, popular phrase. It seems to me that various interest groups have their own interpretation of the meaning of the phrase. So, let's explore the various interpretations and see if there is a consensus to be found.

Starting with an easy topic – electric vehicles. Promotion and acceptance of electric vehicles seems to have an awkward start. Driving around metro areas like Denver and Colorado Springs, spotting an electric vehicle is a regular occurrence. That is not quite so true here in the San Luis Valley. Electric vehicles have the potential to significantly reduce air emissions which would seem to fit the idea of beneficial electrification. Driving through Denver on a weekday with a temperature inversion makes it easy to see the benefit of reducing automobile emissions.

There are some groups who would say that this beneficial electrification is only beneficial if the electricity to charge the vehicle comes from a renewable resource such as solar or wind. Renewable electric generation has come a long way and represents a significant fraction of electric generation of most utilities including Tri-State and REC. At least a reasonable portion of electric generation used to recharge electric vehicles is coming from renewable sources. Another, more recent development that is being suggested as beneficial electrification by some governmental entities in particular is considering reducing, and maybe prohibiting, using natural gas or propane for domestic use in new construction. This would then push future domestic energy use to electricity. The Colorado Public Utilities Commission currently has a proceeding entitled "Investigation Into Retail Natural Gas for GHG Emissions," Proceeding Number: 20M-0439G. This investigation will look into how domestic natural gas usage is impacting greenhouse gas emissions. Cities in California have already banned domestic use of natural gas in new construction.
Electricity is an easily distributed energy source, generated in many different ways. Will it pervasively replace fossil fuels used in our everyday lives? Will fuels such as natural gas, gasoline, diesel and propane ultimately be phased out? I think one of the key developments needed to do that will be finding an electric generation source that is of utility scale and controllable to support the uncontrollable renewable generation sources. No doubt, there are other interpretations of the term "beneficial electrification," but a common theme in all the definitions would be replacing fossil fuels with electricity."

For further information, visit: https://www.slvrec.com/beneficial-electrification-loren-howard-0

Program Delivery and Marketing

With a current-year budget of $3.5 million for energy efficiency and beneficial electrification, Tri-State appreciates that its programs must be carefully designed and marketed to reach the level of impact anticipated in its 2020 REP and realize value for members. One of the most important aspects of this is to ensure that low- and moderate-income consumers have equal access to the opportunities. To facilitate this greater access and to ensure that the technologies being targeted are adequately represented in the marketplace, Tri-State is involving manufacturers, installers, regulators and end-use consumers directly in the discussions it has with its member systems. Meetings have even been held with large corporate customers to evaluate the possibility of converting to 100 percent electric processes. For Fitzgibbon, a key question is "How do we talk about beneficial electrification?" His recently reconstituted department recognizes that energy efficiency, demand-side management and beneficial electrification must go hand-in-hand. "This is not new to our industry," he says. "What's new are the expanded benefits. The generation mix is cleaner and electrification can help us create downward pressure on rates. We need to deliver these benefits to members in a carefully considered way."

Lessons Learned

Tri-State's experience indicates that beneficial electrification is likely to become a strategic contributor in future plans that save consumer-members money while lowering emissions and optimizing the use of available energy resources. Its Responsible Energy Plan contains a suite of tools that will make these outcomes possible, if not likely. And with its emphasis on beneficial electrification, Tri-State is reinforcing its role as trusted energy advisor to its member systems and their consumer-members.

Navigating the Transition – Resources and Tools

NRECA and its partner organization the Beneficial Electrification League (BEL) have developed a number of resources and tools that will be helpful to electric cooperatives and other organizations intent upon implementing beneficial electrification programs to achieve environmental sustainability and other strategic, long-term goals.
The following links provide access to these tools:

- NRECA's Beneficial Electrification home page: https://www.cooperative.com/topics/beneficial-electrification/Pages/default.aspx

  Contents:
  - Fact sheet.
  - The Emerging Opportunity.
  - Video Explainer: What is Beneficial Electrification?
  - Advice for Electric Co-ops on Encouraging Electric Vehicle Use.
  - 'Whiskey, Neat': Kentucky Co-ops to Power New Distillery With 100 percent Renewables.
  - Beneficial Electrification: Member Resources and Research.

- Understanding Beneficial Electrification: https://www.cooperative.com/topics/beneficial-electrification/Pages/Understanding-Beneficial-Electrification.aspx

- Beneficial Electrification C&I Case Studies: https://www.cooperative.com/programs-services/bts/Pages/TechSurveillance/Beneficial-Electrification-CI-Case-Studies.aspx

- Along Those Lines: What Is the Beneficial Electrification League? https://www.electric.coop/along-those-lines-beneficial-electrification-league/

- Beneficial Electrification League home page: https://be-league.com/

For Additional Information Relating to this Report:

Keith Dennis, PE
Vice President
Keith.Dennis@nreca.coop
Ph: 703.907.5787

About the Author

Eric Cody is a consultant who has spent more than twenty years working with NRECA, statewide electric cooperative associations and individual electric cooperatives on technology planning and management issues. He has four decades of experience with electric utilities and was for a dozen years an officer of several New England Electric System companies, including vice president of information technology. Eric holds a bachelor's degree from Amherst College and a master's degree from Harvard University, where he specialized in energy planning and policy analysis.